

ANNUAL REPORT 1990-91



**Department of Scientific and Industrial Research
Ministry of Science & Technology
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I. AN OVERVIEW

The formation of the Ministry of Science and Technology was announced through a Presidential notification dated January 4, 1985 (74/2/1/85. Cab) contained in the 164th Amendment to 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 the Ministry of Science and Technology is the Prime Minister Shri Chandrasekhar.

1.2. Several laboratories under the Council of Scientific and Industrial Research made significant contributions during this year.

An one-dimensional model of marine atmospheric boundary layer that could predict the vertical structure of wind, temperature and moisture has been developed and tested by NIO, for a region in the Arabian sea. The National Laboratories namely CSIO, CGCRI and CMRS were involved in the development of ten point optical fibre mine communication system for coal mine, which was successfully installed in TISCO's Malkara Colliery at Dhanbad. This is the first indigenous development of its kind and introduction of this technology in mine communication system not only fulfills the need of an intrinsically safe system, but also proves to be of economic advantage when voice, video and data are integrated. ITRC has developed an electronic device named Bact-o-kill for disinfection of drinking water. NCL has developed a single step technology the Albene technology (AL for alcohol and bene for benzene) for the production of ethylbenzene from ethyl alcohol and benzene. A process has been developed by RRL, Trivandrum for immobilising the starch saccharifying gluco amylo enzyme on to high silica E glass fabric. This will help reduce the cost of carrier material used in the continuous hydrolysis process for alcohol pro-

duction. Two novel drug delivery systems based on collagen have been developed by CDRI for effective cancer Chemotherapy. A high yielding clone 52-22 has been developed by CIMAP and christened 'Cauvery'. A significant breakthrough in the cultivation of bamboo has been achieved by NCL by the introduction of precocious flowering in three species namely *Dendrocalamus striotus*, *Bambusa arundinacea* and *Dendrocalamus brandisii*. Under laboratory conditions, flowering occurs within a few weeks as compared to several years in Nature. RRL, Jammu has developed tissue culture technique for the production of Shikonin, a red naphthoquinone pigment used as a specific remedy for burns, wounds, skin ulcers, besides being a precious natural drug for silk and cosmetics.

CSIR is involved in the following important societal missions and national programmes:

- i) Provision of drinking water and water management.
- ii) Development of Wastelands.
- iii) Oil Seeds.

The involvement of CSIR laboratories is in the nature of water quality assessment in Andaman and Nicobar islands, Lakshadweep islands, UP, training courses cum demonstrations in construction techniques for rain water harvesting schemes and ferro-cement water tanks. SERC-G has developed ferro-cement bins for village level storage of oil seeds.

The National Information Centre for Chemistry and Chemicals Technology at NCL has created facilities to access computerised databases available internationally.

1.3 Scientific Associations, Institutions, Universities and colleges which undertake research in the

area of medicine, agriculture, natural and applied sciences seek approval to avail the fiscal incentives provided for pursuing such work. During the year 32 institutions were recommended for approval. A Research Review Group regularly examines the returns submitted by such research associations and institutions. On the basis of such a review, earlier approvals granted are renewed or withdrawn. During the year, review of 327 such institutions was made. Similarly institutions engaged in social science research were also examined. 5 institutions were recommended for approval; the Research Review Group in the area of social science had examined the returns of 78 institutions.

1.4 Under the Scheme of granting recognition to In-house Research and Development Units, there were 1188 units having valid recognition as on 31st December, 1990. 308 In-house R&D centres incurred an annual expenditure of over Rs. 1.00 crore each. During the year 1990, the inter-Departmental Screening committee accorded recognition to 86 In-house R&D Centres. During the year, 384 units were accorded renewal; several of these in-house centres are having sophisticated facilities and their scientists have made impressive contributions. During the year 1990-91 four issues of In-house R&D in Industry update were brought out.

1.5 A higher investment allowance at 35% was permissible on Plant and Machinery installed upto 31.03.1987 productionising technology indigenously developed. During the year 11 certificates were issued involving plant and machinery at a cost of Rs. 418.75 lakhs. This included plant and machinery installed in the areas of chemicals, cement, automobiles, drugs and electronics.

The Government had notified an additional incentive and relief to the user of know-how developed in the country. This would be in the form of depreciation allowance at the higher rate of 5% on the cost of plant and machinery installed after 1st April, 1987. During the year, 11 certificates involving Rs. 157.69 lakhs as cost of plant and machinery were issued in the area of electronics and chemicals.

1.6 The Department intensified its activities relating to the scheme on National Register of

Foreign Collaborations A compilation of primary data on FCs for the year 1989 was brought out. Computerisation of data collected on foreign collaborations for the years 1984-89 has been completed. During the year reports on technology status of various sectors/products like magnetic tapes, citric acid, bimetallic bearing and cyanuric chloride were printed. Technology status studies have been commissioned on various products which include: titanium dioxide, xylene, isocyanates, TV picture tubes and PCBs. A new scheme Promotion and Support to Indigenous Development of Capital Goods has been initiated.

1.7 The Technology Absorption and Adaptation scheme provided partial financial assistance to facilitate activity relating to technology absorption projects of 24 companies involving over 45 projects. These include: communication system for distributed monitoring and control system of ECIL, upgradation and development of CNC system of HMT, Bangalore, development/upgradation of fuel efficient diesel engines for tractors of HMT, Pinjore. Studies relating to the norms in use in certain important sectors were commissioned and this includes the sectors such as steel forgings, drug formulation, and ferrous foundry.

1.8 The Transfer and Trading in Technology scheme has commissioned studies relating to preparation of technology profiles and identification of technological needs of ten developing countries. The scheme has also supported other activities such as bringing out publications relating to capabilities and preparation of video films. A scheme to support consultancy services has also been initiated and under this, support was extended to the Consultancy Development Centre, NACE and ACE. Close linkages were maintained in the area of technology transfer with international organisations such as UNCTAD, ESCAP, WIPO and UNIDO.

1.9. The National Information System for Science and Technology (NISSAT) programme envisages promotion and support to the development of a compatible set of information systems on science and technology and inter-linking of these into a network. Nine sectoral centres have been established in Leather Technology, Food Technology, Machine Tools, Drugs and Pharmaceuticals, Textiles and

Allied subjects, Chemicals, Bibliometrics, Advanced Ceramics and Compact-disk. NISSAT has taken the initiatives for the development of metropolitan library networks to ensure better utilisation of S&T information resources through resources sharing.

1.10 Two public undertakings, namely National Research Development Corporation (NRDC) and Central Electronics Limited (CEL) attached to this Department, were engaged in important activities in the commercialisation of indigenously developed technology. Some of the major technologies licenced by NRDC during the year include: nickel cadmium batteries, electrolytic manganese dioxide and monocrotophos pesticide. NRDC gave awards and presented certificates of merit to inventors thereby promoting innovative efforts in the country. NRDC

has been successful in promoting several projects based on their technologies in Indonesia, Viet Nam and Thailand.

1.11 The activities of CEL are sharply focused in three thrust areas namely selected electronic components, electronic systems and solar photovoltaic cells, modules and systems for a variety of applications. Intensive technology development work was carried out by the company in the field of growth of multicrystalline solar cells, new SPV systems and high permeability ferrites.

1.12 During the year 1990-91, there was an around growth in the activities of different programmes of DSIR, particularly in the Plan Schemes.

II. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

1. The Council of Scientific and Industrial Research consists of 42 National Laboratories and Research Associations covering Physical & Earth Sciences, Chemical Science, Biological Sciences, Engineering Sciences, Information Science and Industrial Research Associations. Annexure 11.1 gives a list of these 42 institutions together with abbreviations which are used in this text. An indication of the research output of the Council is presented in Figure 11.1.

2. A brief account of the significant achievements of CSIR in different areas of its activity is given in this report covering activities in: Technology Mission on Drinking Water; Technology Mission on Oilseeds; Wastelands Development; Ganga Action Plan; Standards; Studies on Global Change; Electronic Devices and Systems; Instrumentation; Geophysics; Oceanographic Research; Antarctic Research; Chemicals; Drug Development; Polymer Science; Metallurgy; Agro and Postharvest Technologies; Biotechnologies; Coal and Mining; Energy; Ecology and Environment; Materials; Building Materials and Construction; Structures; Computer software; Transportation; Basic Research; National and International conferences; Planning; Technology Utilisation; International Scientific Collaboration.

2.1 DRINKING WATER MISSION

Geohydrological and geophysical studies were taken up by NGRI in Rajasthan, Orissa, Karnataka, Andhra Pradesh, Jammu and Kashmir, Tamilnadu and Uttar Pradesh for location of suitable drilling sites in villages having acute problem of drinking water. A total of 838 electrical resistivity soundings were conducted in these villages numbering over 400. These include 53 deep electrical resistivity soundings (electrode separation of 3-5 km) carried out for locating deep potable water aquifers in saline water infested area of Barmer district,

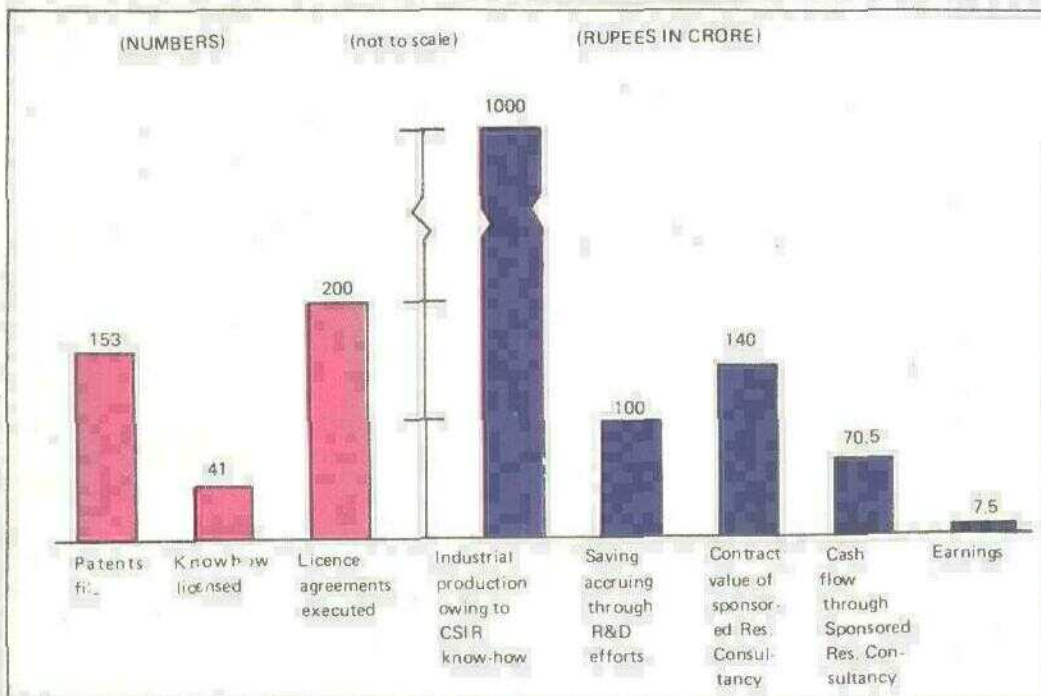
Rajasthan. Magnetic and resistivity profiling has also been carried out to delineate hydrogeological features of interest like contact zones, fault boundaries and lineaments in districts of Barmer, Mehaboobnagar and Jammu and Kashmir. Based on these geophysical and geohydrological investigations, 172 wells have been drilled by various State Government agencies.

Water quality in Andaman and Nicobar islands has been monitored by NEERI from 452 sources. The studies reveal that 51 sources need iron removal. For all sources disinfection is a prerequisite in view of large-scale bacteriological contamination. Water quality has also been monitored in the Lakshadweep Islands from 750 sources. The studies revealed presence of high TDS in the south eastern side of Bitra, and salinity in Chetlat, Kalpeni and Kiltron. It is not possible to reject any source on account of water quality, due to paucity of water. Radial infiltration wells developed by the water supply authority have been found to be acceptable. ITRC carried out Water Quality Assessment in Almora district (U.P) using the mobile-Water.

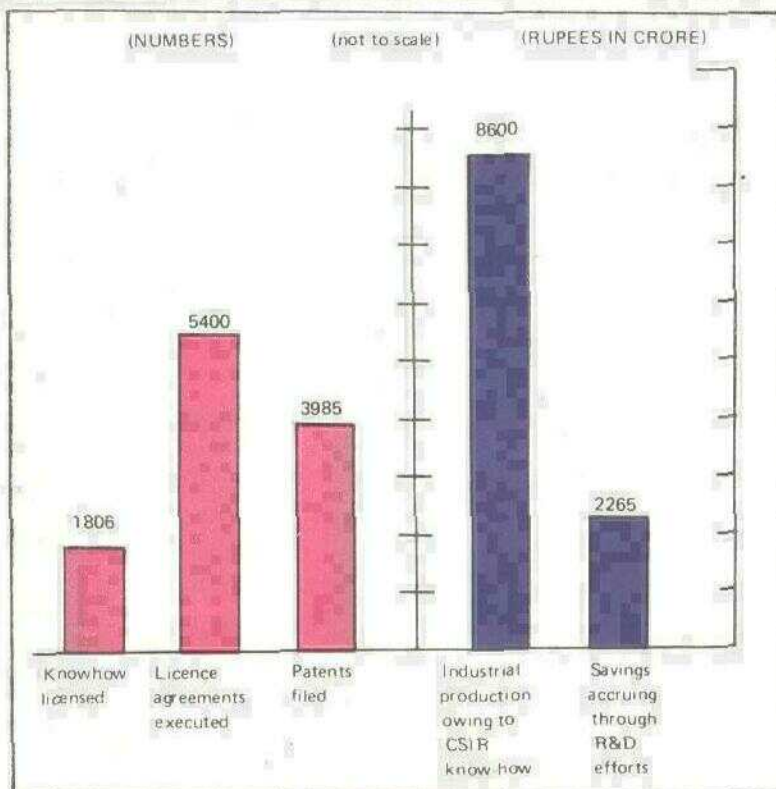
A special satellite-shaped controlled release containing a polymeric hydrogel has been developed by NCL for the regulated delivery of abate/temephos into water for long term control of the guinea-worm disease vector, cyclops. Abate/temephos is released slowly into the water through the six arms of the device. The system has been tested in the laboratory under simulated field conditions and is being perfected to give sustained release of toxicant at 2 ppm concentration for 3-4 months in varying water volumes.

Several natural synthetic compounds were screened by NCL for cyclopicidal activity. At least two have been singled out for commercial application. The formulation of one of them ("GWINCIL")

RESEARCH OUTPUT IN 1989



RESEARCH OUTPUT CUMULATIVE



III Research Output in 1989 and Cumulative research output.



11.2 Amrit Kumbh - A cheap water filter.

has been started and simulated field trials are in progress. "GWINCIL" is a non-toxic natural product about 100 times cheaper than abate/temephos.

SERC-G has conducted 14 training courses cum demonstrations in construction techniques for rain water harvesting schemes and ferrocement water tanks. The participants included field engineers, technicians, masons, planners and volunteers, and were drawn from PHED, DRD, Jal Nigam, Technical Institutions and voluntary agencies (NGD). Sixtyfour (64) demonstration structures were constructed in rural areas of Meghalaya, Manipur, Nagaland, Tripura, Madhya Pradesh, Kumaon and Garhwal Hills of U.P. Rajasthan and Karnataka.

2.2 OILSEEDS MISSION

A minimum cost design for RCC hangar type storage structure for oilseeds has been obtained by SERC-G using technique of nonlinear optimisation. A mathematical model was formulated for this optimisation problem and solved by linking the

analysis, design and estimation routine with a non-linear optimisation programme based on Random Search Technique for global optimisation. The optimal design of modular type storage structure for 1,000 T capacity satisfies both the relevant codes viz. IS: 456-1978 and IS: 875.

For village level storage of oilseeds 5, 10 and 20 cu.m ferrocement bins have been developed by SERC-G. These bins have provision for aeration for oilseeds during storage as recommended by NAFED, NCDC and CFTRI.

2.3 WASTELANDS DEVELOPMENT

One hectare saline land having salinity 60 dSm^{-1} has been planted by CSMCRI with the seedlings raised from the seeds of selected plus trees (island saline soil) at a distance of $5\text{m} \times 5\text{m}$, row to row and plant to plant. The plants have been established and are growing well. A two year old plantation raised with saline water ($\text{EC } 15\text{-}25 \text{ dSm}^{-1}$) on coastal sand dune has yielded 83 kg. of seeds per hectare per year. Fiftysix hectares of wasteland were covered under plantation in the northeastern region. RRL Jorhat provided the cultivation technologies of economic crops. The beneficiaries belonged to scheduled castes and tribes. Wastelands in the north eastern region brought under cultivation totalled to 3080 ha.

2.4 GANGA ACTION PLAN

A unique anaerobic biological pilot scale treatment system (UASB) has been designed to overcome the problems of land and power requirements and bring down operational costs of effluent treatment plants. This plant with a capacity of 40 cubic metres/day was commissioned in one of the tanneries of Kanpur as a part of the Ganga Action Plan for treatment of tannery effluents and sewage. NEERI is engaged in a study on Impact Assessment of Ganga Action Plan on Public Health under the joint sponsorship of GPD & ICMR, and in collaboration with AIHHPH, Calcutta. The study aims at evaluation of the benefits of the project vis-a-vis the costs, and identification of corrective/supplementary measures, if deemed necessary. Varanasi and Nabadwip have been chosen as project sites in view of their religious and cultural significance.

2.5 STANDARDS

A comparative study of two primary pressure standards viz. static and dynamic gas expander systems has been carried out by NPL. The two systems are compared by using spinning rotor gauge (SRG) as the transfer standard in the pressure region 6×10^{-5} to 2×10^{-1} Pa. The results of the comparison are shown in the figure, in which the solid curves represent the results of calibration of two SRGs (NPL I-3 and NPL I-4) on the static expansion system and the points enclosed in circles correspond to the conductance values of the measurements performed on the dynamic system by using the theoretically calculated value of orifice conductance and assuming it to be constant over the entire pressure range upto 0.2 Pa. The mutual compatibility of the two primary pressure standards has been established.

2.6 STUDIES ON GLOBAL CHANGE

A one-dimensional model of marine atmospheric boundary layer that could predict the vertical structure of wind, temperature and moisture has been developed and tested by NIO, for a region in the Arabian sea. The model predicted reasonably well the vertical structure of wind and temperature field.

A three-dimensional model of circulation in the Arabian Sea has been developed. The model has 31 layers in the vertical plane and takes into consideration the actual bottom topography. Numerical experiments have been performed for a one-degree spatial resolution model using climatic data of wind field, temperature and salinity. The model simulated well the climatic circulation in the Arabian Sea, for various months.

Long term studies by NIO, in Mandovi and Zuari estuarine complex of Goa on the effect of pollution on bottom living organisms due to mining activity showed more than 70% reduction in clam production and 50% reduction in benthic biomass due to the mining rejects. The reduction in density of benthic population was 55% with 25% reduction in diversity.

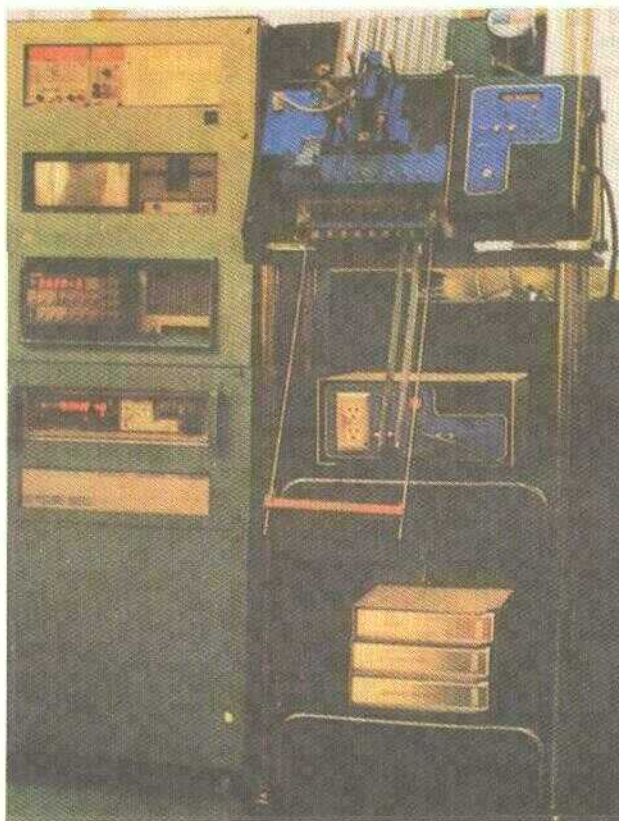
2.7 ELECTRONIC DEVICES AND SYSTEMS

Fabrication of controller chip for a 16 bit processor for the AC Motor Drive system has been completed by CEERI. This chip contains about 3000 components on a die of 4.7x3.4 mm size. The chips were encapsulated in a 48-lead ceramic dual-in-line package.

An effort is underway for scaling down the process technology.

Work on various unit process has yielded good results. It has been possible to dry etch long parallel lines of geometries as small as 0.5 microns, and cut holes to a depth of 1.0 micron on thermally grown oxides. LPCVD nitride, doped and undoped CVD oxides. Various long lines, mesa structures and contact holes of varying geometry have been etched with large anisotropy and near vertical walls.

A 500A capacity bipolar cell with there bipolar electrodes was constructed by CECRI for applications in electrometallurgy and operated at



11.3 LSI/VLSI Tester.

various current densities ranging from 0.8 to 1.25 A/cm². Under the best operating conditions, a current efficiency of over 70% was realised, with the average current efficiency being 60%. Individual cell voltage was 3.2 to 3.5 volts and the specific energy consumption was 11 to 13 kWh/kg.

A ten point optical fibre mine communication system for coal mine was developed and successfully installed in TISCO's Malkera Colliery at Dhanbad.

Three National Laboratories were involved in this achievement, as follows: CSIO, Chandigarh, in the development of O/E and E/O fibre optics compatible modems; CGCRI Calcutta, in the development of micro-processor based exchange and power supplies. The optical fibre cable used in the system is about 5 km and the farthest points connected through the system are about 1 Km apart. One of the design features of the system provides for it being upgraded to 30 lines for future requirements. This is the first indigenous development of its kind and introduction of this technology in mine communication system not only fulfils the need of an intrinsically safe system, but also proves to be of economic advantage when voice, video and data are integrated. In addition, use of such a system along with knowledge based computer aided mine management, is expected to result in increased production by 10% at least.

A joint programme between CEERI and SAC, Ahmedabad in the area of GaAs MMICs is under way. It is proposed to develop a 6/4 GHz down converter and low noise amplifier as a part of satellite pay load receiver system. Lange couplers using state of the art air bridge technology, mixer diodes and FET's have been already developed under this programme. The lange couplers for KU and C band have recently been tested and are performing successfully within the design specifications.

2.8 INSTRUMENTATION

The first prototype of driver evaluation instruments, designed by CSIO, was successfully integrated and tested on a limited scale at PTL, Mohali. This unit has since been shifted to CRRI, New



II.4 Driver Evaluation Equipment.

Delhi, for extensive use on drivers, to generate data of timings of various tests. This equipment, basically, tests the psychophysical response of drivers to changing traffic conditions. This includes quick response or reaction to various stress conditions, as well as, certain vision parameters required in the context of driving task. The system has a number of modules, a microprocessor based control console and a special driver's cabin. During the year, technical know-how of the following instruments was released by NIO to NRDC for large scale production: Direct-Reading Current Meter; Wind Recorder; and Electronic Bathythermograph.

ITRC Gas developed an electronic advice named Bact-o-Kill for disinfection of drinking water. The Bact-o-Kill comprises an oxygenerator consisting of a high current transformer and an electronic current regulating source which is suitably modulated. The output of the oxygenerator is connected to a pair of specially designed electrodes which protrude into the reactor cell filled with water required to be disinfected. An automatic electronic timer circuit is coupled to the input supply through the relay which controls the input supply. Initial experiments on bacterial disinfection studies were conducted with thermo tolerant E. coli strains isolated from Gomti River, Lucknow in peptone water and cultured at 37° C for 24 hours. The developed colonies were cultured and preserved at 4° C in refrigerator. The culture containing 500 MPN/100 ml water and 2500 MPN/100 ml water were subjected to treatment in the device for different times. The treated water was examined for coliform count by plate count and MPN methods after lapses of 15mts and 24hrs. The result

showed no growth during a 10 minute treatment.

2.9 GEOPHYSICS

On the request of the Nuclear Power Corporation, NGRI has initiated monitoring of the background seismicity over an area of 40-50km radius around the Nuclear Power plant site for an initial period of 18 months from March, 90. Reconnaissance survey was done to select sites of six seismic stations and a central site for telemetered recording.

Processing and evaluation of magnetotelluric data acquired in Saurashtra region under the OIIB programme has been done by NGRI. A few magnetotelluric sections along select profiles – one on the Chotila-Dhari profile and the other covering part of the DSS profile, Navibandar-Amreli, were constructed. A first order basement configuration map has also been prepared from the available results. The results have clearly brought out the configuration of the sediments underneath the traps and have thus established the potential of this approach to probe the subtrappean lithology and structure for future hydrocarbon exploration.

2.10 OCEANOGRAPHIC RESEARCH/ ANTARCTIC STUDIES

A total of 629 freefall grab and 103 photograb operations were carried out by NIO, at 140 stations in the Central Indian Ocean for collecting nodule samples. Maximum abundance of nodules was found to be 27 kg/sq. m. From the analysis it is observed that 39% of nodule samples are marginal and/or paramarginal in grade (i.e. combined Ni, Cu, and Co values above 2%) while the rest are sub-marginal (Cu+Ni+Co=<2%). Studies on physical properties of nodules reveal that Indian Ocean nodules are anisotropic and found to be denser, porous and display faster P-wave velocity in comparison to those from Atlantic and Pacific Oceans.

The studies on the data collected during the Ninth Antarctic Expedition revealed decreasing trend in the SST (from -0.5°C to -1.9°C) during January 1988 in the shore polynya off Dakshin Gangotri and is mainly attributed to the process of heat advection. The presence of anomalously warm

saline waters (>14°C) in the upper 1000 m of the southwestern Indian Ocean sector of the Southern Ocean suggests the presence of eddies (300 km) that might shed out from the Antarctic Circumpolar current due to topographic influence of Crozet Plateau.

A three-month training programme in oceanography for 22 scientists from 13 Caribbean Commonwealth countries was organised at NIO Goa, from October to December, 1989. The objectives of this programme are: to enhance the capability of Caribbean countries in investigating, understanding and utilising their marine living and non-living resources; to train caribbean scientists in the classroom, laboratory and onboard ship in area of oceanography and to carry out the oceanographic resources survey in the Caribbean Sea.

NGRI had participated in the first Weddell sea Expedition, Western Antarctica. A team consisting of a geologist and a geophysicist was sent for reconnaissance surveys in Filchner shelf and Berkner island. Samples were collected from Bertrub Moltek and Littlewood Munataks for geochemical and geological studies.

2.11 CHEMICALS

A new family of catalysts (bioxyanions) capable of trans-esterifying phenols with diarylcarbonates has been discovered at NCL. The catalysts have been employed for the synthesis of poly (aryl) carbonate, an important engineering polymer (with molecular weights in the commercial range) at a concentration as low as 10^{-5} moles of catalyst per mole of bisphenol-A. Unlike the known transesterification catalysts, bioxyanions are neutral and contain no metals. As trace metal impurities adversely affect the thermo-oxidative stability of polycarbonates, especially at the processing temperature, the absence of metals in the catalysts is of great significance.

NCL Pune has developed a single-step technology – the Albene Technology (Al for alcohol and bene for benzene) – for the production of ethylbenzene from ethyl alcohol and benzene. This has been commercialized by Hindustan Polymers, Visakhapatnam. The novel and unique one step process for the production of ethylbenzene (as against the two

step conventional process) from ethylbenzene (as against the two step conventional process) from ethyl alcohol can be considered superior to the conventional Mobil-Badger Process. HP has commenced production of ethylbenzene using this technology in their 12,000 TPA plant.

An innovative process for the manufacture of ZSM-5 catalyst has been developed by NCL. United Catalysts India Limited (UCIL), Vadodara, have started producing it on a 500 kg per batch scale. The firm has already started exporting ZSM-5 catalysts to Europe. This marks India's entry in a major high-tech area that had hitherto been the prerogative of multinationals.

Innovative catalyst composition have been developed by NCL for production of middle distillates (kerosene and diesel) from methanol. The Bharat Petroleum Corporation Limited (BPCL), in collaboration with Davy Powergas, Bombay, are setting up a 1 TPD pilot plant at a cost of about Rs. 6 crore. Natural gas will be an important source of chemicals in future and is certain to become more important than oil. This NCL technology is futuristic and holds promise of becoming economical in the long run.

As a part of the Mines-Metallurgy and Habitat (MMAHA) Project on utilisation of lime stones and marble type limestone fines for manufacture of portland cement, an economically viable commercial process has been developed at RRL Bhubaneswar by adopting the pan sintering process, and utilising mixes of limestone fines, cokebreeze,



11.5 Plant for Ethylbenzene at Hindustan Polymers, Visakhapatnam.

ordinary clays etc. The process has been established with 8 Kg. scale of raw material mixtures; portland grade cement clinkers were produced by using an 8×8×16 inch size pan.

2.12 POLYMER SCIENCE

Controlled polymerization of acrylonitrile at temperatures as high as 30° C has been achieved at NCL. A generalized synthetic procedure for obtaining functional metal-free carbenion initiators with varying reactivities has been developed, and the initiators were characterized in detail. The close agreement between calculated and observed molecular weights testifies to the "living" nature of the polymerization.

6-Amino penicillanic acid (6-APA), an important intermediate in the manufacture of semisynthetic penicillin, is made by enzymatic hydrolysis of penicillin G/V with penicillin acylase. The process economics requires repeated use of the acylase enzyme, for which immobilization techniques are used. In a collaborative effort with Hindustan Antibiotics Ltd., Pimpri, Pune, NCL has developed a synthetic macroporous polymer support for the immobilization and the support can be used for over 650 cycles of enzyme reuse, as against 100 cycles currently achieved. The quality of 6-APA is better and the immobilization and bioconversion processes can be handled more easily than is currently possible.

A process has been developed by RRL-Triv. for immobilising the starch saccharifying gluco amylo enzyme on to high silica E glass fabric. This will help reduce the cost of the carrier material used in the continuous hydrolysis process for alcohol production. The cost per unit of glucose produced using the technique is 100 times less as compared to controlled pure glass immobilisation procedure for continuous bioreactors developed by Corning Glass Works.

2.13 DRUG DEVELOPMENT

Single dose of the Mycobacterium habana antileprosy vaccine has been found to change 75 per cent of lepromin negative rhesus monkeys to lepromin positive status. The vaccine has been found to be safe in acute and subacute toxicity

studies in rats and rabbits, and the data has been submitted by CDRI to the Drug Controller (India) for permission to initiate phase I clinical trials. Inocuity test carried out as per recommendations of ICMR has been completed; the vaccine has been found to be safe.

Phase IV clinical study to monitor efficacy and adverse effects of Centimzone has progressed well at the Department of Surgery, KGMC, Lucknow and the Department of Endocrinology and Metabolism, AIIMS, New Delhi. At the Lucknow centre, patients suffering from hyperthyroidism have shown remission in most cases and partial remission in some cases. Decline in T_3 , T_4 and TSH has indicated the achievement of euthyroid state. At the Delhi Centre half the cases had clinical remission and some cases showed partial response.

An agreement has been signed by CDRI with Arkopharma Laboratories, Nice, France for commercialisation of Gugulipid in eight European countries – France, Italy, Switzerland, Belgium, Germany, Spain, Great Britain and Holland, attracting a substantial premium and royalty.

IICT undertook a number of sponsored research assignments for development of drug technologies. Processes for Flurbiprofen (a fluorinated anti-inflammatory drug), Norfloxacin (application in bacterial, gastroenteritis and certain unresponsive lower respiratory tract infections), Etoposide (treatment of lung and testicular cancer), Mitoxantrone (treatment of breast cancer and other solid tumours), Sulbactam (a semi-synthetic penicillin process), Timolol maleate (used for glaucoma) Azidothymidine (anti-AIDS), Acyclovir (anti-viral) and Pyrazinamide (anti TB) have been passed on to industry for commercial exploitation.

Two novel drug delivery systems based on collagen have been developed by CDRI for effective cancer chemotherapy : Injectible gelating microspheres (particle size 10-30 μm); and Implantable collagen-poly (hydroxyethylmethacrylate). hydrogels.

These two systems are highly biocompatible, nontoxic and body-friendly. They are ideal controlled release systems, since the entrapped anticancer drugs are delivered in a near zero-order fashion for about 8-10 days. The hydrogels and

microspheres can be successfully utilised as carriers for various other therapeutic agents such as peptide drugs, hormones, contraceptive vaccines and growth factors.

2.14 METALLURGY

Preparation of Neodymium metal of high purity has been scaled up to 300 gms per batch at RRL, Trivandrum. The vacuum remelted metal has been used by DMRL for making Neodymium-Iron-Boron magnets of satisfactory quality. Conversion of iron oxide in ilmenite either to the ferrous state or the metallic state was carried out in a micro pilot plant with coal and ilmenite as reductants. The conditions of reduction were optimised. Large scale trials have been planned.

A generator-cum-rectifier combination to draw current approximately of 1200 amps., has been commissioned at NML for the production of desired grade of powder through electrolysis. The cathodic efficiency is 95-96% with 25 amp/ft² cathodic current density. The application of high cathodic current density (with modification) offers many advantages viz. : Finer powder; Elimination of acid addition to sponge fines; Metal ion (Fe^{++}) fairly constant pH; and 60% increase in productivity in 25 kg/day production cell. 150 kg. of iron powder has been produced and energy consumption was recorded to be 2 KWh/kg. of iron powder. The (electrolytic) iron powder was evaluated at Andhra Sintered Products (ASP), Hyderabad, Mahindra Sintered Products (MSP), Pune and MSS Nagpur. The physical, chemical and sintered properties of this powder have been found to be excellent and acceptable for the manufacture of P/M parts.

2.15 AGRO AND POST-HARVEST TECHNOLOGIES

A ten tonne compost was made at the low cost composting unit designed by CSIR-C-Palampur and distributed to entrepreneurs. The yield results have been very encouraging. In the first demonstration farm, 5 per cent conversion rate (92 kg. of fresh crop harvested from 1850 kg. of compost) was achieved within first eight days of cropping (first flush) in the usual 8-12 weeks of cropping period.

A high yielding clone 52-22 has been developed by CIMAP and christened "Cauvery". It contains, on an average, about 70 per cent higher oil content than that of the check variety OD-19 under south Indian agro-climatic conditions.

Yield of *Cymbopogon khasianus* - a geraniol rich plant, was enhanced by RRL, Jorhat by application of graded lime upto 10 tonnes/hectare. The application of K_2O at kg/ha gave optimal yield of acceptable quality leaves in respect of cv. 'Desawari'. The yield of essential oil was also maximum (0.1%) from this NBRI treatment coupled with good quality and long shelf life of leaves. Hydrocarbons and I-8, cineole content increased in the oil. The loss due to diseases was minimum.

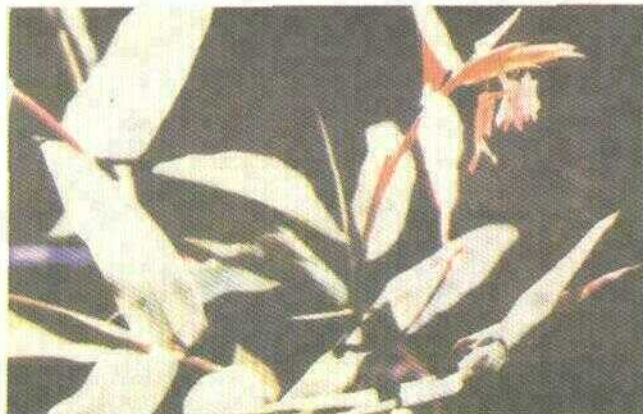
An efficient distillation unit for production of quality rose oil was designed, fabricated and installed, at the Bonera farm of CIMAP in Kashmir and preliminary trials were conducted. This unit is the directly-fired type and any agrowaste may be used as fuel.

A new food adjunct acceptable to several regions of the country has been developed by CFTRI. The adjunct is based on orange peel which, at present, is thrown away as a waste. This particular process for a new product is likely to benefit the fruit and vegetable industry.

2.16 BIOTECHNOLOGIES

A significant breakthrough in the cultivation of bamboo has been achieved at NCL by the induction of precocious flowering in three species, *Dendrocalamus strictus*, *Bambusa arundinacea* and *Dendrocalamus brandisii*. Under laboratory conditions, flowering occurs within a few weeks as compared to several years in Nature. The discovery has wide implications in the breeding of bamboo and could help in understanding the mystery surrounding the unpredictable flowering behaviour of these species in Nature.

Success was achieved by NBRI in production of cloned plants of *Dalbergia latifolia*. A protocol was standardized by which normal shoots, without vitrification and necrosis of shoot apices, were proliferated on a newly formulated balanced medium. A prolific rate of multiplication of shoot apices of



11.6 Precocious flowering of *Bambusa arundinacea* in culture.

Chrysanthemum cinerariifolium was achieved by incorporating cycocel. The regenerated shoots were isolated and rooted 100 per cent in IAA, within 25 days, whereas IBA and NAA were not conducive to root induction. The rooted shoots (plantlets) were hardened and successfully transferred to potted soil and grown under glasshouse conditions.

In a significant development at CIMAP in protoplast fusion studies, putative somatic hybrids have been developed at intergeneric level between *Atropa belladonna* + *Hyoscyamus muticus*, *Atropa belladonna* + *Nicotiana Tabacum* and *Hyoscyamus muticus* + *N. tabacum*. Genetically superior and stable artificial autotetraploids with over 90% seed set have been developed at CIMAP in *Hyoscyamus niger*; these are capable of yielding over 20% more tropane alkaloids as compared to parent diploids.

The preparation of a number of products required for research in molecular biology has been standardized by CFB. The products include Plasmid pUC 19 DNA, Plasmid pBR 328 DNA and restriction enzyme Kpn I. Pancreatic DNA and Pancreatic RNase are in advanced stage of purification. A number of custom made oligonucleotides for use as probes and standard sequences for use as adaptors, linkers, primers etc. were prepared and supplied to leading groups in the country working in the genetic engineering field. A blood group A specific lectin has been purified to homogeneity. It is expected to be of use in blood typing.

RRL Jammu has achieved three fold increase in the production of 2,5-Diketogluconic acid (an important intermediate for the production of Vitamin C) by modifying the reactor design. This increase has been achieved by using positive influence of high and constant dissolved oxygen tension on the induction of dehydrogenases for direct oxidation of glucose in *Gluconobacter oxydans*.

RRL Jammu has developed tissue culture technique for the production of Shikonin, a red naphthoquinone pigment used as a specific remedy for burns, wounds, frostbite, skin ulcers and anal hemorrhage besides being a precious natural dye for silks and cosmetics. High yielding cell strains have been isolated and selected.

Biotransformation of rifamycin B to S through rifamycin oxidase was optimised at laboratory scale in a 10 litre fermenter and IMTECH successfully transferred the knowhow and the strain to the Indian Drugs and Pharmaceuticals Ltd. for use in commercial production of rifampicin.

2.17 COAL & MINING

A bitumen based surface sealant was developed by CMRS in collaboration with Shalimar Tar Products for application over surface cover in a fire area to minimise air permeation. This fire-resistant sealant was applied over an experimental bench at the Jhinbgurda colliery. It was observed that the coating was effective in the prevention of fire in benches.

Surface subsidence investigation was in progress over 97 panels/workings at different coalfields in India for effecting conservation of coal resources and development of method of extraction of coal seams underneath surface features and structures. The investigation carried out so far by CMRS revealed that in coal mining areas subsidence might take place due to activities other than mining.

A system of three dimensional modelling was developed to study the subsidence parameters over underground extractions of various geometrical designs.



11.7 Distillery Spentwash Biomethanation pilot plant.

Effect of vibration due to underground blasting on rock support, surrounding rock mass and structure in its vicinity was studied at five collieries to establish a relationship between peak particle velocity, vibration, explosive charge and the distance of measuring point from the source for design of safe blasting pattern.

2.18 ENERGY

A geothermal power plant, designed and built at NAL was set up at Manikaran, Himachal Pradesh to generate electric power from hot water (about 90°C) issuing from borewells drilled in a water dominated geothermal reservoir. This 5 kW plant was indigenously developed under a collaborative programme between NAL, Geological Survey of India and the Himachal Pradesh State Electricity Board. The power plant was successfully commissioned and run at full load. It is expected that the power pack will meet the street lighting requirements of Manikaran village.

Fed batch digestion is essentially a batch digestion system with periodic input of feed so as to maintain the desired biogas production rate. Based on this system, a biogas plant for production of 1.5-2.0 cu.m. biogas per day was developed at RRL, Jorhat.

The demonstration project on bi-fuel operation of the test buses with diesanol was successfully completed by IIP. The targeted kilometerage of 65,000 KM on each bus was completed without any operational problems. The bus engines were stripped open to undertake detailed measure-

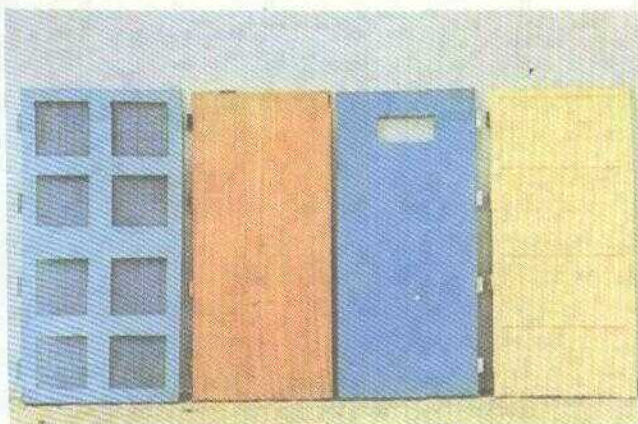
Development of process technology for the preparation of the Ytria-stabilized zirconia (YSZ) substrates indigenously, was undertaken at CGCRI. Thick (2-3 mm) disc type substrates were made by isostatic pressing followed by sintering and finally surface polishing. A number of such fully dense substrates were supplied to NPL (New Delhi), CEERI (Pilani), IIT (Kharagpur) and DMRL (Hyderabad) for their use.

Ceramic heads (16 nos) for hip joint prosthesis were fabricated at CGCRI. Samples were hydrothermally treated to reduce bacterial count. The heads along with standard metallic stems (4 nos) procured from an external agency were gamma sterilised at ISOVED Bombay. One complete hip joint prosthesis was transplanted on a patient at Calcutta Medical Research Hospital, Calcutta. The transplantation operation was successful and no abnormality has been reported by the patient.

2.21 BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY

CBRI developed a package technology for the manufacture of good quality building bricks for adoption at mass scale. The package involved development of a highly fuel efficient kiln, enhancing product output, designing appropriate clay matrix for high strength, upgrading skill of artisans, costing, evaluation and ensuring smooth transfer of the entire technology.

Ferrocement door shutters developed by CBRI are resistant to rotting, swelling, warping, peeling and attack from moth, termites, and are less prone



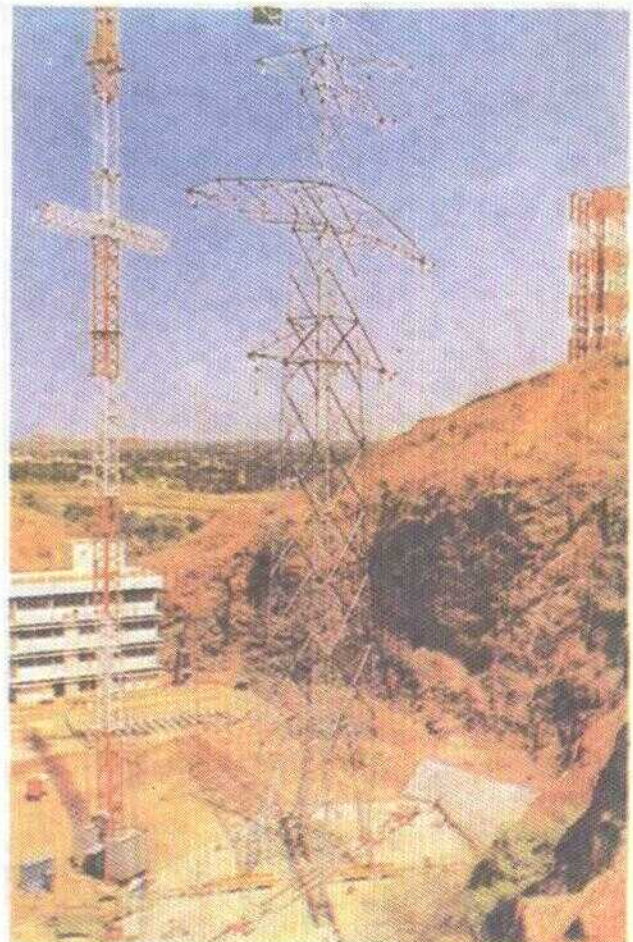
11.9 Different Types of Ferrocement Door Shutters.

to damage by fire and weathering. Besides, they resemble wooden shutters and have better dimensional stability. Feedback studies carried out over a period of two years indicate satisfactory performance.

2.22 STRUCTURES

A 65.5 m tall, 500 kV double circuit tower was tested at the Tower Testing & Research Station (TTRS) of SERC, Madras. This test was conducted at the request of M/s Locweld Inc., Canada, who are the designers and fabricators of the tower. The tower was designed for M/s Ontario Hydro, of Canada. Fifteen different tests, including the 'double twist', (a special requirement for Canadian conditions), were successfully conducted.

A mathematical model has been developed by SERC-M for the design of partially prestressed concrete flexural members, incorporating time-



11.10 Testing of the 65.5m Canadian Tower.

dependent effects such as creep, shrinkage, relaxation, differential shrinkage, modulus of elasticity of concrete and degree of prestress, quantity and position of non-prestressed reinforcement, cracking of concrete and two different neutral axes of strain.

NAL made a significant contribution to the LCA programme by undertaking to design and fabricate a 1:4.405 scale high speed air intake model for testing in the wind tunnel at Modane, France. A number of air intake design parameters were to be evaluated in order to obtain a proper design of the air intake, and to eliminate the intake buzz problem. *The design of the model, therefore, employed a modular concept to accommodate the different variants of the intake geometries.*

A measurement system has been developed at SERC-M to acquire transient dynamic load and response data from any structure during its field test, and then to process offline on a computer, with good accuracy and efficiency, the corresponding time histories and spectra in both digital and graphic forms. This facility helps in evaluating the dynamic effects due to wind, blast or impact on structures during the conduct of field experiments. Related studies on blast resistant structures have been conducted on a sponsored basis for the Terminal Ballistics Research Laboratory (TBRL), Chandigarh.

2.23 COMPUTER SOFTWARE

Software to retrieve and analyse the raw data on heave/pitch/roll time series to obtain directional wave spectra has been developed by NIO. Wave hindcasting numerical model "DOLPHIN" has been implemented and is being refined for both uniform and varying wind fields. A software for dynamic analysis of single point surface buoy mooring has been developed.

An interactive graphics program nodule on (FEM) mesh generation has been developed by SERC-M and integrated with the main program on modelling of ship hulls. A computer program has been developed to evaluate the added mass effect (to account for fluid structure interaction) using 21-noded isoparametric 3-D fluid element. Fifty-

four packages were licensed to twenty parties in different parts of India.

An improved version of the Flosolver parallel computer, with sixteen Intel 80386-80387 processors (32 bit) has become operational during the year, marking a significant advance in NAL's parallel computer development programme. The new version attains a sustained speed of 3-4 MFLOPS. A panel code and a monsoon code, requiring a very intense computing environment, have been successfully run on the new Flosolver version.

A computer software for optimization of composite washing of mixed coals has been developed by CFRL. As a case study Kedla coals (drawn from 9 seams) blended and washed in three different size ranges were tried. It was observed that the programme could tackle the operational constraints like the lower and higher limits of specific gravity-cuts of any washer and the method helped in maintaining consistency of product and maximising the overall clean output.

2.24 TRANSPORTATION

A study has been undertaken by CRRI on the estimation of short-haul urban and sub-urban freight traffic for 15 cities, out of which field collection of data has been completed for 5 cities. Likewise, for a study on establishing priorities for development of road system for Delhi, transport submodels have been developed and utilised to project demand for the horizon year 2001, and speed studies have been completed on selected networks.

As part of development of effective techniques for control of landslides, work has been completed on evaluation of the role of coir-netting in preventing shallow slides, and the role of geogrid in preventing rockfall. Studies towards correction/control of landslides were undertaken by CRRI in Uttar Pradesh, Himachal Pradesh, Maharashtra and Sikkim and appropriate measures recommended. A landslide hazard zonation study was conducted for 20 km long Kathgodam-Jeolkote section of the Kathgodam-Nainital road, and a scale developed considering the significant

influencing factors such as geological formation, geotechnical factors, geomorphology of the area, erosion etc., on the basis of which the landslide hazard potential was assessed and a zonation map prepared.

A study on road geometrics and surface characteristics on a 600 km length of State Highways in Gujarat has been completed in the field, by CRRI.

2.25 BASIC RESEARCH

An inter laboratory programme was initiated in January 1989 to develop a demonstration SQUID device by March 1990. Four laboratories viz. CEERI, Pilani, CGCRI, Calcutta; NPL, New Delhi; and RRL, Trivandrum were entrusted with this programme, with NPL as the nodal laboratory.

High temperature superconductors are granular in nature and the superconducting grains provide natural Josephson junctions at the grain boundaries. Thus a bulk superconductor consists of a large number of Josephson junctions. These inherently present Josephson junctions have been exploited in making a two hole SQUID which operates at liquid nitrogen temperature (77° K). It is an rf SQUID and is made out of bulk yttrium-barium-copper oxide (YBCO) Superconductor which remains superconducting upto about 90° K.

A simple physical technique based on spin-on method to prepare the superconducting films of ceramic oxides has been developed. Using this technique $T_c(0) = 82K$ thin films (thickness 0.6 μm) of lead doped bismuth cuprate oxide superconductor, with $J_c = 567 \text{ Amp}/\text{cm}^2$ at 77K on MgO Substrates has been obtained. D.C. SQUID structures were fabricated in these films using conventional photo-lithography and chemical etching, with the junction width of 75 μm , length 40 μm & separation of the order of 130 μm . The structure exhibited critical current (J_c) of 10 mA and oscillatory output at 4.2 K, demonstrating quantum interference effects. Recently, CEERI has developed a technique to package SQUID devices. Hardware and software were developed by CEERI using laser beam for the purposes of deposition of thin films and fabrication of SQUID.

Basic research on growth and characterization of oxides grown over doped polysilicon for inter dielectric layers in EEPROM devices has been carried out by CEERI. Low leakage currents and high dielectric breakdown polyoxide films were grown and studied for their electrical and structural properties. Oxides grown over doped polysilicon films, initially-deposited in amorphous form, show good dielectric properties. The results were interpreted in terms of surface and interface roughness.

A project to synthesize specific RNA sequences and study their structure has been initiated at NCL. The methodology for the chemical synthesis of 3'-5' (natural) and 2'-5' (unnatural) linked RNA has been established. The 3'-5' RNA is susceptible to cellular nucleases (ribonucleases) whereas 2'-5' is not. This will be useful in the rational design of nucleic acid probes and drug targeting/delivery systems via RNA.

A low molecular weight, calcium dependent pro-aggregatory factor has been isolated by CDRI from the mouse blood; the factor may provide an important new site of action for antithrombotic drugs useful in myocardial infarction. Antioxidant enzymes and polyamine uptake mechanism of filarial parasite have been identified as important biochemical targets for drug action.

The effect of exposure to strong white light on photosynthetic electron transport reactions of PS I and PS 2 were investigated by NBRI in spinach thylakoids in the absence or presence of oxygen. Irrespective of the conditions used for photoinactivation, the damage to PS 2 was always much more than to PS 1. Photoinactivation was severe under anaerobic conditions compared to aerobic conditions for the same duration, showing thereby that the presence of oxygen is required for prevention of photoinactivation of thylakoids.

A mathematical model to simulate the liquid-liquid extraction circuit of rare earth separation has been developed. This is able to handle multi-component systems of rare earth and would be of great use, since most of the existing models tackle only binary or ternary systems.

2.26 NATIONAL WORKSHOP

A national Workshop was organised by CGCRI in collaboration with the Bureau of Indian Standards on the above subject in February, 1990. The Steel Authority of India, Tata Iron and Steel Ltd, IRMA and the Indian Ceramic Society were co-sponsors. Invited lectures by eminent experts in the field of Refractories, a Poster Session and a panel discussion were the highlights of the Workshop.

2.27 INFORMATION DISSEMINATION

The specialized database on medicinal and aromatic plants (MAPIS) supplied information on the subject to a large number of its users both in India and abroad. Recognising the important role being played by MAPIS in collection and dissemination of information on medicinal and aromatic plants, UNESCO designated PID as the national node in its Asian & Pacific Information Network on Medicinal & Aromatic Plants (APINMAP).

PID published a book entitled *CSIR-Catalyst in National Development* to mark the occasion of National Science Day (1990).

INSDOC organised a course on Bibliometrics in collaboration with NISSAT. Twenty information specialists from all over India were trained in bibliometric analysis of the output of individuals and groups. The second revised and enlarged edition of the Directory of Scientific Research Institutions in India covering 2000 Scientific Institutions in India has been published.

NISSAT Access centre for International Databases (NACID) started operating in May 1989 and more than 200 bibliographic searches have been made so far, the number of searches being the largest among all NACID Centres. The National Information Centre for Chemistry and Chemicals Technology (NICHEM), at NCL, has created facilities to access computerized databases available internationally. This facility enables accessing of international databases through telex and PSTN/GPSS/PAD modes. Contacts with DIALOG and STN database vendors in the USA were

established. Facilities for online search on specific topics have also been made available.

INSDOC organized an exhibition of Indian S&T publications in Vietnam, from 12 to 17 February 1990. More than 1000 monographs and periodicals spanning the entire horizon of science and technology in the country were displayed. A four-member delegation represented CSIR at the exhibition which received wide coverage in the print and electronic media of Vietnam.

2.28 PLANNING

The Planning Division completed preparation of the "Report of the Working group Constituted by the Planning Commission for the formulation of the Eighth Five Year Plan (1990-95) of CSIR". The report was published in two volumes: volume 1 covering the executive summary indicating the approach, policies and brief particulars of various programmes and volume 2 covering the details of R&D programmes.

Based on the policies and the guidelines of the Government the Division prepared an Action Plan (1990-91) for the extension of CSIR technologies to the rural areas and other users.

2.29 INTERNATIONAL SCIENCE COLLABORATION

Under the CSIR-TISTR (Thailand) S&T Agreement, CSIR on behalf of the Govt. of India gifted two R/O desalination Plants (one mobile & one stationary) manufactured with the technology developed at CSMCRI to the Govt. of Thailand on 31.3.89.

The second meeting of the Joint Committee under the Protocol on Scientific and Technical Cooperation between CSIR and the Royal Scientific Society of Jordan was held at Amman, Jordan during 11-19 February 1990. The areas identified for cooperation relate to Beneficiation of Low Grade Copper Ore; Heat Treatment and Metals; Primary Standards, Calibration and Testing; Re-cycling of Plastics; Utilisation of Waste Phosphogypsum in Jordan.

2.30 HUMAN RESOURCE DEVELOPMENT

The number of Research Fellows and Associates receiving financial assistance during 1989-90 was 3999. Out of these, 1224 were JRFs, 2244 SRFs and 531 RAs. The awards made during the year numbered 400 JRFs, 510 SRFs and 175 RAs.

During the year, 281 persons trained abroad registered for the Scientists' Pool. A total of 133 persons, including 49 registered earlier, was selected to the Scientists' Pool, 39 of them in absentia. Among the 133 persons selected, 104 returned to India, 55 joined the Pool, 20 were expected to join on securing placement in suitable institutions, and 29 did not join the Pool, presumably because they secured regular employment. Further, 117 highly qualified persons who were trained in India and selected to the Pool during the year, also joined the Pool. The number of Pool officers working as on March 31, 1990, was 515. Of them about 45 per cent were scientists, another 45 per cent medical personnel and 10 per cent were engineers and technologists. A total of 325 Pool Officers left the Pool, either after securing regular employment or after completing their tenure in the Pool. Since its inception in 1958, 8971 highly qualified scientists and engineers have availed of the Pool scheme.

A new programme known as the CSIR Visiting Associate Scheme was started this year to foster interaction among the working scientists of various universities, industries and CSIR-Laboratories and other Departments of the Government. A total of 14 VA positions were filled.

Superannuated scientists represent a pool of talented and experienced teachers, guides and researchers. CSIR provides financial assistance to such scientists to pursue research or write monographs or books in their respective fields of

specialisation relevant to the programmes and activities of CSIR. This year 70 Emeritus Scientists were in position.

CSIR distributes research grants to non-CSIR laboratories, mainly in the universities. A total of 740 projects (132 being new) were supported this year. More than 1200 fellows and associates were collaborating with the Principal Investigators in these projects. Twenty journals in 9 Indian languages were provided support.

2.31 SCIENCE AND TECHNOLOGY MANPOWER

Biogdata of 154 scientific and technical personnel, against 28 vacancies notified were furnished to the Division to facilitate their absorption in regular posts. This included 73 working Pool Officers and 81 non-Pool personnel.

An orientation-cum-training programme has been developed for fresh recruits so as to familiarize them with the CSIR system and to facilitate their becoming productive as soon as possible. This year two courses were organised and in these 61 Scientists-B related to 25 different CSIR laboratories, participated.

A training programme for Scientists-C and E has been formulated. This course of two weeks duration included lectures on the status of science and technology in the country and on subjects relating to project management, including project planning, interpersonal relations, methodology of research, safe laboratory practices, computer usage, MIS and administrative and budgeting techniques and technology transfer process. The first course of this kind was offered in January-1990. Twentyfive scientists from 15 CSIR laboratories participated in the course.

III. SCIENTIFIC RESEARCH ASSOCIATIONS/ INSTITUTIONS

1. INTRODUCTION

With a view 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 RESEARCH ASSOCIATIONS IN THE AREA OF NATURAL AND APPLIED SCIENCES

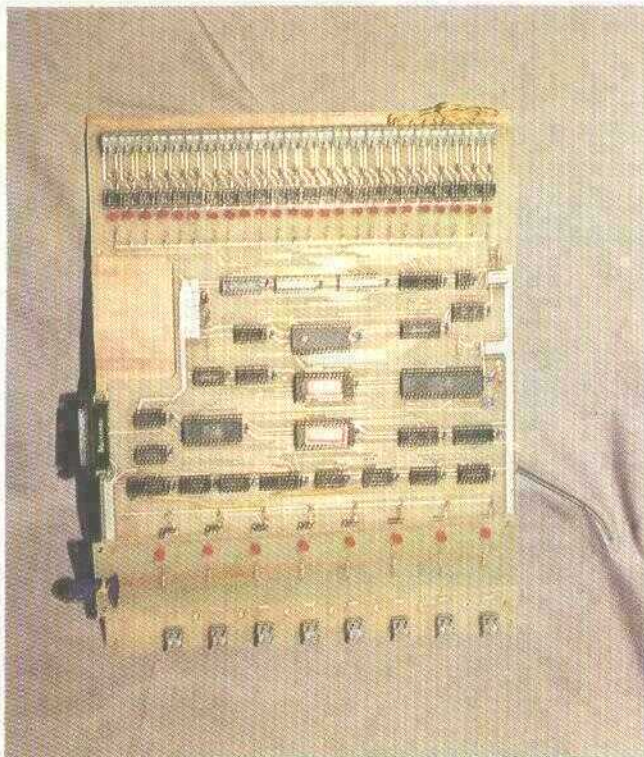
Scientific Research Associations, Institutions, Universities and Colleges which undertake research in the area of medical, agriculture and other applied sciences seek approval under section 35 (1) (ii) of the Income Tax Act if they wish to have donations from Industries or other sources. The institutions 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 June 1, 1982, ICAR and ICMR were the Prescribed Authorities for making recommendations to the Ministry of Finance in the areas of agricultural sciences, medical sciences, respectively. With effect from June 1, 1982, Secretary, Department of Science and Technology was designated as the 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. Following certain amendments to the I.T. Act in 1989, the Director General, Tax Exemption is the Prescribed Authority, with the

concurrence of Secretary Department of Scientific and Industrial Research.

For considering the cases for approval under section 35 (1) (ii) and (iii) of the Income Tax Act there is a standing committee known as Screening Committee which consists of the representatives of Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Social Science Research (ICSSR), Central Board of Direct Taxes (CBDT), and Department of Scientific and Industrial Research DSIR. The recommendations of the Committee are submitted for seeking approval of the Secretary DSIR.

Approval to these institutions is granted for a limited period in the initial phase. These institutions are required to submit the annual returns to Secretary, DSIR. These annual returns are reviewed in the Department by a group known as Research Review Group constituted by the Prescribed Authority. The group makes necessary recommendations regarding the further extension or withdrawal of approval.

In order to ensure conformity with the guidelines, wherever necessary the organisations are advised to make necessary changes such as in the objectives of the Memorandum of Association or in the Investment Clause. During the year, about 50 organisations held discussion with the Department. Through an amendment by the Direct Tax Laws (Amendment) Act 1987 effective from 1st April 1988 Section 35 inter-alia was deleted. The Department therefore, prepared a scheme on Recognition of Scientific and Industrial Research Organisations. For operating the scheme which was almost on similar lines as the earlier approvals u/s 35 a Screening Committee was constituted. The Screening Committee consists of represen-



III.1 Programmable Logic Controller.

tatives of Indian Council of Agricultural Research, Council of Scientific and Industrial Research, Indian Council of Medical Research (ICMR), Ministry of Finance CBDT, Indian Council of Social Science Research and Adviser (DSIR) as the Chairman. During 1990, the aforesaid Committee met 12 times and approved 32 fresh cases and reviewed 327 cases. A list of 32 fresh cases approved under the scheme in the area of Natural and Applied Sciences and Medical Sciences is given in Annexure III-1.

At present there are 134 research organisations in the area of medical sciences, 145 in natural and applied sciences and 23 in agricultural sciences, thus making a total of 302 research foundations in various categories. Fig. III-4 may be seen which gives details of approved associations/institutions.

Government of India restored section 35 of the Income Tax Act with modifications by Direct Tax Laws (Amendment) Act 1989 from 1-4-89-Sub clauses (ii) and (iii) of clause 1 of section 35 deal with approval of the scientific research organisations and institutions in the area of agriculture, animal husbandry and fisheries, medical and other natural and applied sciences.



III.2 Matching Programme and Self Diagnostic Programme for Wheel balancing M/c

In dealing with such associations and institutions the Amendment Act has made the following modifications :

- i) Application in the prescribed form will be made to the Prescribed Authority.
- ii) The Prescribed Authority could call for additional information as considered necessary.
- iii) Approval at a time will be for 3 years or less.

The Prescribed Authority for section 35 is the Director General (Income Tax Exemption) in concurrence with Secretary, Department of Scientific and Industrial Research (Ministry of Science and Technology), Government of India.

The new procedure for making applications for approval and renewal has been laid down by Ministry of Finance Notification No. SO. 669 (E) (8436)/F. No. 142/25/89-TPL dated 23.08.1989. This procedure is summarised below :

- a) Applicant will make application in the Director General (Income Tax Exemption) in triplicate through the Commissioner of Income Tax having jurisdiction over the applicant.
- b) Simultaneously 6 copies of the application will be sent to Secretary, Department of Scientific and Industrial Research, Ministry of Science and Technology. The applicant will furnish any further details as may be required for dealing with this case by the Director



III.3 Elastic Proving Ring Dynamometers.

General (Income Tax Exemption) or Department of Scientific and Industrial Research.

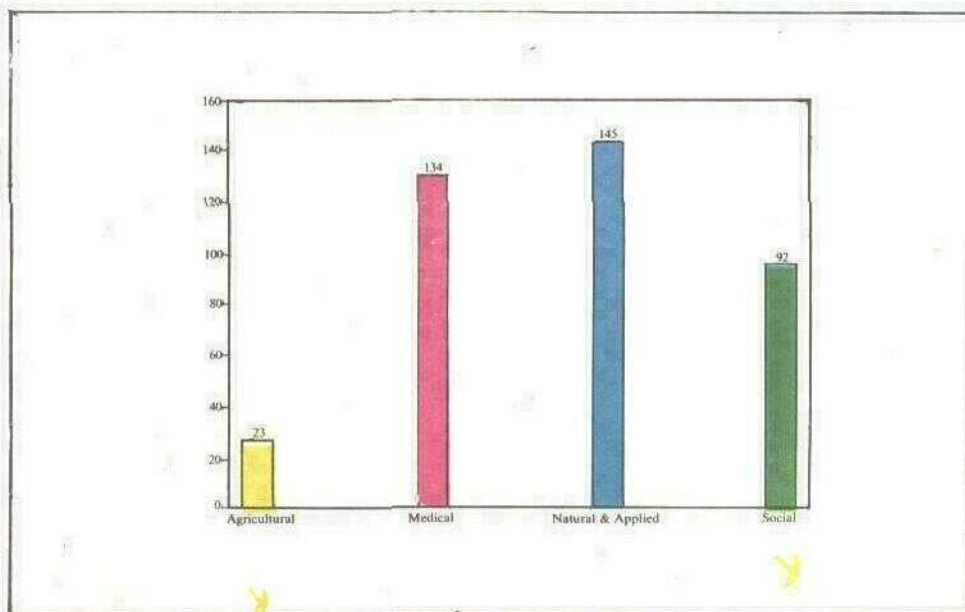
- c) It has also been laid down that the Organisations which has been approved u/s 35(1)(ii)/(iii) will maintain separate accounts of the sums received by it for scientific research.
- d) The organisation will submit to the Prescribed Authority and to the Department of Scientific and Industrial Research a copy of the Annual returns showing income and expenditure balance sheet showing its assets and liabilities. The auditor should certify that the amounts incurred are for scientific research if the organisation is to avail of exemptions u/s 10 (21) of the Income Tax Act.

The Department of Scientific and Industrial Research will examine the applications according to the norms laid down by the Department and after obtaining Secretary, DSIR's approval, department will communicate its comments to Director General (Income Tax Exemption), Calcutta.

3. SCIENTIFIC RESEARCH INSTITUTIONS IN THE AREA OF SOCIAL SCIENCES

Section 35 (1) (iii) of the Income Tax Act 1961, provides for deductions from profits and gains of business or profession and in respect of other incomes and stipulates that any sum paid to a university, college or other institutions to be used for research in social science or statistical research will qualify for deductions at the hands of the donors related to the class of that business.

Till June 1, 1982, the Indian Council of Social Science Research was the Prescribed Authority for the purpose of section 35 (1) (iii) of the Income Tax Act 1961. On June 1, 1982, Secretary, Department of Science and Technology was designated as the Prescribed Authority for this purpose. Consequent to the creation of the Department of Scientific and Industrial Research, Secretary, DSIR had been designated as the Prescribed Authority.



III.4 Institutions recognised

In June 1984, a Group called the Research Review Group on Social Sciences was set up to review the activities of social science research institutions approved u/s 35 (1) (iii) of the Income Tax Act 1961. This Group was reconstituted in October 1985 so as to include the representative each of the Ministry of Finance and Indian Council of Social Science Research and in November 1987, to include a representative of Ministry of Welfare.

From 1.4.88, DSIR launched a new scheme of recognition of scientific and industrial research organisations as mentioned in section 2. During the year Screening Committee had 12 meetings and approved 5 new cases as given in Annexure III-2 and reviewed 78 cases. At present there are 92 research organisations in the area of social sciences.

The formal procedure adopted in 1984 for consideration of fresh applications by the Fresh Approval Committee has resulted in considerable reduction in the time lag between the receipt of fresh applications for consideration under section 35 (1) (iii) and their disposal.

Similarly, the setting up of the Research Review Group on Social Sciences has led to a quicker dis-

posal of application for renewals, received from the interested institutions and an overall review of the social science research work carried on by the institutions approved u/s 35 (1) (iii) of the Income Tax Act 1961.

After obtaining Secretary, DSIR's approval necessary comments are sent to the Director General (Income Tax Exemption), Calcutta.

4. SCIENTIFIC ACHIEVEMENT OF THE ORGANISATIONS

In order to evaluate and bring out the scientific activities and achievements of these Scientific Research Organisations, a publication entitled "Profile of Scientific Research Associations" covering about 74 institutions was brought out in 1988. A second volume of Profile of Scientific Research Organisations was brought out in 1989, covering 180 organisations. During the year under report a third comprehensive volume covering institutions is under print. This has enabled a better appreciation of the good work done by these organisations, indicating therein the contribution they make in the overall scientific research activities in the country.

IV. IN-HOUSE R&D IN INDUSTRY

I. RECOGNITION OF IN-HOUSE R&D UNITS

Over the years 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, etc. 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 has been giving special attention to the 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 Centre.

A scheme for granting recognition to In-house R&D Units in industrial sector and private or public funded research and development laboratories, was being operated by the Department of Science & Technology, Government of India, New Delhi started in 1973, is now dealt with by the Department of Scientific & Industrial Research in the Ministry of Science & Technology. One of the objects of this scheme is to provide liberalised import facilities to recognised R&D Units for equipping their laboratories with equipment, components, and raw materials necessary to carry out R&D work in order to update the technology and effecting improvements in the manufacturing process, introducing new products, processes, developing substitutes for imported items, etc.

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 import substitution, export promotion, etc. process/product/design improve-

ments, development of new technologies, design and engineering, testing and analysis related to these efforts, development of new products or covering 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, etc.

The R&D activities are expected to be separated from routine activities of the firm such as production and quality control. It is not necessary to have all the R&D activities segregated and located in a separate building. It is appreciated that In-house R&D activities are likely to be intermingled with the activities related to the manufacture 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 Managing Director 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 1188 as on 31 December, 1990. The growth is also represented in Figure IV.1. Of these 1188 units, about 100 are in public sector and the remaining are in private sector and joint sector which include organised non-profit making foundations/societies engaged in R&D. A revised and updated Directory of recognised In-house R&D units was brought out during August, 1990.

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

In-house R&D in Industry

Major Activities

To Recognise and
To Renew Recognition

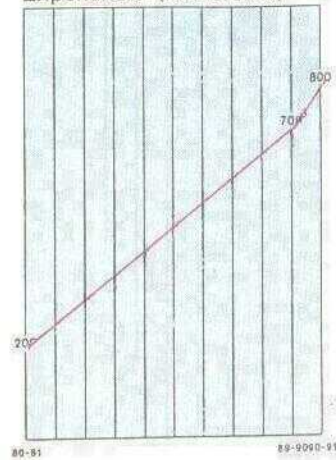
Facilities Provided

Import of Equipment
and Materials on OGL
for R&D

Fiscal Incentives

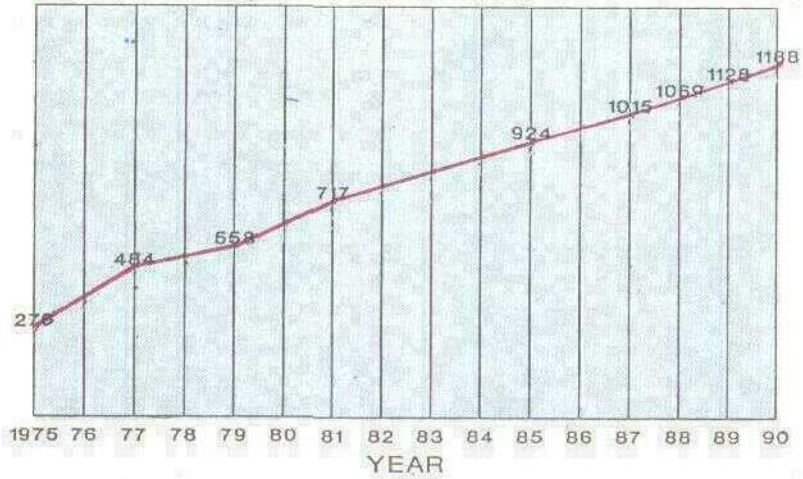
All R&D Expenditure
qualifies for Tax
Exemption

Expenditure (Rs. Crores)



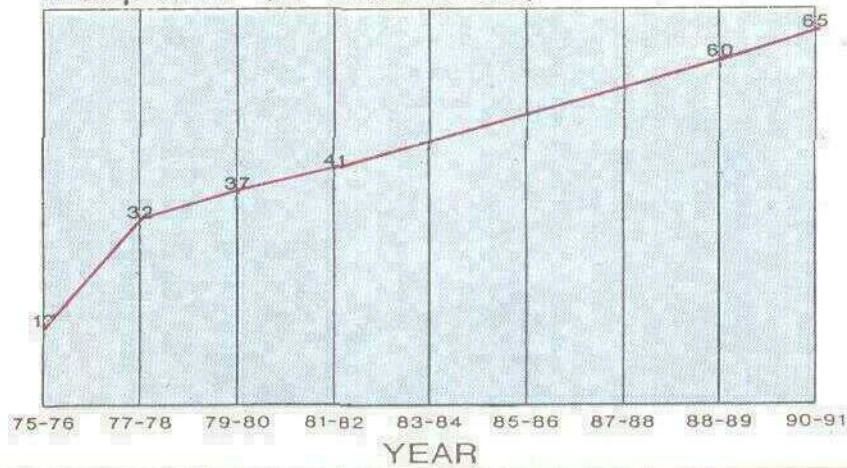
YEAR

No. of Recognised R&D Units



YEAR

Manpower (in thousands)



YEAR

IV.1 In-house R&D in Industry.

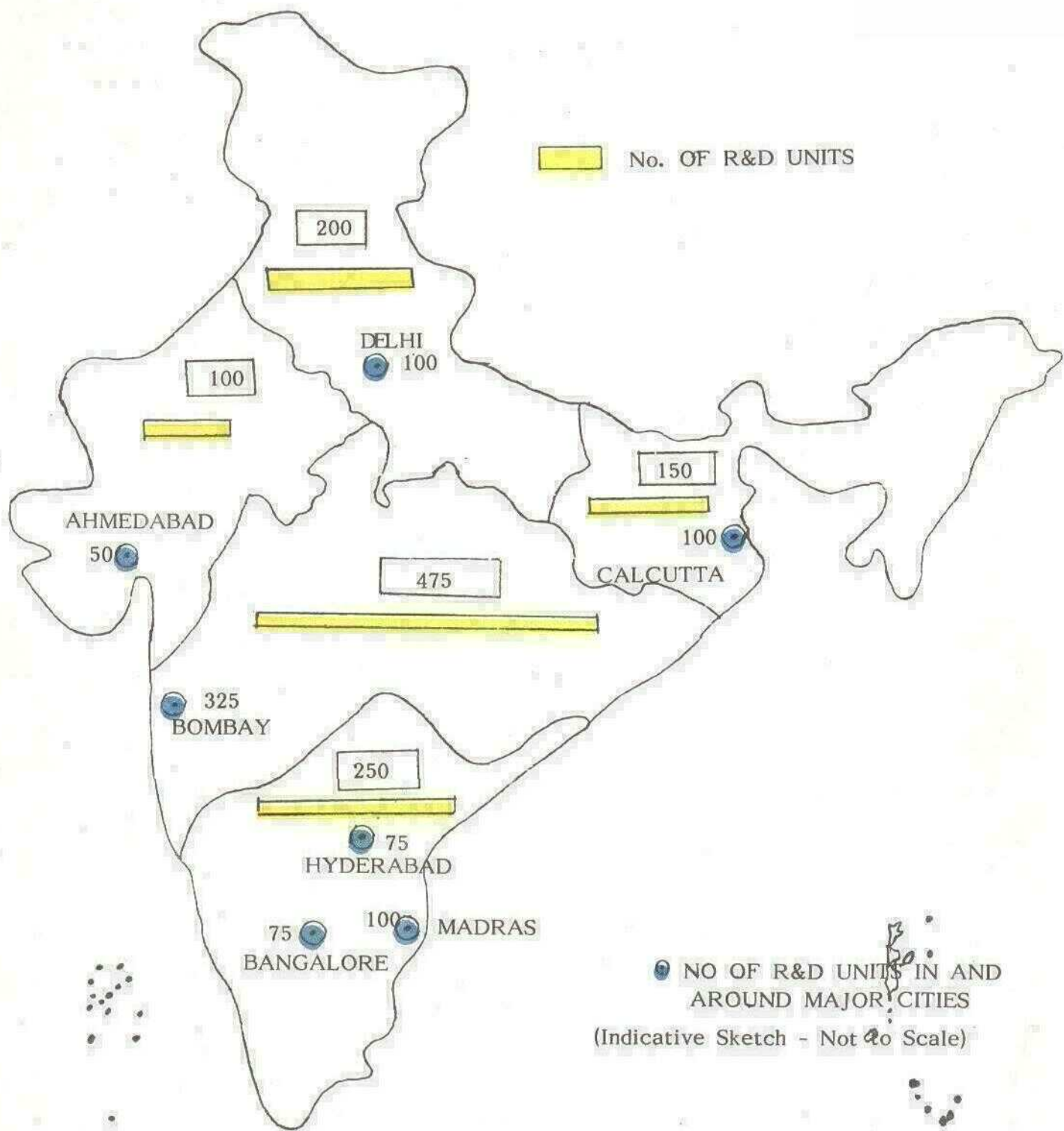


Fig. IV.2. In-house R&D Units - Zonal Distribution

applications after scrutiny in the DSIR are circulated for comments to various other Departments/Agencies such as concerned administrative Ministries, DGTD, DCSSI, CSIR, ICAR, ICMR, and NRDC. The units having more than 26% foreign equity are normally visited by expert teams comprising of representatives of DSIR as well as outside agencies like administrative Ministries, CSIR, NRDC, ICAR, ICMR, IITs, 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, DSIR with representatives from Department of Chemicals & Petrochemicals, Department of Fertilizers, Department of Industrial Development, Ministry of Environment and Forests, Department of Coal, Department of Electronics, DGTD, CSIR, DCSSI and NRDC along with the DSIR representatives. The Committee considers 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 applications, or (c) for deferring the case for obtaining further details, discussions with the company or visit to the unit for clarification of various points. The Screening Committee also considers proposals under the Plan Scheme on Research and Development in Industry operated by DSIR.

The Screening Committee meets every month and considers the application for fresh recognition. Arising out of this, the pendency at any point of time during the year 1990 has been very much within a small number.

During the year 1990 the Screening Committee met 12 times and considered 132 applications for recognition; 86 R&D Units were granted recognition, 8 R&D Units were endorsed on the existing letters of recognition in respect of other R&D Units of their company and 38 applications were rejected.

The pendency at the end of December 1990 was 20. A statement giving monthwise receipt, dis-

posal and pendency of applications for recognition of R&D Units is given at Annexure IV.1.

99 units were visited till the end of December 1990 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 150 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 1990, 401 In-house R&D Units were due for renewal of recognition beyond 31 March, 1990. Hence on the evaluation of the performance of the R&D Units, renewal recognition was granted to 384 Units. All applications recognised for renewal were dealt with and there was no pendency in the year 1990. A statement showing monthwise receipt, disposal pendency of the cases of renewal of recognition of the R&D Units is given at Annexure IV-2.

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

The In-house R&D Units are distributed throughout the country. A zonal distribution of the units is given in Annexure IV.2. 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, about 475 units in the Central Zone covering Maharashtra, Madhya Pradesh and Orissa, over 250 units in the Southern Zone covering the 4 Southern States and around 150 units in the Eastern Zone covering Bihar, West Bengal, Assam etc. The length of the base is proportional to the number of units in the zone.

It is also worth noting that a 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; around 100 in and around Calcutta; 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 1188 recognised R&D Units is nearly Rs. 775 crores and about 40% of it is accounted by over 100 public sector R&D Units and about 60% by over 1075 R&D Units in private and joint sectors. 127 R&D Units spend over Rs. 1 crore each on R&D, 219 R&D Units spend between Rs. 25 lakhs to Rs. 1 crore each per annum on R&D. The list of these R&D Units is given in Annexure IV.3 and IV.4 respectively.

The major R&D Units in public sector undertakings are Hindustan Antibiotics Ltd., SAIL, ONGC, IOC, HMT, IDPL, CMC, HAL, ITI, BEL, BEML, BHEL, GCEL, EIL and PDIL. Some of the major R&D Units in the private sector are ACC, Astra Research Centre, Bajaj Auto Ltd., Boots Co. Ltd., Dunlop India Ltd., Hindustan Lever Ltd., J.K. Synthetics, Larsen & Toubro Ltd., National Organic Chemicals Ltd., Siemens Ltd., Tata Iron and Steel Co. Ltd., Ranbaxy Laboratories, Hoechst Pharmaceuticals, Cipla Ltd., Ashok Leyland, Escorts, Kirloskar Cummins, MRF, Godrej, Peico, Tata Hydroelectric Power, Wipro, Wockhardt etc.

5. R&D INFRASTRUCTURE

The In-house R&D Centres have also created impressive infrastructural facilities including sophisticated instrumentation 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 is over Rs. 700 crores at present. Some of the sophisticated equipment facilities available are : scanning electron microscope; computerized X-ray diffraction and X-ray fluorescence analyzers; UV-Vis, infrared, vacuum emission, nuclear magnetic resonance, and atomic absorption spectrophotometers; chromatographs; thermoanalytical equipment; RUL: creep measuring and high temperature evaluation equipment; microprocessor development systems; electronic and electrical testing and evaluation equipment; computers; custom built

test rigs; colour matching computers; mechanical testing, fatigue testing equipment; programmable temperature controlled high temperature furnaces etc. Most of the R&D Units also have good library facilities of their own and subscribe to a number of periodicals and journals.

6. R&D MANPOWER

There has been a steady increase in R&D manpower employed by the In-house R&D Units. By 1975-76 about 13,000 R&D personnel were employed by nearly 400 units. By 1981-82 the figure was over 41,000 for about 750 units. The present estimated manpower for the 1188 In-house R&D Units is over 65000.

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 Industries Sector	— 350
(ii) Electrical and Electronics Industries Sector	— 275
(iii) Mechanical Industries Sector	— 225
(iv) Processing Industries Sector (Metallurgical, Refractory, Cement, Textile and others)	— 250
(v) Agro Industries and Others	— 75

8. IN-HOUSE R&D UNITS : OUTPUT

- (a) Contribution 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.
 - Interphase 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) Major R&D achievements reported by some of the recognised In-house R&D Units are indicated below :

Chemical Industries Sector

- Discovered natural products, antibacterials - Decaplanin, Mersacidin, Napsamycin, Alisamycin; antifungals, Deoxy-mulundocandin, Aranosinol, Maclafungin; biosynthetic regulator butalactin; immunomodulator cammunocin.
- Processes developed for Captopril, famotidine, Propyphonazone Ciprofloxacin, Triflupromazine, Terbutaline Sulfate, Glibenclamide, Gentisic acid, ethanolamide, Norfloxacin, Salbactam, Ammoxycillin, Dane's Salt, 7-ADCA, Cephalexin, Cloxacillin Sodium, Sodium Salt of amroxycillin, Nifedipine, Clofazamine, Chlorzoxazone, Povidone Iodine, Dextropropoxyphene HCl, Nefopan, Benzalkonium chloride, Defloxacin Methane Sulphonate, Buspirone HCl, Piroxicam, Pindolol, Thioridazine, Tiamulin, Hydrazen Fumerate.
- Technology Developed for Amino Ethyl Ethanolamine, Phenyl diethanolamine, Iso propanol amine, ethylene diamines, Glycol ether Acetate, Ethylene Glycol diacetate, Ethylene Glycol Ether acetates, propylene glycol ethers, Hippuric acid, 2, 4-dinitroaniline and its bromo derivatives,

quinezarin, Tetra Methyl Thiurium Disulphide, Chloro propionyl Chloride, 4, 4-Dithiodimorpholine, trichloro acetyl chloride

- Developed cashew nut shell liquid based phenolic composition for use in manufacture of brake-linings, flame retardant polypropylene, LDPE & HDPE Sheathed Compound for telephone cables, super plasticizer for concrete, Ion Exchange membranes, Polyurethane potting compound, Polyurethane adhesive, Metal clad decorative laminates, Paper epoxy laminates.
- Developed rubber containers used in submarines, special roll coverings for high speed paper machines, special bonding of suction press rolls, Deckle tubes and aprons used in paper industry, special linings for use in the membrane cell.
- Process developed for rice herbicide, butachlor and herbicide safener, 2-hydroxy guinoxaline, 0,0 dimethyl phosphorochloridothioate, 0,0 diethyl phosphorochloridothioate, Acephate, 2-Chloro-N-methyl acetoacetamide.
- Developed Vinyl sulphone Ester, C.I. Direct Black-22, C.I. Dispense Diazoblack-9, 4,4 diamino Diphenylamine, N, N-dioxyethylaniline, 3,3 Dinitro Diphenyl Sulphone, Meta Amino Phenol, 3,3 diamino diphenial Sulphonate, K-acid.
- Processes were developed for D (-) Phenyl Glycine and D (-) Phenyl Glycine Chloride - Hydrochloride, D (-) Parahydroxy Phenyl Glycine and its Dane salt, 5-Sulpho Isophthalic acid, Mosquito Larvicide, Gibberilic acid-GA-3.
- Developed basic blue dyestuffs, developers for plain paper copies, computer ribbons, film ribbons, microcapsule latex stamp pad, Pesticide resistant side strips lacquer for pesticide containers, Invisible UV Sensitive Inks for security documents, specific chemicals for making currency printing plates, screen inks for Polyolefines like HDPE, PP.
- Developed membrane based biomethanation process for treatment of distillary effluent, fermentation process for the production of 'Natural Grade' butyric and propionic acids, brain infusion powder and special peptone that can support better growth of microorganisms.

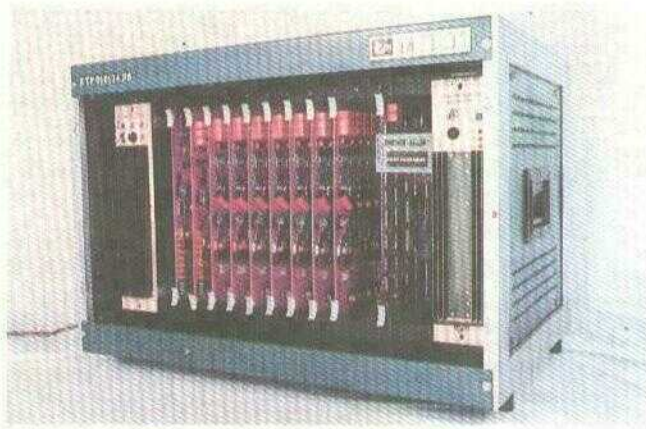


IV.3 Laboratory Scale Fermentors in Antibiotic Screening.

- Developed a new fragrance chemical sandalene synthesised from 3-carene.

Electrical & Electronics Industries Sector

- Developed low watt loss inductive ballast; potted ignitor; orthocyclic ballasts; opalite luminaries; low cost mounting luminaries; lamp holder systems; floodlight; glare free street lights with pot mirror; low wattage street lights. Indigenised lacquers for standard film resistors : SFR 25H and MR 25; Cadmium free colour coding inks; Feature phone designs; Dual standard push button telephone; SM/FM receivers; electronic ballasts; PAL/SECAM Modules; Micro Processor based public address system; Micro-processor based medium frequency oscilloscopes 50 MHz and 100 MHz linear; 100 MS/S digital storage oscilloscope; Digital multifunction instruments; microprocessor based data acquisition and control system; electronic weighing systems; Medical electronics equipment; Entertainment electronic items like radio recorders; AM/FM portable sets; Mono/stereo recorders; Double deck stereo recorders; Home audio systems with CD Player, CTV & MTV.
- Developed excitation regulator for plasma arc DC generator; PLC/PC based tube mill automation package; high precision digital speed regulator for induction heating; PLC for AMF systems; MF inverter for induction heating; synchroloc motor upto 30 KW; 7.5 KW switched reluctance motor drive; class H insulation system for a.c. generators; class C insulation system for low voltage a.c. motors; computer software for selection of motors.



IV.4 Mini ILT

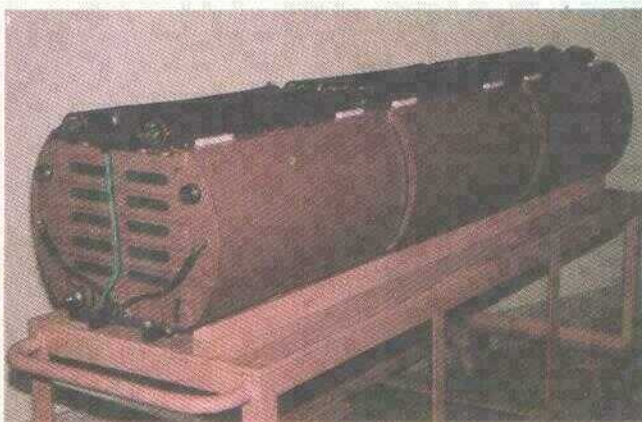
- Developed Nickel cadmium 40 Ah acrobatic batteries, 6 Ah and 7.2 Ah Nickel cadmium batteries for communication equipments; silver oxide zinc secondary cells for space programmes; silver chloride Magnesium sea water battery for torpedo propulsion; silver Oxide Zinc primary service battery for missile application.
- Developed electronic voting machine for election commission; Radiometric Belt weighers; IBM PC/AT based engineering workstation; PC based fast Medical scanner; PC based stable Beam spectrophotometer; OMC system for E10 B telephone exchange; Progicon 3000 programmable controller; Gyro for beltec; unmanned synthesised S-based TVRO.
- Developed highly ruggedised military computers for electronic warfare systems and a strap down inertial navigation system; Fourth generation of display system for command and control application;
- Developed a variety of phones like hands free phone; answering phone; STD lock and executive secretary phone; A series of IEF 488 instruments which could be used stand alone or to form comprehensive test systems; Micro Computer based transistorised AC drives; High Voltage Systems to cater varied industry segments; FEM based software packages, software vibration analysis; structural analysis; PCB layout software; castor oil derivatives for HT capacitors; polymer concrete insulators to replace porcelain and epoxy insulators.
- Developed solar refrigerator based on solid adsorption using zeolite; three types of solar sterilizers viz. paraboloid dish; acrylic spherical reflector and box type.
- Developed central nursing station; Oscilloscopes for defence/DOT; plain paper copiers; 14" and 20" B/W TV; 20" Colour TV; 21" FST; Components such as galvanometers; selenium drums; electro magnetic clutches; platen glass; teflon coated rollers (high L/D ratio).
- Developed suitable generators with high run-way speeds for micro hydel power stations; Two speed pole amplitude modulated (PAM) motors; Multispeed sugar centrifuge motor; 4-6 MW Diesel generators; 12 KV 630/1250 A 26.4 KA Outdoor vacuum circuit breaker for use of



IV.5 OHE Inspection Car.

state electricity boards; MOCB panel rated upto 12 KV, 20 KA for industrial application; special plastic components for high temperature application in switchgear; Magnetic putty for substitution in place of magnetic wedges; Special grade epoxy resins with higher pot life and filler loading for epoxy cast CST & PTS.

- Developed a variety of colour televisions with features like remote control, PMPO sound output, swing speaker boxes, 29 programmes memory; on screen display remote control; a variety of black and white televisions with features like turret tuners; 6 programme selectors;
- Developed application software like Draft pack 3D to model complex components in three dimensions offering extensive modelling capabilities; omega NC with 2, 1/2 and 3 axis capabilities for specifying tool paths and generate paper tape to drive NC machines;

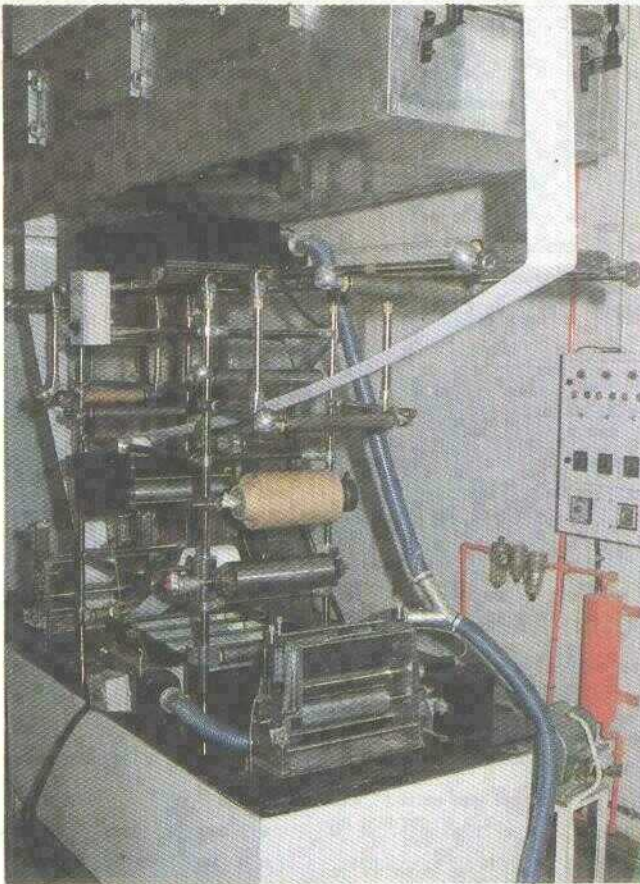


IV.6 Primary Silver Oxide - Zinc battery for underwater applications.

software for modelling vehicle dynamics for vehicles like trucks, cockpit simulators and evaluators for examination of a wide range of flight and navigational parameters. Floppy terminals & tape drive bus controllers; DR-11 W DEL standard parallel bus interface; MIL 1553 B Department of Defence Standard avionics bus interface; Digital scan converter for defence.

Mechanical Industries Sector

- Developed overhead equipment inspection car and track laying equipment for railways; dedusting and heat recovery unit for tea making, special header for harvester combine (S-8100) developed for harvesting sunflower; a new model 27.0 KW tractor fitted with an indigenously developed 9x3 gear box, a double reduction gear axle with fully enclosed, water-proof dry friction disc brakes suitable for wet land cultivation; fluidised bed boiler to work on agro-based fuel such as paddy husk, groundnut shell, coffee husk etc.; complete wheat/rice straw handling system comprising of reaper cum baler, stationary baler, off road bale straw handler; de-dusting unit and heat recovery system for fluid bed drier and thyristor converter for continuous fermenting machine; lighter rigid tine cultivator to suit lighter soils; ergonomic pedals for operating clutch and brake on TAPE 25 tractor, fluidised bed combustion technology for bagasse.
- New design optimised using finite element analysis with CAD facilities, a steel and aluminium combination wheel for T-72 tank prototype for field trials; sampled data continuous path control CNC for profile cutting; programme station software for CNC profile cutting; CNC slant bed turning centre, STC 25; linear transfer machines, LTM moving column type CNC special purpose machines; SNC-V and SNC-H; lens grinding and polishing machines; GLP; CNC trainmaster lathe, T-70; import substitution of vertical machining centre VMC 500; CNC retrofit system for milling machine, rotary encoder, infra-red intruder detector system.
- Introduction of super tuned delta engine on two stroke 100cc motorcycle for better low end torque; foam type filters on three-wheelers; AC blinker system on two wheelers; plastic magneto fan in place of aluminium die cast fan; machinery



IV.7 Pilot Plant - Rotary Laboratory Coater.

for trendy ball pen assembly machine development and refilling assembly; pilot pen assembly and facing machine; automatic transfer system in a co-generation plant for uninterrupted HRSG operation; plug valves with pressure balance and flexible loading system for use in general industrial application; super 'H' pressure balanced plug valves; high pressure gate valves for nuclear power plants; import substitution of power pack for TAFE 25 Tractor with indigenous engine, new front axle and 3-point linkage in line with IS specification; electronic water level indicator for drum level measurements.

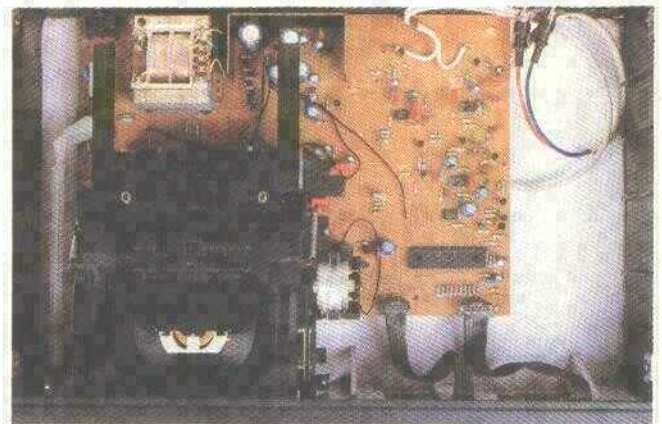
- Developed welding technology to withstand stress corrosion cracking in the oil field equipment for off-shore platforms; microbes for phenol reduction in waste water from coal based combined cycle power plants; cartridge of twin blade with lubra strip; auto rapper with digital electronic circuits with relay outputs and digital memory to accommodate different rapping frequencies.

- Development of special purpose water cooler for installation in railway coaches. Three models developed i) 110 V DC with automotive compressor, ii) 110 V DC with open type compressor, iii) 230 V AC with hermetic compressor and inverter; conversion of scanners from ultra violet to visible light.
- Development of biogas plants based on water hyacinth; composite agriculture waste & kitchen waste; 3.7 KW throatless downdraft gasifier for rice husk; 25 hp wood based gasifier.
- Design and Development of travelling grate with pneumatic distribution for bagasse fired boiler. A new gear box for landing ship tanker (LST) and Triple Tandem articulate co-axial gear box of 18400 HP for Indian Navy.

Processing Industries Sector

(Metallurgical, Refractory, Cement, Textile and Others)

- Breakthrough in sinter making using low alumina Indian blue dust; improvement in Blast Furnace productivity to the highest ever level in India.
- Development of a gas shrouding system to prevent oxygen pick up during teaming of steel; optimum addition of calcium silicide in steel for deoxidation on the basis of oxygen measurement; Development of corrosion resistant rebards TISCONCRS, with 4-5 times more corrosion resistant than conventional rebards for use in corrosive environments in marine and polluted industrial atmosphere.



IV.8 Indigenous CO Player.

- Development of Autosetting Mill for sugar plant unique design feature to give better performance compared to any other mill in the world; Design and development of sulphur burner with complete automation for process control; dumping grate boiler with spreader stoker upto 65 TPH capacity; TIG welding process for aluminium and titanium alloys.
- Coating system for the pre painted sheets have been developed indigenously to meet the customer's requirements in Indian Climatic conditions.
- Developed technology for manufacturing of High Density High Alumina Grinding Media and Wear resisting material containing 90% Al₂O₃.
- Developed new speciality grades of MICR Cheque, coated printing base and laminating base paper; Pink Newspaper; Mirrox deluxe photocopier paper; ARSR paper; coating base paper & carbonless base paper.
- Developed alternate technology for high yield pulping of rice straw/bagasse based on new cooking composition.
- Developed extra deep drawing quality of cold rolled sheets for automobile industries.
- Developed Indigenous Flame Retardent Additive fibre; a permanent Flame Retardent Viscose Staple Fibre; Viscose Fibre having a trilobal (Y shape) cross section useful for sanitary/hygine product.
- Developed substitute for imported electro-conducting grade viscose fibre "VISCOSTAT"; viscose sponge; Auxillary pilot plant equipment

for preparing new textile stain removers, wetting agents, softness resins binders and sizing materials.

- Developed ribbon like flat rayon fibre; triangular cross section rayon fibre; high elongation rayon fibre; X-ray opaque rayon fibre; water repellent fibre; relevent spun cellulosic fibre.
- Continuous development in dyeing and printing processes for camouflage printed fabric.
- Development of river erosion control Geotextile for Calcutta Port Trust.
- Development of Bullet proof fabric from kevlar yarn, Computer Ribbon fabric, spindle tape fabric, elastic fabric for blouse material and denim, rope bleaching yarn dyed P/C export fabric.
- Process developed for Marble Polishing stone, creep feed grinding wheel, Razor blade semi-finishing wheel, water proof paper with latex impregnated paper as backing, power vitrified products, buffing paper with white aluminium oxide grains, alumina and magnesia purging cones, Ultra low cement castables/alumina slide plates, zirconia bubbles, plasma powder.

Agro Industries Sector and Others

- Promising exotic sunflower hybrids suitable to Indian agro climatic conditions were identified and put under New Seed Policy Trial. Crop production techniques were improved in sunflower belts yielding an increase of about 25% in production. An early maturing radish in 20 days time, black gram, induced mutant, polypoid high yielding and draught resistant were developed. Hybrid cotton, yiz. Jai Shree and Jai Saradha with yield of 50-65 quintals/hectare and 50-60 quintals/hectare were produced. Disease free okra was developed. Micronutrients blend has been developed for crops like sugarcane, pulses and paddy. A herbal based botanical pesticide named Nimbecidine acting as antifeedant and compatible with most of the chemical pesticides has been developed.
- BV 300 Brand of new strain of Egg laying Chickens fully acclimatized to Indian agro climatic condition was developed as a substitute to imported Brand from USA. 45000 Grand Parents (seed stock) in the country were pro-



IV.9 Pilot Plant for chemical synthesis.

duced. The hens of new strain developed produced 25 extra eggs per year eating 1.5 kg less feed. Improvement in 'Hubchix' broiler in making available a highly competitive meat type bird to Indian Poultry Industry. Indigenous development of Brolier representing three fold benefit to the poultry production in terms of more meat per bird based with less feed consumption in short period - indigenous development of Key-ston Golden a tinted egg layer specifically for selective and rural market.

- New Varieties of biscuits, bread and cakes Gooday pista Badam, Pure magic, circus were introduced commercially. A new process of bread production - Activated Dough Development process was introduced. New packs have been introduced in biscuits using heat sealable BOPP.

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 under the Open General Licence facilities available to them by virtue of the recognition. These include : Precision Viscosity Bath and Refractometer, Flashcan Photoplotter Model 4P-MKII Plotter, Dispergrader with Monitor to operate on 220 v 50 cycle, laser airborne particle counter, Borehole logging system and digital nuclear logging system, Scanning electron microscope, energy dispersive X-Ray Spectrometer, Sub-system for Telecommunication/Data communication equipment, Integrator Printer/plotter chromatocorder with Thermal printing head, Programmable curve tracer, 'Varian' EN 360L NMR Spectrometer, Storage Oscilloscope, Preparative HPLC system, Extrusiograph, X-Ray fischerscope for coating thickness measurement, Perkin Elmer Model 8700 Gas Chromatograph, Automatic Abbe Refractometer, 100 MHZ Digital Storage Oscilloscope with X Y Plotter, Shaft Vibration Monitoring System, APV Gaulin Homogenizer, Differential Scanning Calorimeter, Monsanto Mooney Viscometer, Monsanto Mooving die Rheometer, SHIMADZU' VV-VIS Spectrophotometer, Ratio XR Turbidometer, Multipoint Scanner, High Voltage Bridge Biccotest model and Magpie equipment, Oscilloscope with plotter/software.

10. OTHER BENEFITS AVAILED BY THE RECOGNISED R&D UNITS

The department provides assistance to the 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 of R&D and for maintenance/commissioning of imported R&D equipment requiring such expertise; allotment of special controlled materials, etc. for R&D are dealt with.

The Department also examines the issues relating to the pricing for the products whose technology has been developed indigenously. The bulk drugs manufactured through process know-how developed through In-house R&D are exempt from the Drug Price Control order (DPCO) for a period of 5 years after their first introduction in the market. The department examines the requests 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 1990-91, certificates of indigenous development of technology/process for manufacture of bulk drugs for claiming exemption from Price Control were issued in respect of 6 bulk drugs viz. Theophylline (Pefco Industries Ltd.), Doxycycline hyclate, Nalidixic acid (Ranbaxy Laboratories), Verapamil HCl (Associated Drugs Co.), Povidone Iodine (Wockhardt Ltd.), Ranitidine (Globe Organics Ltd.).

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.

11. PROMOTION OF INDUSTRIAL RESEARCH IN INDUSTRY

DSIR has a Plan Scheme on Research and Development in Industry.

Major activities undertaken under the scheme are reported below :

(a) 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 31st December, 1990, there were 1188 In-house R&D units recognised by DSIR and whose data is entered in the computer.

(b) In-house R&D-DSIR interaction

At the instance of Secretary, Department of Scientific & Industrial Research (DSIR), a one day interaction meeting was arranged with Heads of selected In-house R&D units and National Laboratories on 8th October, 1990 in Technology Bhavan, New Delhi. With Secretary, DSIR in the Chair, the Department was represented by Adviser, DSIR and Joint Adviser-In-charge of Industrial R&D Division. The Industry was represented by Managing Directors, Chief Executives, R&D Chiefs and other Senior Officials of selected firms having R&D units recognised by DSIR. Various invitees were also present from other Government Departments and agencies. The number of participants was over 70 from nearly 45 companies.

This meeting was arranged with a view to soliciting the suggestion and advise from the Industry and National Laboratory System, with a view to encouraging/strengthening linkages between industry and public funded R&D units. Four topics namely Instrumentation, Pollution Control and Monitoring, Food Processing and New Materials were also identified for indepth discussions and to explore the possibility of collaboration/linkages between Industry and National Laboratory System.

The following action points emerged out of the discussions.

- i) Short term courses for instrument technicians could be arranged by CSIO, Chandigarh.
- ii) Small cluster meetings/interactive groups on specific topics could be arranged between

Laboratories and Industries. These could be held in the National Laboratories so that the laboratories can be visited by the concerned personnel. CSIO, Chandigarh; NEFRI, Nagpur; CFTRI, Mysore and NPL, New Delhi can be the nodal agencies in the areas of Instrumentation, Pollution Control and Monitoring, Food Processing and New Materials respectively.

- iii) A list of CSIR Pool Officers, Junior Research Fellows can be made available to industry and industry can select people from these lists for employment.
- iv) Pass book scheme could be pursued for recognised In-house R&D units.
- v) DSIR could commission a few market studies in new and emerging areas.
- vi) Directory of instrument makers and indigenously available instruments could be made available.
- vii) Instrument Research and Development Board could be set up under the Ministry of Science and Technology to guide, direct and coordinate all R&D activities in the field.

Actions arising out of the above recommendations have been initiated.

(c) Fourth National Conference on In-house R&D in Industry

The Fourth National Conference on In-house R&D in Industry was organised by the Department of Scientific & Industrial Research (DSIR) jointly with the Confederation of Engineering Industry (CEI) on 22nd and 23rd November, 1990 in New Delhi. Attended by nearly 500 participants comprising of Senior Government officials, Scientists, Technologists, and Engineers from industry, Educational institutions and National Laboratories and the public funded institutions and consultancy organisations, the conference was inaugurated by the Secretary, Department of Scientific & Industrial Research. The valedictory address was also delivered by the Secretary, DSIR.

The highlights of the recommendations are : In-house R&D in industry is now mature to take up

challenges, Investments are low and as such must be enhanced fast to achieve technological leadership. Effective planning and management of R&D in Industry are critical for the success of in-house research. The variety of issues connected with men, material and resources which are distinct to the Indian context and as such call for appropriate management systems which should be evolved to suit organisational requirements. Every technology import should have an in built facility for continuous upgradation of such technology and as an inherent part of the package. For absorption and upgradation of imported technology large industrial units may take up development contracts for products supplied to them by their ancillaries/equipment suppliers. Focussed Task Forces may be setup for specific sectors of capital goods industry to assess status and identify weaknesses. Measures should be initiated to catalyse user sectors which are dependent, in a large way on imports of capital goods. Mechanism should be evolved to support the consultancy sector to develop engineering capability in respect of capital goods and basic engineering packages in respect of process plants.

(d) National Awards for R&D Efforts in Industry

As part of scheme of granting recognition to in-house R&D units in industrial sector, the DSIR has instituted 'National Awards for R&D Efforts in Industry' during 1987.

During the year 1990, the Department has selected winners of National Awards for R&D Efforts in Industry; these are :



IV.10 Dr. AP Mitra, Secretary, DSIR and DG, CSIR delivering the Inaugural Address.



IV.11 National Awards for Best R&D Efforts in Industry.

Chemical Industries Sector

1. Malladi Drugs & Pharmaceuticals Limited, Madras.
2. Polychem Limited, Bombay.

Electrical Industries Sector

3. Larsen & Toubro Limited, Bombay.
4. High Energy Batteries (India) Limited, Madras.

Electronics Industries Sector

5. Marine and Communication Electronics (India) Ltd. Visakhapatnam.
6. V. Automat and Instruments Pvt. Limited, New Delhi.

Mechanical Industries Sector

7. HMT Limited, Bangalore

Processing Industries Sector

8. The Tata Iron and Steel Company Limited, Jamshedpur.

Agro Industries Sector

9. Venco Research and Breeding Farm Limited, Pune.
10. Pioneer Seed Company Limited, New Delhi.

Successful Commercialisation of Public Funded R&D

11. National Organic Chemical Industries Limited, Bombay.
12. Renewable Energy Systems (P) Ltd., Secunderabad.

Secretary, Department of Scientific and Industrial Research gave away silver shields to these firms at the impressive inaugural function of the Fourth National Conference on In-house R&D in Industry on 22nd November, 1990 at Ashok Hotel, New Delhi.

(e) Compendium on In-house R&D Centres-1990

At present there are more than 1100 in-house R&D units recognised by the Department of Scientific and 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 improvement to the technologies in use, a more qualitative and quantitative assessment of the same would be required to be made in order to ensure that the contributions made by the in-house R&D centres dovetail adequately in the overall context of technological and industrial developments. As a first step towards this, the DSIR has made a beginning in bringing out some of the highlights of the achievements claimed by the In-house R&D centres. The first publication of Compendium of In-house R&D Centres was brought out during 1985 covering 193 In-house R&D units, the second in 1986 covering 132 units, third in 1987 covering 209 units, fourth in four volumes in 1988 covering 589 units. The fifth one covering 189 units was brought out in 1989.

DSIR has now compiled and brought out the Sixth successive publication on Compendium on In-house R&D Centre, 1990 in two volumes covering the activities and achievements of 448 In-house R&D units. This was released during the inaugural session of Fourth National Conference on In-house R&D in Industry on 22nd November 1990 at Ashok Hotel, New Delhi.

(f) In-house R&D in Industry - Information Update

As the number of in-house R&D centres has increased while the activities of DSIR have also diversified significantly with respect to in-house R&D units, it was felt appropriate to devise a quick communication system between DSIR and in-house R&D Units. Accordingly, the DSIR started bringing out a quarterly Information Update on In-house R&D in Industry on a regular basis since

April 1988. The Information Update is expected to provide a communication link between DSIR and In-house R&D units and serve to disseminate useful and important information relevant to R&D in Industry.

During 1990-91, four issues of In-house R&D in Industry were brought out in April, July, October, 1990 and January 1991. These have been well received by the Industry, and all other concerned agencies.

(g) Support for R&D Conferences/Workshops/Seminars/Studies

With a view to promoting R&D activities in industry and help establish viable linkage between in-house R&D units and academic institution the department supported the following studies/reports during 1990-91.

- i) Preparation of Technology Status Reports on In-house R&D in a) Cement Industry b) Refractory and Ceramic Industry were entrusted to M/s. Associated Cement Co. Ltd., Bombay.
- ii) Study on 'R&D in Industry Determinants and Policy Implications' sponsored to National Institute of Science and Technology and Development Studies, New Delhi.

(h) Publications

Following publications were brought out :

- (i) Compendium on In-house R&D Centres, 1990 - Chemical, Processing and Agro Industries.
- (ii) Compendium on In-house R&D Centres, 1990 - Engineering Industries.
- (iii) In-house R&D in Industry - Information Update - April 1990.
- (iv) In-house R&D in Industry - Information Update - July 1990.
- (v) In-house R&D in Industry - Information Update - October 1990.
- (vi) In-house R&D in Industry - Information Update - January 1991.
- (vii) Directory of Recognised In-house R&D Units, August, 1990.
- (viii) Proceedings of the Fourth National Conference on In-house R&D in Industry, 1991.

V. FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

I. INTRODUCTION

Various incentives have been evolved for utilisation of the technologies based on the indigenous research and development efforts. These incentives include 100 per cent deduction of the expenditure incurred on scientific research, investment allowance at enhanced rate upto 31.3.87 and custom duty exemption on the scientific equipment and consumables imports by the non-commercial institutions. 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 as detailed in section IV of this report. Similarly contributions made to approved scientific research organisations is also entitled to 100% deductions and indications of such Associations and Institutions are detailed in section III of this report.

2. ENHANCED INVESTMENT ALLOWANCE UNDER SECTION 32-A (2B) OF INCOME TAX ACT

Many of the fiscal incentives that have been introduced in the past, have encouraged the development of technology and scientific research activities in the various institutions, associations and foundations. However, there were very few attractive incentives to use these technologies and commercialise them. As a measure of meeting this requirement, the Government had notified additional relief to the users of the know-how, developed in the country in the shape of Investment Allowance at the higher rate of 35% upto 31.3.87. The Investment Allowance was available on new plant and machinery installed after June 30, 1977, but before 1st Day of April 1987 for manufacture/production of goods based on

technologies developed in approved institutions. To avail this benefit, the applicants are required to submit a certificate from Secretary, DSIR to the effect that such article or thing is manufactured or produced by using technology (including any process) or the know-how developed in any of the institutions.

- i) a laboratory owned or financed by Government;
- ii) a laboratory owned by public sector company; or
- iii) any institution recognised in this behalf by the prescribed authority.

The right to manufacture or produce the article or thing based on the technology (including any process) or other know-how is also acquired by the tax payer from the owner of such laboratory or any persons deriving title from such owner.

During the year 1990, 11 certificates involving about Rs. 427.75 lakhs as the cost of Plant and Machinery were issued in the area of chemicals,



V.1 A selection of Aluminium Paste Plant.

cement, automobiles, drugs, electronics etc. under the scheme. The details of these cases are given in Annexure V-1.

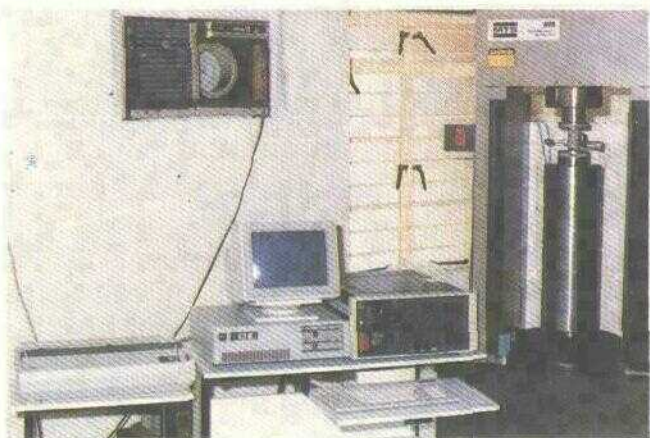
3. DEPRECIATION ALLOWANCE ON INDIGENOUS TECHNOLOGY

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

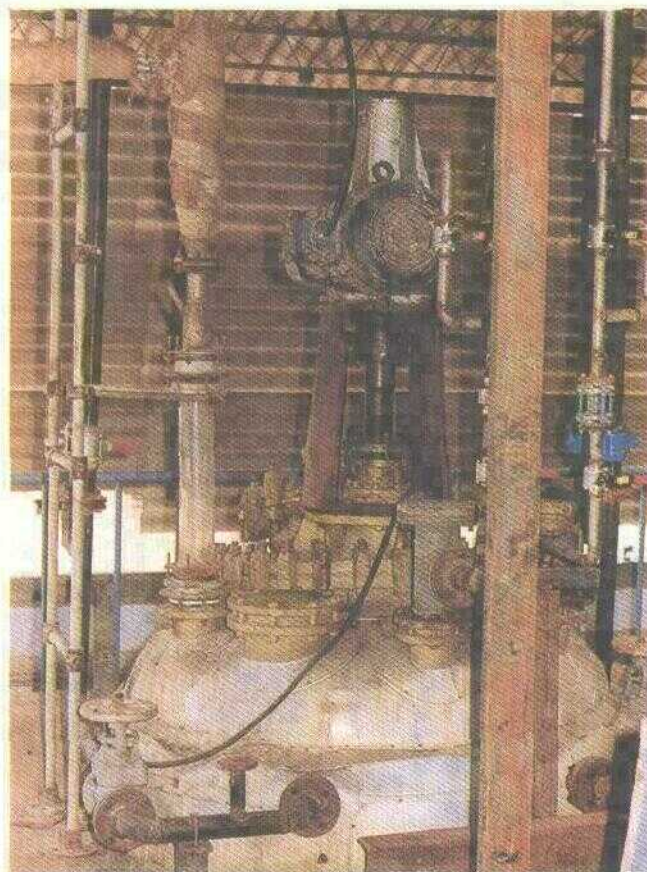
Plant and machinery used as anti-pollution device and those using indigenous know-how are proposed to be placed in a block carrying the higher rate of depreciation 50%. The measure has been brought into effect by the third amendment in the Income Tax Rules 1962, vide notification no. 133/342/86 TPL dt. 1.4.87.

Secretary, Department of Scientific and Industrial Research, Ministry of Science and Technology, is the Prescribed Authority for issuing certificates where depreciation of 50% is to be allowed for the plant and machinery using indigenous know-how. Guidelines have been issued for making applications for obtaining the aforesaid certificates.

During the year 1990, 11 certificates involving Rs. 757.69 lakhs as cost of plant and machinery were issued in the area of electronics and chemicals etc. Details of these cases are given at Annexure V-2.



V.2 Rock Mechanics Testing System.



V.3 Plant for manufacturing Diafuran.

4. CUSTOM DUTY EXEMPTION

The Scientific Research and Development Laboratories and Institutions of non-commercial character are eligible for Custom Duty Exemption on the import of scientific equipment, instruments, spares as well as consumables for research and development activities and programmes. Custom Duty Exemption has been extended to consumables imported by the public funded institutions as well as Institutions/Foundations approved by Department of Scientific and Industrial Research (DSIR) under SIRO scheme and u/s 35 (1) (ii) of the I.T. Act 1961.

The procedure for issuing the custom duty certificates to the Institutions under Administrative control of DSIR has been formalised. A committee for this purpose was constituted which meets normally once a week to examine the proposal.

SCIENTIFIC EQUIPMENT, ACCESSORIES & SPARES ETC.

The Institutions (non-commercial in nature) are required to obtain Not Manufactured in India (NMI) certificate from DGTD and Essentiality Certificate from the concerned Administrative Ministries.

CONSUMABLE ITEMS

i) Import upto Rs. 5.00 lakhs c.i.f. annually

(a) The Research Institutions engaged in non-commercial activities and registered with Department of Scientific and Industrial Research (DSIR) or by any University are required to produce Essentially Certificate from the Ministry of Science and Technology or the Administrative Ministry concerned with them. A certificate from the Head of the Department is also required regarding the nature of the Institution and certifying the amount of the import i.e. less than Rs. 5 lakhs (c.i.f.)

(b) The publicly funded institutions are required to produce a certificate from the Head of the Department regarding the nature of the institution and certifying the amount of

import i.e. less than Rs. 5 lakhs through the Pass Book Scheme. Essentially Certificate and NMI are not required.

ii) Import over Rs. 5.00 lakhs (c.i.f.) annually

In the event the import of the consumable items exceeds Rs. 5 lakhs annually the institutions are required to produce the Not Manufactured in India (NMI) certificate from DGTD in addition to Essentiality Certificate from the respective Administrative Ministry and also a certificate from the Head of Department regarding the institution.

During the year a total of 739 certificates were issued for the import of scientific equipment, accessories, and components, including consumables items. The value of scientific equipment instruments and the consumables was Rs. 26.59 crores.

Some of the major equipments imported were Atomic absorption, spectrophotometer, gas analyser system, X-ray powder diffractometers, super-conducting NMR Spectrophotometer, Magnetometer, voltage scanning systems, Acoustic Emission Systems, turbomolecular pumping system, H.P.L.C. Detector, Excitation system, Ultra Sound Scanner, Ion-laser system, Universal testing machine, Echocardiograph, Uniaxial rock mechanism testing system, High resolution laser Raman spectrophotometer.

VI. INDUSTRIAL TECHNOLOGY

1. INTRODUCTION

The industrial technology group deals with: (a) 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. (b) proposals received for grant of certificate for indigenous development of technology required for preferential treatment in grant of LOI for non-MRTP units and exemption from the provisions of Section 21/22 of the MRTP Act, 1969 for MRTP units.

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 meetings for technical evaluation and Approval Committees/Boards such as Technical Evaluation Committee and Foreign Investment Board (iii) holding meetings of Board of Indigenous Technology and Delicensing Committee for disposal of Proposals for grant of exemption certificates and delicensing certificates (iv) creation and updation of database on the above proposals and preparing suitable software for easy and quick retrieval.

2. INDUSTRIAL LICENSING

About 2220 proposals for grant of Letter of Intent were received during the year as compared to 3000 in the last year. There was thus a drop by about 25%. The group attended 52 meetings of Licensing Committee and 18 meetings of LC-cum-MRTP Committee held by SIA. The following is an illustrative list of products approved for grant of Letter of Intent based on indigenously developed technology.

30 Channel Subscriber Carrier Systems
512 Port RAX
Endosulfan (Technical)
EPABX
Fly Ash Bricks
Geo Textiles
Microwave Ovens

3. FOREIGN COLLABORATION

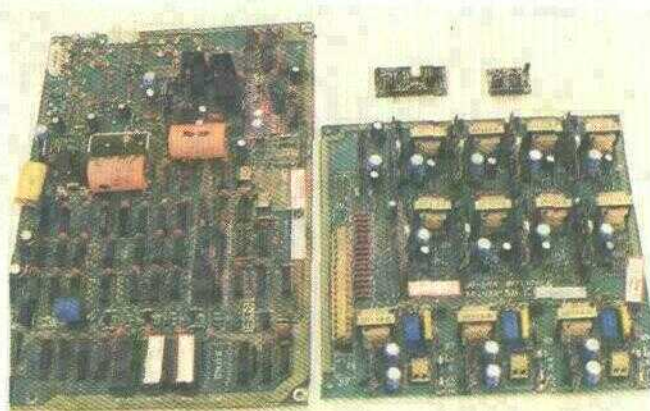
The number of foreign collaborations and composite proposals dropped from 970 in the previous year to 750 in the year under review. The proposals involved technology transfer and/or foreign equity participation. The proposals of NRI were slightly above 20 and those entrepreneurs proposing to set up 100% EOU were of the order of 530.

Additional information was sought from about 300 applicants for foreign collaboration so as to facilitate detailed examination with respect to import of technology.

During the year the Department participated in the Technical Evaluation Committee, which held 49 meetings, for consideration of the above proposals and to send recommendations to Foreign Investment Board, Project Approval board, Special Approval Committee (NRI) and Board of Approvals for 100% EO undertakings.

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

	No. of Meetings
Foreign Investment Board	15
Project Approval Board	16
Special Approval Committee (NRI)	7
Capital Goods Committee	14
Board of Approvals for 100% EOU	11
	41



VI.1 EPABX System (5 trunk lines & 8 Extensions)

The Special meetings of the Project Approval Board for consideration of projects of facsimile, colour TV picture tubes, VCR/VCP, Cordless Telephone, Sheet glass, Nylon 66 yarn, Spandex Fibre, Steel Strips and Sheets etc. were also attended.

4. INDIGENOUS TECHNOLOGY

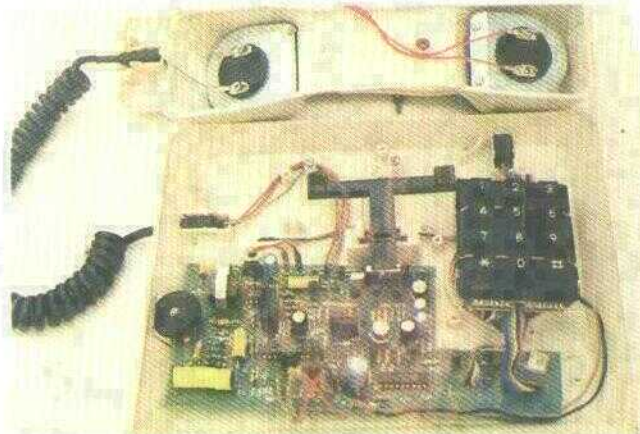
EXEMPTION FROM MRTP ACT

During the year under review, 9 proposals based on indigenous technology were received for grant of certificate for MRTP exemption. List of cases approved by the Board for the year under review are given in the annexure VI. 1. The certificates issued for MRTP exemption covered the following products :

Famotidine
 Monochloro Acetic Acid
 Non Shrink Grout
 Styrenated Phenol
 Trimethoxybenzaldehyde and Trimethoprim

TECHNOLOGY APPROVAL PERTAINING TO DELICENSING

The Department received 14 proposals from non-MRTP companies for grant of delicensing certificate for manufacture of products based on indigenously developed technology. 4 proposals were pending from last year. These 18 proposals were considered by the Delicensing Committee. 8 proposals were approved, 2 closed, 5 rejected, 1



VI.2 Inside view of Push Button Telephone Instrument.

was deferred and 2 fresh proposals were received in the middle of December 1990.

The proposals considered by the Delicensing Committee during the year are given in the annexure VI.2. The delicensing certificates issued covered the following products :

Colour TV - Digital Technology
 Electronic Push Button Telephone
 Electronic Choke
 EPABX
 Geo Textiles
 Integrated Security System
 Ni-Cd Batteries

5. INFORMATION/DATA PROCESSING

The Department has already created a database for the following :

- a) Proposals for Letter of Intent 1989 onwards
 Foreign Collaboration proposals 1989 onwards
 Composite applications 1989 onwards
- b) Foreign Collaboration approvals 1981 onwards

The Department has also developed software for updating, preparing summary, processing and quick retrieval of the desired information. The software has been prepared for above mentioned proposals as well as approvals. These databases are continuously updated with the help of the above software.

VII. NATIONAL REGISTER OF FOREIGN COLLABORATIONS

1. PREAMBLE

The Seventh Plan Scheme, "National Register of Foreign Collaborations" (NRFC), picked up further momentum during the year 1990-91. An Inter-departmental Technical Advisory Committee (TAC) set up to advise on and to guide the functioning of the scheme, held two meetings during the year 1990-91. It reviewed various activities initiated under the scheme and took stock of the progress made, besides approving new projects to be undertaken.

2. OBJECTIVES AND ACTIVITIES

Following are the major objectives set for the scheme :

- Establish/create a data bank on the import of technology;
- Undertake financial, economic and legal analysis for the above set of data;
- Carry out a detailed analysis of the imported technology and state of the art of technology in use in the country;
- Provide a basis for a national technology strategy and indicate directions for national science strategy, wherever possible;
- In the long run, lead to unpackaging of imported technology and in generation of national strength in competitively purchasing only selected components of technology.

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

- Compilation and study of basic data on foreign collaborations (FCs) approved.
- Analytical study of technological, economic and legal aspects of FCs;

- Preparation of reports on technology status in identified sectors/products.

3. FOREIGN COLLABORATION DATA COMPILATION

Continuing the work of in-house compilation of primary data on FCs beginning with year 1981, the compilation for the year 1989 was brought out, in the year under report. The data include basic information like the names of the Indian/foreign companies, products, duration of collaborations, nature and amount of payments involved. The available data on FCs approved during the year 1990 has been computerised and is being prepared for printing.

The work of computerisation of the data collected for previous years (1978-86) had been initiated through the National Council of Applied Economic Research (NCAER), New Delhi. The information on these collected from foreign collaboration applications, has been computerised and the work in this regard has been completed for the period 1978-86.

4. ANALYTICAL STUDIES

4.1 The project awarded to the NCAER, to analyse economic aspects of FCs, such as, impact of technology imports on indigenous technology development and exports, is under finalisation. NCAER has submitted reports which examine relationship between import of technology and indigenous technology development in respect of CNC machine tools, switchgears, transformers and cement machinery. The reports on "Effects on economic liberalisation on exports in Indian engineering industry", has also been submitted. These reports have been evaluated by respective

inter-departmental evaluation committees, suggestions of which have been incorporated in the said reports. All these reports are now being consolidated by NCAER.

4.2 The project on analysis of legal clauses in assorted 100 foreign collaboration agreements which was commissioned on the Indian Institute of Foreign Trade (IIFT), New Delhi, has been completed.

4.3 A project on the study of technical dependence in the Indian public sector, was commissioned on the Institute of Public Enterprise, Hyderabad. The study, essentially, aims at analysing the performance of the public sector, as far as, import of technology through foreign collaborations is concerned. Issues investigated are: conditions under which technology is being imported and efforts made by these firms to adapt the imported technology to local conditions. The report has been completed.

4.4 The Indian Council of Arbitration, New Delhi, has been assigned a project on "Study of terms and conditions, including provisions for arbitration and other dispute settlement clauses, incorporated in foreign collaboration agreements". The issues like deliberate default on the part of foreign collaborators, implications of fixing the venue of arbitration, besides evolving a model set of terms and conditions will be covered in the study. The draft report is under finalisation.

4.5 A project on the Consultancy Development Centre (CDC), New Delhi, on follow up of the implementation of foreign collaboration agreements, was supported. The report submitted by CDC analyses the foreign collaboration agreements made during the period January-June 1986 and compares the same with the terms and conditions of the approval by the Govt. of India. The report has been submitted by CDC.

4.6 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 West Germany (who are major suppliers of technology to India) to technology

transfer agreements, in order to make the prospective Indian importers of technology aware of these implications. A tentative draft report relating to Indian applicable law has been submitted.

4.7 A project on "Techno-Economic Study of Synthetic Fibre Industry in India" was commissioned on Shriram Research Institute and the Institute of Economic Growth, New Delhi. This study aims at assessing the overall dependence of the synthetic fibre industry on imports and efforts made so far in indigenising various components of the technologies in this sector. The study reveals that inspite of import of technology for new plants and fiscal incentives by way of reduction of excise duty, which have been liberally allowed on all fibres, no significant attempt on technology development towards self reliance and capability built-up for future indigenisation and export is apparent. Synthetic fibre production capacities are likely to double within next decade. Support to this industry by the way of indigenous development of ancillaries, like, fibre finishes, anti-oxidants, anti-static agents, delustering agents, like titanium dioxide, etc., as well as, precision engineering components and tools, like, metering pumps, valves, seals, spinnerettes, etc., is very much needed. The industry should be asked to contribute to its development by creating an independent co-operative organisation to meet its needs of technological and engineering services. The study has been completed.

4.8 A study on "Technology acquisition & development in Indian Telecommunication Industry" was entrusted to the Institute of Public Enterprise, Hyderabad. The study aims at assessing the technological changes in Indian telecommunication industry and the role of foreign collaboration in it. The draft report of the study has been discussed by an inter-departmental evaluation committee. The revised draft report has been submitted.

4.9 In order to further increase the technological cooperation between the Soviet Union and India, in the industrial sector, a study of 'Relevance of USSR technologies to Indian industries', was commissioned on the India-USSR Chamber of Commerce and Industry, New Delhi. The objective of the study has been to identify technologies of

relevance to the Indian industry, both in public and private sectors and to bring out those details of technologies which would enable the Indian entrepreneurs to have a preliminary idea about the techno economic suitability of these technologies, relating to their needs. If these were suitable and if further details were required for full techno-economic evaluation, they could get in touch with concerned organisation in USSR. A compendium of USSR Technologies of Relevance to India has been brought out.

Further, a 3-day National Workshop on USSR technologies was held at New Delhi. The objective of the workshop was to provide a forum for Indian industry and research organisations to meet their counterparts from the USSR; for discussions on details of technologies offered, their use, techno-economic aspects and other relevant information. This workshop was attended by a large number of Indian industrialists, representatives from research organisations, concerned Govt. Departments and other organisations. A number of soviet delegates including those from renowned research institutes in the USSR participated. Representatives of agencies engaged in the transfer and trading of technology from USSR to India also attended this workshop. There was very useful interaction and detailed discussions were held in respect of a number of projects.

5. TECHNOLOGY STATUS STUDIES

5.1 As mentioned above, one of the main objectives, of the NRFC scheme, is to conduct technological analysis of imported technology and state-of-the-art of technology in use in the country. About 100 priority sectors/products, including those involving repeated imports of technology were identified, in consultation with other ministries and departments during the VII Plan. Another 100 projects/sectors/products have been identified for the VIII Plan on a similar basis. The task of preparation of the status reports is entrusted to experts/professionals/consultants in the respective fields.

5.2 During the year, reports on technology status of 18 sectors/products were discussed by their respective inter-departmental evaluation committees. These are :

- (i) XLPE Cables
- (ii) Hard Ferrites
- (iii) PVC Coated Sheets
- (iv) Lightning Arresters
- (v) Sponge Iron
- (vi) Semi Conductor Devices
- (vii) LLDPE
- (viii) Rifampicine
- (ix) Sulphamoxole
- (x) Polypropylene
- (xi) VCM
- (xii) Passenger Car
- (xiii) Coke Ovens
- (xiv) PVC
- (xv) Phthalic Anhydride
- (xvi) High Pressure Sodium Vapour Lamps
- (xvii) TV Glass Shells
- (xviii) Charge Chrome

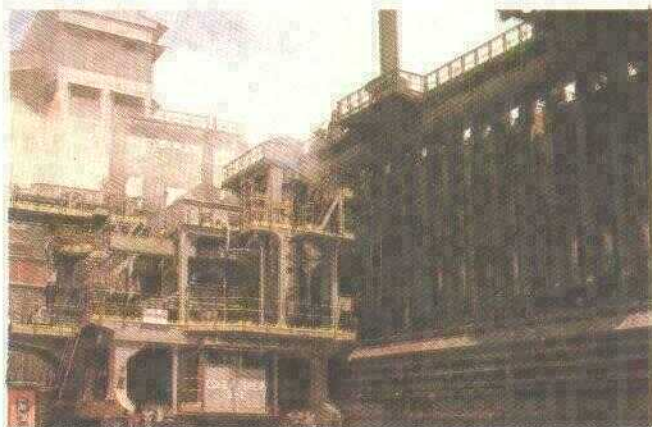
Draft reports deal, at length, with important aspects relating to the industries in the country in these sectors/products. These aspects include : current status of technology; efforts by the industry to absorb and to adapt the imported technology, performance of foreign collaborations; contemporary international trends in technology, 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 of studies under NRFC are being used as inputs to the Technology Absorption and Adaptation Scheme (TAAS), operated by the Department.

5.3 The following are the major findings of studies completed :

Coke Ovens

Coke is a major input factor in blast furnace which accounts for around 60% of hot metal cost. Coke quality particularly in respect of size fraction, ash content, carbon content, reactivity, moisture content M-10 indices etc. has been the major factors affecting the performance of blast furnace. The report reveals that during the course of development various innovations and improvements have taken place in major areas of coke ovens, such as :

- i) Battery construction with respect to refractory bricks,



VII.1 7m tall coke oven battery

- ii) Built in provisions in battery for heat economy and uniform distribution of heat and;
- (iii) Oven equipments like oven anchorage system, oven doors, oven machines, door body and door frame cleaner, gas off take cleaning mechanism, environmental aspects and pollution control equipments and waste energy recovery system.

Out of the major problems encountered by the Indian coke oven has been the continuous deterioration in quality of coal resulting in coke with high ash content and poor strength. This has contributed to phenomenal high coke rate of Indian blast furnaces as compared to developed countries. Several technologies have been developed and tried to combat this problem. Technologies which can be accrued for improving coke quality are : selective crushing of coal, stamp charging of coal, partial briquetting of coal charge (PBCC), preheating of coal charge, coke dry cooling process and solvent refining of coal. Some of the new technologies have been incorporated in some of the steel plants. PBCC has been implemented and commissioned in Bhilai Steel Plant recently in the country. TISCO has commissioned country's first stamp charging facility last year. VSP coke oven battery with 7 m tall ovens have been commissioned last year with coke dry cooling facility.

Coal Washeries

The report concludes that the present washeries are not in a position to meet the demand both in

quantity and quality. Moreover, problem of deteriorating raw coal feed available to washeries, indicates the necessity of creating an agency, to co-ordinate the activities, technological development and standardisation of material/spares/equipments, in this area. The report also suggests that the industries efforts could be directed towards development of process technology both for coarse and fine coal, water clarification, slurry management, energy conservation & application of on-line and off-line controls : Interaction among the industry, academic & research institutions; standardisation of equipments in conjunction with cement and paper research institutions where common technologies are feasible and interaction with consumers is also very important.

Hard Ferrites

The report concludes that in the hard ferrite industry, powder preparation and manufacturing of end products could be considered as distinct sectors. This would enable to set up viable capacity levels with lower investments and automation to meet international standards thereby creating an export potential for India. The report suggests that to be competitive in the export market Indian industry needs to adopt the products like radially oriented magnets, small size magnets used in micro motors and oriented rubber bonded magnets used in DC motor applications. This could be achieved through sophisticated tool room facilities for production of quality and complicated tools to keep pace with fast changing products in this area.

Lightning Arresters

The report has revealed that lightning arresters are an important equipment from the point of view of protection of HV apparatus from the over voltages caused due to lightning and switching phenomenon. With the use of lightning arresters insulation co-ordination of systems has gained importance.

International manufacturers are marketing both non-linear resistor type with gap and gapless metal oxide arresters for use in system voltage up to 800 KV. Indian manufacturers are supplying lightning arresters for use in systems upto a voltage of 400

KV. At present there are three manufacturer in Indian marketing both non-linear resistor type with gaps and gapless metal oxide type. All arresters are provided with pressure relief device in order to control the explosion of an arrester due to its failure. Leakage current monitor is used to predict the deterioration of arrester with passage of time.

Lightning arresters for HVDC applications are to be developed in India as HVDC transmission will find wider application in the country also reliability of pressure relief arrangements should be given high importance. There is also a need for collection of failure data of lightning arresters manufactured in the country.

Linear Low Density Polyethylene (LLDPE)

The study has revealed that LLDPE gives better surface finish, better gloss and has higher melting point. It has a higher melt viscosity. Thus warranting higher energy for pumping the melt in the moulds. The estimated demand figures of the LLDPE for 1995 is 145 KTPA of which 75% will be in the film sector. In 1977 Union Carbide started aggressive marketing of LLDPE and its Unicarb Technology. The first plant of LLDPE in India of IPCL is coming up at Nagathone, which is expected to go in production early next year and the second plant is of Reliance which is expected to be completed by the end of next year.

There are three broad type of polymerisation processes, based on phase of reactants and products. The gas-phase fluidised-bed process is very simple to operate and from energy consumption and flexibility consideration, it is preferred. In this case because of long residence time in the reactor, grade change require more time. While importing technologies it would be desirable to ensure that the technologies acquired will be compatible with the operating and research experience already gained. There should be a Technology development effort by the industry specially in the field of process engineering and catalyst development.

Poly Vinyl Chloride (PVC)

The study has revealed that there is a steady increase in the demand of PVC in India. The present

production of PVC is 175 KTPA and the demand is 275 KTPA. Most PVC plants in India have small capacity and also the capacity utilisation is only 70%. The optimisation of the process depends on the reactor volume, reactor size, surface area and type of cooling. There are four major processes of producing PVC e.g. suspension polymerisation, bulk polymerisation, emulsion polymerisation and solution polymerisation. Suspension polymerisation of vinyl chloride is the most important technique constituting about 80% of total PVC produced in the world. A small quantity of PVC is also produced by solution polymerisation technique. Emulsion polymerisation has limitation in terms of product grades and is used only when PVC is required as latex or paste in end application. Bulk polymerisation, the latest of the four processes has recently become attractive due to low investment and operating cost. Technologies operating in India are quite old except for IPCL plant. R&D efforts by national laboratories/institutions for development or improvement of PVC technology is almost non-existing. Existing units should be persuaded to upgrade their technologies. Some of the features like slurry stripping, vent gas stripping etc. can be incorporated without much modifications.

Phthalic Anhydride (PAN)

The study has revealed that PAN has been an important chemical of commercial importance. The principal use of PAN is in the manufacture of plasticisers, phthalate esters comprise the largest single group of plasticisers, which are used mainly to modify the properties of and assist in the processing of organic polymers. Another important use of PAN is in the manufacture of alkyd resins. PAN is manufactured world over by air oxidation of naphthalene or O-xylene. All the processes broadly fall into three categories, e.g. vapour phase fixed bed, vapour phase fluid bed and liquid phase. Most of the plants in the world are based on vapour phase fixed-bed process.

PAN in India is being produced by seven units having an installed capacity of 68,900 TPA against a licensed capacity of around 98,000 TPA all of them are having their foreign collaborations. Consumption of PAN in India is growing steadily. The production of PAN in 1989-90 was 60,000 tonnes.

capacity utilisation of the plant 87.1%. The problem of short supply of O-Xylene persists even today and this is coupled with high price of O-xylene. The PAN demand as estimated for 1994-95 and 1999-2000 are 75,000 and 113,000 MTA respectively.

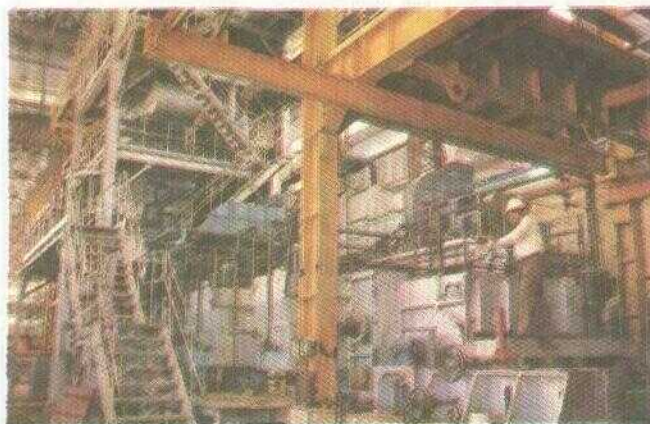
The performance of the new plants using improved technologies need to be studied with respect to technical, economical and safety angles. If found suitable, attempts should be made to adapt the existing technologies. The possibility of manufacturing the catalyst in the country may be initiated to save FE.

PVC Coated Sheets

The report has revealed that PVC/Organic coated sheets/coils, colour coated products, have shown a phenomenal growth in the past decade in various industrial and decorative applications world over. PVC/Organic coated sheets/coils find extensive usage in a wide variety of applications in building, transport, home applications and office furniture industries. It offers several advantages over post painting to both manufacturer and end user.

There are six units who have industrial licences of total capacity 300,000 TPA. Under broad banding policy of the government mini-galvanisers are also entitled to go in for manufacture of organic coated sheets. M/s Nippon Denro have started their commercial production and M/s Shree Pre-coated Sheets Ltd. will go into production in 1991. The industry as such is in its infancy. At present, more than 220 organic coating lines of various capacities are operating all over the world.

Organic coating is applied to metal substrates either as liquid, usually by reverse roller coating or as solid film laminate by adhesive bonding in a continuous strip coating line. There are a number of variations in processing of coating, such as heavy duty tension leveller or stretch leveller, multi-stage pre-treatment sections, primary coating on one side or both sides by two/three reverse roller coaters, catanery or floatation curing oven, water quenching and drying, finish coating by reverse roll coating technique. The prospects of organic coil coating industry is inextricably linked to the Aluminium and steel industry.



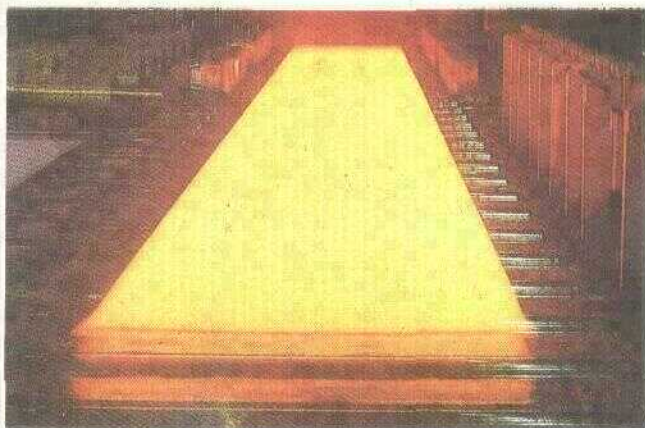
VII.2 40,000 t/yr mini galvanising line, Munak Galva Sheets.

Polypropylene Fibre and Filament Yarn

The report reveals that by and large the technologies available in the country is at par of international standard. However, for polypropylene fibre, high speed on line with speed of upto 500 m/min and high speed spinning followed by fibre draw line with speed upto 1500 m/min is yet not practised in the country, but for polypropylene fibre yarn slow speed spinning with speed of 350 m/min, high speed spinning for partially oriented yarn with speeds of about 2500 m/min is being practised in the country. The filament manufacture technology gap exists only in the bulk continuous filament manufacture as this technology has not so far come in India. The report gives emphasis for import of only certain key components required in the plant for development of indigeous manufacturers for plant and machinery infrastructural facilities in the field are existing in the country. Report also recommends for foreign collaborations with latest and cost effective technologies only.

Rolling Mills for Flat Products

The study reveals that the status of technology in India in the flat products rolling mill industry is a unique blend of old and new technologies. Upgradation/modernisation of the plants, currently using outdated/technologies is essential with a view to increase mill productivity, improvement in yield and product quality, production of diverse range of value added products and conservation of depleting energy resources. Technologies, by and large have been successfully absorbed and adapted



VII.3 3600 mm plate mill, Bhilai Steel Plant.



VII.4 5-stand tandem cold rolling mill with hydraulic AGC, Bokaro Steel Plant.

to Indian working conditions. Also a fairly high degree of import substitution has already been achieved in most plants. In the field of design and engineering of rolling mill equipment the leading companies have successfully absorbed and adapted know-how obtained through foreign collaboration. The report gives emphasis on development of Human-resources. According to the report the development of people and their professional competence are inter-related with the growth process of an organisation.

Self Advancing Roof Supports (SARS)

The report concludes that the Self Advancing Roof Supports industry is still in its infancy in spite of the fact that the collaboration agreements were made in 1978-79. Absorption of technology has been hardly 40% of the total price of the support, covering mostly the structural because inadequate effort made to develop suitable ancillary, poor availability of raw materials and irregular demand. The financial position of the manufactures is also not encouraging due to poor quality, poor production, long delivery time and inadequate after sales service to the users. In view of this, report recommends, for the development of manufacturing facilities, testing facilities and standardisation of testing procedures, centralised manufacturing facility for hydraulic components, ancillary industries and adequate co-ordination with the Government departments and users to cut down the delivery time.

Streptomycin

The report concludes that the industry efforts could be directed towards improvement in strain

efficiency, cycle times, extraction efficiency and identifying cheaper raw materials. The aspect of automation and control in fermentor parameters by introduction of microprocessors instead of manual control systems could also be considered to narrow down the technological gaps and reducing cost of production. The possibility of co-operative research project of common interest in a research institute having necessary infrastructure could also be considered. The report also suggests future demands of streptomycin is dependent on the acceptance of rifampicin, which is a drug of choice with better efficacy in the treatment of tuberculosis but the therapy is costly.

Sponge Iron

The report concludes that the indigenous coal based direct reduction technologies are now available from indigenous manufacturers for carrying out complete engineering, erection and commissioning of coal based DR plants. Indian machine manufacturers are also in a position to supply plants upto 100,000 TPA capacities. Most of the manufacturers have now been stabilised and the technologies adopted by them are well established under Indian conditions. The report also highlight the need for testing of raw materials prior to identifying the source of raw materials and site for the project. Necessary steps could be initiated for the production of superior grade of non coking coal, which is a critical aspect of the DRI processes. There is a need for modernisation of the technology in the mini steel plants by adopting DREF units, ultra high power furnaces with computer based control systems.



VII.5 Oxide Pellets and Lump Ores for sponge iron.

Vinylchloride Monomer (VCM)

The study has revealed that VCM production is almost entirely consumed in the PVC production and the VCM availability should be around 5% more than PVC requirement. The existing capacities of the plants in the country are too small and the new plants should be of 100,000 TPA capacity. Also the service hours and percentage utilisation of plants in India is lower than the International Standards. The industry is now changing from the air base plants to oxygen base plants because of economic considerations.

The VCM plants of NOCIL and IPCL are very recent and are based on latest process. There is hardly any R&D efforts in the industry. The only R&D efforts in the industry are towards the development of promoter and catalyst. Under the present day scenario of high cost of power and large demand/supply gap, only balanced VCM plant based on ethylene feed stock is expected to be attractive in India. To overcome this gap, it will be worthwhile to put up new grassroot economic size plants.

5.4 Status reports on the technology studies of 16 more sectors/products have been commissioned. These are :

- (i) Titanium Dioxide
- (ii) Acrylonitrile
- (iii) Xylene
- (iv) SBR/PBR
- (v) Isocyanates
- (vi) BOPP/Polyester Films
- (vii) Purified Terephthalic Acid
- (viii) Nor-Flexacin
- (ix) TV Picture Tubes
- (x) PCBs
- (xi) Shuttleless Looms
- (xii) Two for One Twister
- (xiii) Fluidised bed Combustion steam generators
- (xiv) Shock Absorbers
- (xv) Dump Trucks, Tipping trucks & dozers
- (xvi) Medium Density Fibre Boards

6. FINAL REPORTS

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

- Magnetic Tapes
- Hydraulic Excavator
- Cyanuric Chloride
- Citric Acid
- Acrylic Fibre
- Bimetallic Bearings
- Printing Machinery
- Draw Twisters/Draw texturizers
- SF 6 Circuit breakers
- Refrigeration Compressors
- Light Commercial Vehicles
- Ball and Roller Bearings
- Cooling Towers
- Computer Peripherals
- High Density Polyethylene
- Carbon Black
- Furfural
- Precured Tyre Treads
- Midget Electrodes
- Polypropylene Fibre an Filament/Yarn
- Two way Wireless Communication Equipment
- Diesel Engines
- Tractor Industry
- CNC Lathe and Machining Centres
- PVC/Organic Coated Sheets/Coil

7. SEMINARS

During the year 1990-91, seminars/meetings

were organised to finalise the following technology status reports :

- * Printing Machinery (in-house by DSIR, on 24th July, 1990)
- * Computer Peripherals (in association with Tata Consultancy Services at New Delhi on 31st July, 1990)
- * Ball and Roller Bearings (in-house by DSIR, on 24th August, 1990)
- * Light Commercial Vehicles (in-house by DSIR, on 28th August, 1990)
- * Dry Process Cement Plants (in-house by DSIR, in September 18, 1990)
- * Rolling Mills (in association with SAIL R&D, at New Delhi on 30th October, 1990)
- * Petroleum Refining (in-house by DSIR on 16th November, 1990)
- * Process Control Instruments and Data Acquisition Systems (in association with CEERI, Pilani at New Delhi on 20th November, 1990)
- * HT Insulators (in association with CPRI, Bangalore at Bangalore on 22nd Nov. 1990)
- * National Workshop on USSR Technologies of Relevance to India 26-28 November, 1990
- * Electrolytic Capacitors (in-house by DSIR New Delhi on 07 December, 1991)

8. PROMOTION AND SUPPORT TO INDIGENOUS DEVELOPMENT OF CAPITAL GOODS

8.1. Background

Capital Goods are essential inputs for economic growth. They are required for all sectors of economy. They are needed for : setting up new capacities, for expansion of existing capacities, as well as, for, modernisation and replacement.

Indian, capital goods producing, industry, had an estimated output of Rs. 38,000 crores, during the year 1989-90, which is, roughly, 82%, of the indigenous demand. Imports, during the same year, were Rs 8500 crores, on C.I.F. basis, forming roughly, 18%, of the indigenous demand. The share of imports, in the total demand, on landed cost basis, was higher. Imports was rising by, about, Rs. 700-800 crores, every year.

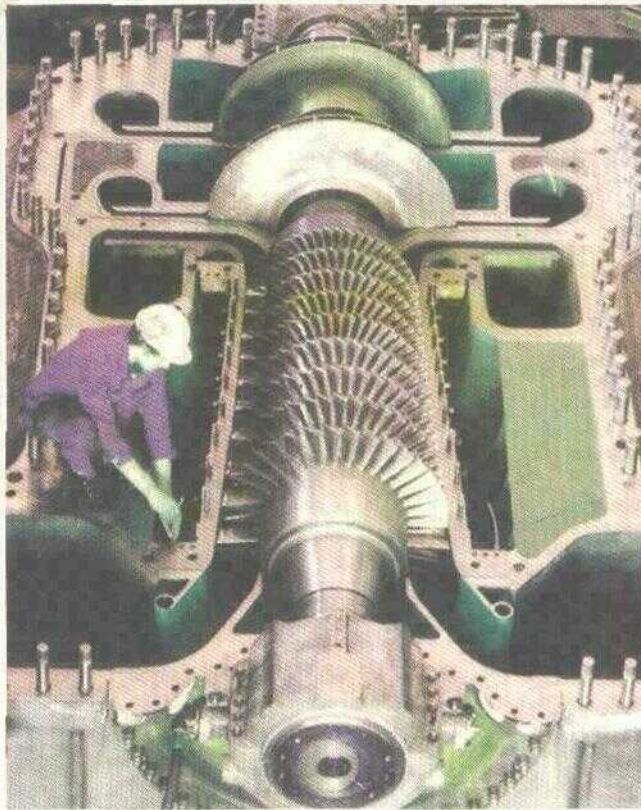
The ratio, of payments, for capital goods imports, to the payments for importing, the knowledge and skills, part of the technology, has been, of the order of, 8:1 to 14:1, during last few years. The experience, of many other technology importing countries, is similar.

Export of capital goods, from India, are small, forming only 2-3%, of the indigenous production. The share of exports, of Indian capital goods, in the global trade of such goods, is negligible, despite the fact, that India, with its low wage rate of skilled and trained manpower, has an advantage in production of industrial capital goods, whose manufacture is, mostly, labour intensive.

Though, manufacturing infrastructure, in India, may be in need of modernisation, in some areas; the availability, of manufacturing capacity, is not the prime constraint, in development of capital goods. In fact, most of our leading CG manufacturers, have sub-optimal capacity utilisation.

The need for promoting indigenous development, of capital goods, has also been highlighted, by a number of technology status studies, carried out under, the National Register of Foreign Collaborations (NRFC). Some of these status reports are listed below :

- Technology Status Report on Aluminium Foil
- Technology Status Report on Phosphoric Acid
- Technology Status Report on Mopeds
- Technology Status Report on Nylon Tyre Cord
- Technology Status Report on Nylon Filament Yarn
- Technology Status Report on Polyester Staple Fibre.
- Technology Status Report on Bi-metallic Bearings
- Technology Status Report on DMT & PSF
- Technology Status Report on Mopeds
- Technology Status Report on Magnetic Tapes
- Technology Status Report on Dry Cell Batteries
- Technology Status Report on Ball Bearings
- Technology Status Report on Coal Washeries
- Technology Status Report on Maleic Anhydride
- Technology Status Report on Penicillin
- Technology Status Report on Midget Electrodes
- Technology Status Report on Automobile Tyres



VII.6 Axial flow and centrifugal compressors, for chemical and technical processes

- Technology Status Report on Polypropylene fibre/yarn

Some important recommendations, in these studies, are :

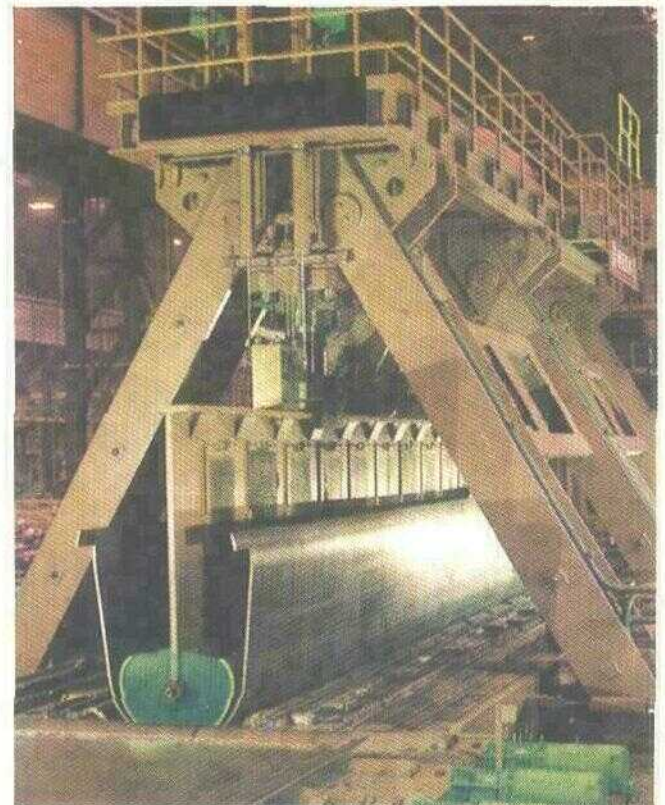
- Encourage specific R&D projects, in the area of equipment design, for development of new product.
- The critical equipment like agitator, hydrolyser, filter and special pumps, should be indigenised.
- Technology absorption efforts should be encouraged to encourage the production of certain process equipment, in area of synthetic filament yarn.

8.2. Constraints faced by the Indian Capital Goods Manufacturing Industry

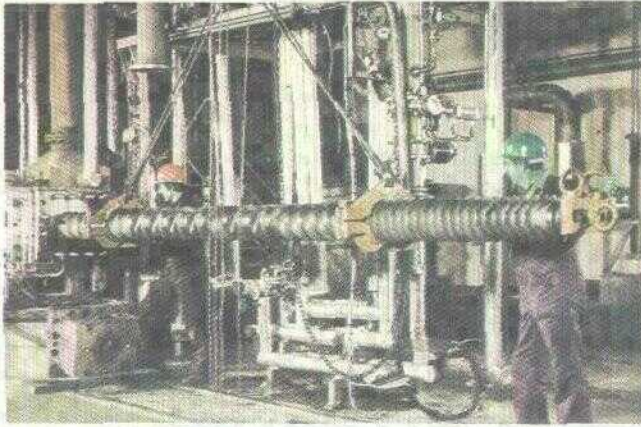
With the industrial growth, achieved over past many years, the requirements of capital goods is becoming more sophisticated, technologically. Indigenous CG industry is unable to develop the Capital Goods, required by newly developing

industries. An attempt was made, to identify constraints, faced by the Indian CG industry, in becoming, internationally competitive. In this connection, a meeting of : industry, R&D institutions, concerned government departments and financial institutions, was also called in DSIR, on August 17th, 1990. Responses of the participants, present in the meeting, were carefully analysed to identify the constraints. Some of these are :

- Inadequate design and engineering capability with indigenous CG industry.
- Unsteady demand of specialised capital goods.
- Inability of user industries, particularly, those based on imported technology, to provide detailed specifications of capital goods, needed by them.
- Inadequate ability to unpackage project imports.
- Unfavourable duty structure on import of components, sub-assemblies and raw materials, vis-a-vis, finished capital goods.
- Inadequate systems engineering capability in consultancy sector, to integrate various stand alone equipment, into complete plants.



VII.7 Plant and machinery for the production of, seamless and welded, tubes and pipes.



VII.8 Twin Screw Compounding Extruder for Polypropylene production plant.

- Inadequacy of human resources for, design and engineering, of advanced capital goods.
- Inadequate information on the export demand.
- Problems in obtaining necessary imported, components and raw materials, because the import procedures are designed for bulk imports, rather than, for the actual users, who need a variety of, components and materials, in small quantities.
- General unwillingness of users to purchase newly developed indigenous capital goods.
- Inadequate institutional support for : design, development and testing, of capital goods.
- Obsolete manufacturing set-up, in most CG producing units.

8.3 Plan Scheme for "Promotion and Support to Indigenous Development of Capital Goods"

A plan scheme, for implementation during the VIII five year plan, had been conceptualised and, included in the report, of the Working Group, for the VIII plan of DSIR, which was constituted by the Planning Commission. The scheme received a wide support from members of the working group, as well as, the Planning Commission.

The scheme aims to promote indigenous development of capital goods by removing some of the identified constraints. Major aims of the scheme are :

- Promoting indigenous development, of capital goods, by providing, technological inputs and

catalytic financial support, for such development.

- Promoting interaction between producers and users, of capital goods, to enable unpackaging, of capital goods import packages.
- Providing information base on : demand, costs, prices, impact of taxes and duties export potential, of capital goods, to help in formulation of policies, for further growth, of capital goods industry.

In accordance with the objectives, the scheme will have the following functions :

- Providing partial financial support, to the R&D projects, of capital goods manufacturing industry, aimed at, development and technological upgradation, of capital goods, so far imported and, capital goods which have export potential.
- Provide assistance, to users of imported capital goods, to develop, design and engineering, infrastructure. Such users, familiar as they are, with users aspects of such capital goods, are in the best position to develop, design and engineering, know-how, provided that they have skills in, design and engineering.
- To support, R&D and academic, institutions, with a view to provide, technical, analytical and testing, expertise for, design and engineering, of capital goods.
- Providing partial support, to industry, for obtaining services of competent consultants, for drawing up specifications, of capital goods, for new projects, which are based on imported technology : thereby promoting unpackaging of capital goods.
- Carrying out studies, on demand of capital goods, on sectoral basis.
- Carrying out studies, pertaining to, cost/price structure of capital goods and, impact of, duties and taxes, on the cost structure.
- Bringing out detailed compilations of capital goods imported, on year-wise basis.

The Plan Scheme is under consideration, of the Planning Commission, for approval, for implementation, during the VIII Plan.

8.4 Activities

Studies of major sectors, which are large importers of Capital goods, were initiated, during the year under report. The studies, inter-alia, aim at : ascertaining the demand of capital goods, by these sectors, during next five years; identifying those capital goods, which have a substantial demand and which can be indigenised and; suggesting suitable developmental strategies, for indigenous

development of the same. Such studies have been initiated in respect of :

- Synthetic and Man-Made fibre industry.
- Thermoplastic Polymers industry.
- Food Processing industry.
- Electronic Industry.
- Metal Forming Industry
- All types of Dies and Moulds.

VIII. TECHNOLOGY ABSORPTION AND ADAPTATION SCHEME

I. INTRODUCTION

The Technology Absorption & Adaptation Scheme (TAAS), in the Ministry of Science & Technology, has been introduced to enable absorption and upgradation of imported technology. An inter-Departmental Advisory Committee has been set up in DSIR to advise and review the activities and functioning of the Scheme besides approving new projects to be undertaken.

2. OBJECTIVES AND FUNCTIONS

2.1 The major objectives of the scheme are :

- To reduce the necessity for further import of technology after having it in use over a long period.
- To upgrade the technology imported, incorporating improvements identified during its use.
- To strengthen the base for selecting and negotiating appropriate and competitive technology.

2.2 The main functions for achieving the above objectives are:

- i) Catalytic support to the industry for technology absorption exercises and upgradation programmes related to imported technologies.
- ii) Monitoring and evaluating the efforts in implementation of technology and absorption exercises by the industry.
- iii) Technology evaluation & norms studies in important sectors/areas.
- iv) Information dissemination through Seminars/

workshops/training related to imported technology.

3. ACTIVITIES

3.1 Support/Assistance for Technology Absorption/Upgradation Projects and strengthening R&D base.

3.1.1 The scheme provides promotional support and assistance to the industry for technology absorption and upgradation exercises related to imported technologies. Financial support is essentially catalytic in nature and is directed to trigger and stimulate target oriented technology absorption activities by the industry.

3.1.2 Proposals include projects for filling up of technology gaps in aspects such as :

- Product/Process technology evaluation exercises/analysis.
- Process/product/production technology optimisation and upgradation.
- Evaluation and upgradation of existing process/equipment through design investigations and development work.
- Accelerated indigenisation/substitution of imported raw materials/components.

3.1.3 Projects of 24 companies involving over 45 projects have been approved so far for absorption exercises related to imported technology. The support has been for the developmental expenditures such as prototype/pilot plant build up/raw materials/components/testing/consultancy, user trials etc. while capital and other expenditure are expected to be borne by the industrial units themselves. Project periods are usually 2 to 3 years. The

details of the various projects approved, are as follows.

i) M/s Instrumentation Limited, Kota

The project related to 'Contronic-3' Automation System for power plants (Collaborators M/s Hartmann & Braun, West Germany) was initiated in 1986 with partial support of Rs. 37.70 lakhs out of a total project cost of Rs. 110 lakhs. *The project including technical demonstration of the indigenised system has been completed.* The company have indigenised over 300 components of cubicle and about 40 varieties of PCB modules. Thirty test rigs have also been developed. An estimated foreign exchange savings of about Rs. 5 crores has been achieved.

ii) M/s Punjab Tractors Limited, Chandigarh

The projects related to hydraulic and transmission systems of Fork Lifts (collaborators M/s Komatsu Fork Lift Co., Japan) was initiated in 1986 with partial support of Rs. 30 lakhs out of a total project cost of Rs. 108 lakhs. *The projects are completed.* The firm have indigenised 5 types of hydraulic pumps, 4 types of hydraulic cylinders and 2 types of Direction control valves of hydraulic system, and 2 types of Torque Flow Control Valves and 2 types of power shift Clutch Packs, of transmission system involving 3 models of Fork lifts. An estimated foreign exchange savings of about Rs. 1.5 crores on account of faster indigenisation and import substitution is achieved.

iii) NGEF Limited, Bangalore

The project related to insulation system of 400 KV EHV transformers (collaborators M/s Transformoren Union Ag, West Germany), was initiated in 1986 with partial support of Rs. 15 lakhs out of a total project cost of Rs. 45 lakhs.

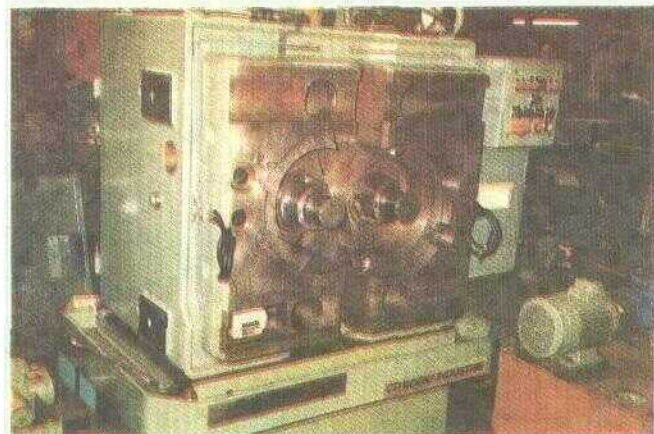
The project is completed. The firm have developed 69 experimental models of EHV transformers (44 models of 220 compiled detailed evaluation of partial discharge performance and electrostatic field distribution on various prototypes. A few components have also been indigenised resulting in foreign exchange savings & cost reduction. Ability

to evaluate and adapt modelling concepts, failure prediction capacity & design analysis has been developed and practised.

iv) M/s Praga Tools Limited, Secunderabad

The project related to proto-type development of four types of Incremental Thread Rolling machines (collaborators M/s Escofier of France) was initiated in 1986 with partial support of Rs. 15 lakhs, out of a total project cost of Rs. 40 lakhs.

The firm have developed prototypes of two models of spline rolling machines, Tube finning machine and pulley forming machine. The metallurgical aspects of the rolls have been examined by DMRL, Hyderabad. CMTI, Bangalore of the rolls. *The project is completed.* Automobile and Refrigeration industries are expected to benefit from the faster pulley forming machines and Tube finning machines. CNC band procurement time has been reduced from 16 to less than a week.



VIII.1 Incremental spline Rolling machine.

v) Kerala Minerals & Metals Limited, Quilon

Four projects related to Titanium Dioxide (Collaborators M/s Kerr McGee Corp., USA); Beneficiated Ilmenite (collaborators M/s Benelite Corp., USA) and HCL recovery (collaborators M/s Woodall Duckham, UK) were initiated in 1987 with partial support of Rs. 40 lakhs, out of a total project cost of Rs. 157 lakhs.

The firm have since achieved considerable progress in all projects. This includes development of

new grades of titanium dioxide pigments; import substitution of silica crystals, 'Trimet' coating agent and sodium silicate resulting foreign exchange savings of the order of about Rs 3 crores per annum; recovery and successful application of waste bi-products e.g. Iron oxide in primer & paints and achievements aiming for improved process, better productivity and energy savings. The firm have consulted RRL, Trivandrum in studies related to illeminate beneficiation and other aspects of the project. The project is nearing completion.

**vi) M/s IBP Co. (Chemical Division), Ltd.,
Gurgaon**

Five Projects related to slurry and emulsion explosives (collaborators M/s Ireco of USA) were initiated in 1987 with partial support of Rs. 5 lakhs, out of a total project cost of Rs. 30 lakhs. The projects deal with thickening and cross linking agents, investigation of process parameters on product quality, P5 explosives and bulk delivery SMS explosives, and know-why studies related to emulsion explosives technology. *All the projects are successfully completed.* The achievements include development of cost effective substitute of Guar gum, development of a new formulation for P5 class of permitted explosives, superior in terms of energy and fume characteristics and indigenisation of Crystal Habit Modifier in SMS explosives. Estimated savings of foreign currency is Rs 60 lakhs, and it estimated by the firm that the cost of P5 variety would be reduced by Rs 200 per tonne.

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

The projects related to high performance greases & Lubricants (collaborators M/s Optimol of Italy) was initiated in 1987 with partial support of Rs 20 lakhs, out of a total project cost of Rs 150 lakhs for 3 years.

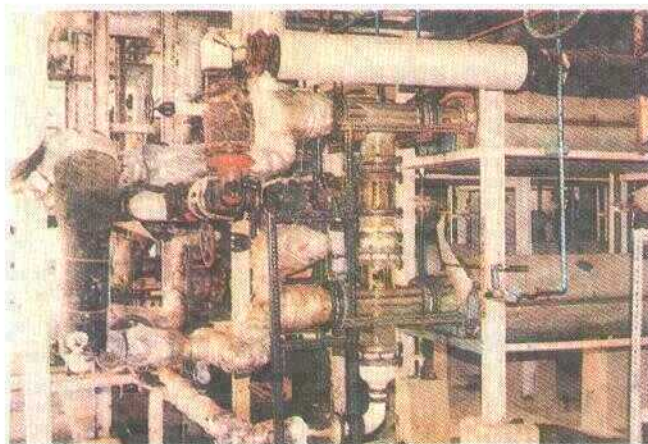
The firm have since developed additive components and finished products such as Aluminium complex greases, tailor made fat components for soda & calcium greases and high performance thread components. The achievements also include development of products for steel and textile sectors. Technology upgradation and equipment

design have resulted in 10-20% improvement of productivity. As estimated foreign exchange savings on account of various developments would be around Rs 5 crores per annum. *The project is completed.*

**viii) Southern Pesticides Corporation Ltd.,
Hyderabad**

The project related to Gamme BHE pesticides (collaborators M/s Stauffers Chemicals, USA) was initiated in 1988 with partial support of Rs. 19 lakhs, out of total project cost of Rs. 68 lakhs. The work so far includes successful substitution of the glass material of construction with glass lined material resulting in lesser breakages. The firm have also strengthened their R&D facilities by installing a 50 litre distillation vessel and has finalised an agreement with IICT for pilot plant studies.

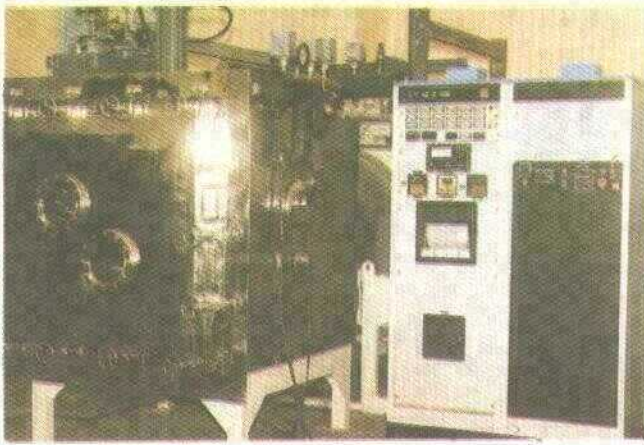
The project is progressing satisfactorily.



VIII.2 A view of the reactors in BHC plant.

**ix) IBP Company Limited (Engg. Division),
Nasik**

Two projects related to Cryogenic containers (collaborators M/s Ar Liquide of France) and Freeze driers (collaborators M/s Leybault Heraus of Germany) were initiated in 1988 with partial support of Rs 4.225 lakhs, out of a total project cost of Rs. 10 lakhs. The projects deal with development of improved cryogenic containers and 100 kg freeze drier. *The projects are completed.* The firm has developed a number of proro-



VIII.3 A view of Freeze drying Plant.

types of cryogenic containers with varied configurations for performance evaluation. The 100 Kg Freeze drier was designed and a prototype was fabricated and tested. The projects result in import substitution and development of indigenous capability for design and manufacture of full range of freeze drier plants and high efficiency cryogenic containers. Evaporation loss of liquid nitrogen in the cryo containers has reduced by 0.028 litres/day. Estimated foreign exchange savings would be about Rs 120 lakhs.

x) M/s Hindustan Antibiotics Limited, Pune

The project related to Penicillin Strain (collaborators M/s Toyo Jozo Company, Japan) strain initiated in 1988 with partial support of Rs. 1.50 lakhs, out of a total project cost of Rs. 5 lakhs. The project which deals with optimisation & upgradation of down stream technology has been successfully completed at pilot plant. The firm carried out numerous investigations and NCL, Pune has carried out a mathematical modelling for identification & optimisation of key parameters controlling the process. *The project is completed.* This leads to optimisation of fermentation process of Penicillin production.

xi) M/s Hindustan Latex Ltd., Trivandrum

Three projects related to Condoms (collaborators M/s Okomoto Riken Gomu, Japan) were initiated in 1988 with partial support of Rs. 2.95 lakhs, out of a total project cost of Rs. 20 lakhs. The projects related to improving product quality by using sper-

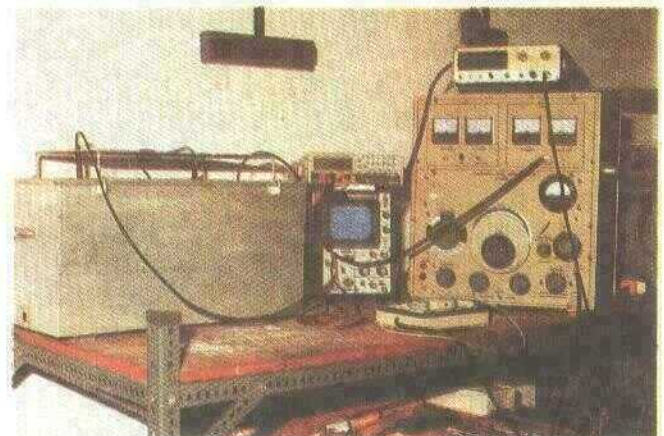


VIII.4 Contraceptives condoms under test.

micidal aids and ultrasonic wave vulcanisation have been successfully completed in collaboration with Medical College, Trivandrum and Cochin University of Science & Technology. *The projects are completed.* A new product, spermicidal coated condom with large export potential has been developed.

xii) M/s Bharat Earth Movers Limited, Bangalore

Two projects related to High Pressure (210 bar) Hydraulic Pump for dumpers (collaborators M/s Westinghouse, USA) and hydrostatic transmission for dozers (collaborators M/s Komatsu, Japan) were initiated in 1988 with partial support of Rs. 14 lakhs, out of a total project cost of Rs. 74 lakhs. The firm have developed 210 bar prototype pumps in each category of 3.3, 5.4, 5 and 6.5 module. Prototype Dozer using hydrostatic transmission in



VIII.5 Ultrasonic Vulcanisation.

place of mechanical transmission is under performance evaluation. The firm is also working on the indigenisation of critical components of the transmission.

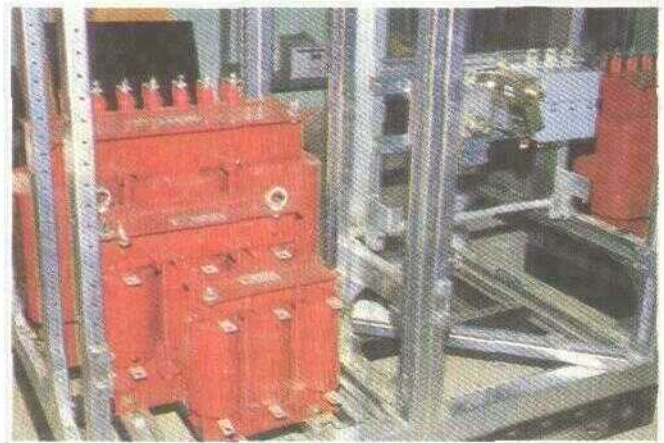
xiii) M/s Gujarat Communications & Electronics Ltd., Baroda

The project related to Rural Radio Telephone System (collaborators M/s Italtel, Italy) was initiated in 1988 with partial support of Rs. 7.50 lakhs, out of a total project cost of Rs. 48 lakhs. The Phase I of the project which deals with technology updating for subscriber radio equipment and radio base station has been taken up through redesign of equipment with respect to its mechanical engineering aspects and electronics circuitry and is completed. Phase II concerns Exchange Terminal Equipment, and prototype development has commenced, after finalising designs.

The other project which relates to Digital Video Effects (collaborator M/s Ampex, USA) was initiated in 1988 with partial support of Rs. 10 lakhs, out of a total project cost of Rs. 52 lakhs. The project deals with development of low cost Digital Video effect for smaller studios. The activities connected with indigenisation of DVE and testing, are completed. The design of various sub-assemblies used in low cost DVE are also completed, and procurement of components is under progress. Prototypes are expected by December, 1990.

xiv) M/s Kerala State Electronics Development Corpn. Ltd., Trivandrum

These projects are being undertaken by ERDC. Four projects based on 3 phase uninterruptible power supply system (UPS) (collaborators M/s Brown Boveri Co., Switzerland) were initiated in 1988 with partial support of Rs. 15 lakhs, out of a total project cost of Rs. 52 lakhs. The projects include upgradation of 3-phase UPS, development of single phase UPS, AC drives and SCADA systems. The upgraded version of 3 phase UPS System has been designed and a working module of 40KVA 3 phase UPS is being assembled. The prototypes of single phase UPS system and AC drives have been developed and are under performance evaluation. As regards SCADA, the testing is completed. The progress is satisfactory.



VIII.6 Transformer Assembly - 3 phase UPS.

xv) M/s Mishra Dhatu Nigam Limited, Hyderabad

Three projects related to Electroslag Refining technology for the manufacture of special steels & high performance alloys (collaborators M/s Creusot Loire, France) were initiated in 1988 with partial support of Rs. 13 lakhs, out of a total project cost of Rs. 90 lakhs. The projects involve establishment of liquid slag start technology, optimisation of slag chemistry and indigenisation of ESR slags. The firm has successfully refined indigenous calcium fluorospar and has also developed liquid slag start technique. The projects are progressing satisfactorily.

xvi) Electronic Corporation of India Ltd., Hyderabad

The project related to communication system for Distributed Monitoring & control system, was initiated in 1988 with partial support of Rs. 5 lakhs, out of a total project cost of Rs. 47 lakhs. The project deals with understanding of basic hardware & software of Manufacturing Automation Protocol (MAP) (imported from M/s Impex, USA) and development of collapsed version of Full MAP for application in smaller projects. The firm have given consultancy work to CEERI, Pilani for development of Controller Boards. Designing, procurement, and fabrication activities are completed.

xvii) M/s Hindustan Machine Tools Limited, Bangalore

The project related to advanced CNC system (collaborators M/s Siemens, West Germany) was

approved in November, 1988 for partial support of Rs. 30 lakhs, out of a total project cost of Rs. 180 lakhs. The project aims at upgradation and development of State-of-the-art CNC system using latest technologies. The hardware design & mechanical system designs are completed. Specifications for the advanced CNC Systems have been formulated with user group. The firm working with CMTI for joint development work in the areas of conversational part programming language for CNC machines and FMS interface.

xviii) M/s Uptron India Limited, Lucknow

Two projects related to Distributed Digital Process Control System (collaborators M/s Leeds & Northrup, USA) and Coal Washery System for mining applications (collaborators M/s Hawker Siddeley Dynamics Engg. Ltd., UK) were approved in 1988 with partial support of Rs. 30 lakhs each, out of a total project cost of Rs. 200 lakhs & Rs. 217 lakhs respectively. Both projects are aiming at upgradation and development of improved version of the systems and have been progressing satisfactorily. Sub designed and demonstrated to Bokaro Steel Plant. In Coal Washery System, the system design has been completed. The procurement is in progress.

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

The project related to manufacture of heavy duty industrial fans (collaborators M/s Davitson & Co. Ltd., UK) was approved in Feb., 1990 for partial support of Rs. 10 lakhs out of total project cost of Rs. 47 lakhs. The project deals with optimisation of efficiency/abrasion resistance characteristics of industrial fans. Mathematical modelling/design analysis has been carried out by Indian Institute of Science, Bangalore and IIT, Madras. Manufacture of six prototypes, and user trials are further envisaged. Detailed engineering has been undertaken by the firm based on design support given by IIS and IIT. The project is progressing well.

xx) M/s Hindustan Machine Tools Ltd., Pinjore

The project concerns development/upgradation of fuel efficient diesel engines for 3511, 4511 and

5911 tractors based on technology for 25 HP diesel engine imported from M/s AVL, Austria. The project was approved in December, 1989 for partial support of Rs. 7 lakhs out of total project cost of Rs. 33 lakhs. The project is progressing the design engineering is completed. Initially 3 prototypes will be manufactured and subsequently a pilot batch of 15 will be taken up.

xxi) M/s Tamil Nadu Industrial Explosives Ltd., Vellore

Four projects related to Nitroglycerine based explosives, were approved in November, 1989 for partial support of Rs. 7.25 lakhs, out of a total project cost of Rs. 71 lakhs. The projects deal with replacement of Guargum for improving gelling/water resistance property, reduction/replacement of Nitrotoluenes to reduce toxic effects in post detonation fumes; Biological degradation of waste water; and import substitution of dextrine, used in lead azide. For replacing guargum, trials with Rosin & TKP were completed. Nitrotoluene is to be eliminated by incorporating Turpentine oil, and Dextrine is substituted with indigenous tapioca starch. Work on biological degradation is being done with guidance from microbiology deptt. of Christian Medical College.

xxii) Tamil Nadu News Print & Papers Ltd., Madras

Two projects related to improvement in preservation of bagsse for brightness and quality and for improving the quality of mechanical bagasse pulp (collaborator M/s Beloit Walmsley, England and M/s Beloit Corpn., USA) were approved in February, 1990 for partial support of Rs. 9.40 lakhs out of total project cost of Rs. 65 lakhs. The project is in the initial stages.

xxiii) Hindustan Teleprinters Ltd., Madras

The project related to adaptation and upgradation of Electronic Teleprinters (collaborators M/s SAGEM, France) was approved in Feb., 90 for partial support of Rs. 12 lakhs out of total project cost of Rs. 63 lakhs. The project deals with upgradation of existing electronic teleprinter TX-30 by adding additional features like 32 K memory, real time clock, auto dialling, add on VDU, add on FDD and

adapting the reggedised version for military application. The project is in the initial stages.

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

The project envisages import substitution of hydraulic AGC (Automatic Gauge Control) system, simulation and testing for understanding/know-why and adapting it to multistand tandem mill. This project was approved in October 90 for partial support of Rs. 10 lakhs out of total project cost of Rs. 75 lakhs. Project is in the initial stages.

3.2 Technology Profile Studies

The Profile Studies of imported technology in 19 States have been initiated. The reports will contain details of existing industrial units based on foreign collaborations; brief highlights of absorption of technology and a broad analysis of collaborations in the concerned states. The draft reports covering 9 states viz, Delhi, Himachal Pradesh, Haryana, Punjab, Kerala, Maharashtra, West Bengal, Orissa and Rajasthan have been finalised, and those of 8 more states are being finalised.

3.3 Implementation of Foreign Collaborations

The studies on implementation of foreign collaborations approved on 1981-1983, 1984 and 1985 undertaken by Consultancy Development Centre have been completed. The reports are being finalised. These studies aimed to evaluate the present status with regard to implementation of foreign technology approvals. The reports throw light on aspects such as reasons for non implementation of approved cases and constraints in implementation.

3.4 Video Film on Technology Absorption

The preparation of video film on technology absorption has been undertaken. The film would cover the highlights of technology absorption projects supported under TAAS.

3.5 Technology Evaluation and Norms Studies

3.5.1 Under the Scheme, Technology Evaluation and Norms Studies were initiated in various sectors/areas of importance. The norms studies inter alia aim at identifying major elements of technological gaps and to formulate the time targeted project/programmes for technology acquisition/R&D/modernisation/operational improvements to bridge the technology gradients existing between India and international levels of operations. These aims are pursued through supporting of sectoral and unitwise studies. The technology norms studies in 40 sectors/areas have been commissioned so far through professional consultants in their respective fields. 50 more areas for the studies have been identified in consultation with other Ministries/Departments.

3.5.2 The reports on electric lamp, non-ferrous castings, ministeel, fertilizer (phosphatic), fertilizer (nitrogenous), aluminium, boilers, forged & portable tools, paper & pulp machinery have been finalised and printed. The reports on steel forgings, drug formulations, steel and ferrous foundry have been finalised taking into account the observations in the respective workshops recently held and are being printed. The draft reports on pumps, fire fighting equipment/systems, ceramics, plastic processing and caustic soda industry have been finalised while the draft reports on industrial furnaces, ferro alloys, refractories, flour & rice mill and cement are being finalised. The studies which are under progress include Pesticides, Electrical Motors, Packaging, H.T. Fastners, Rubber Processing, Sulphuric Acid, Edible Oils, Medical Electronic Equipments, Industrial Oils, Leather Tanneries, Leather Products and Secondary Aluminium Products. Other studies commissioned during the year are in the areas of Home appliances, Marine food products, Industrial Alcohol and Fruit juices industry.

3.6 Workshops

Four workshops concerning Technology and norms in Steel Forgings, drug formulations, steel and ferrous foundry industries were organised. Four more workshops including those on Pumps,

Fire fighting equipment system, ceramics industry are being planned in early 1991.

3.7 Talented Indian Engineers and Scientists (TIES)

Talented Indian Engineers and Scientists Scheme (TIES) is one of the measures recommended by a Committee constituted by the Minister of State for Science & Technology to review the policy of Government and various schemes already in operation for attracting back talented Indian Scientists and Technologists settled/working abroad. These recommendations were further endorsed by Scientific Advisory Council to Prime Minister.

The "Talented Indian Engineers and Scientists Scheme (TIES)" of the Department of Scientific & Industrial Research aims to streamline and co-ordinate all activities in providing assistance to Talented Indian Engineers and Scientists, in areas such as : ascertaining the TIES expertise and intentions : awareness of areas of importance : status and feasibility reports; clearances like industrial licenses; foreign collaborations and capital goods, finances, RBI approvals etc.

In pursuance of these objectives, DSIR is initiating activities such as preparation of pre-investment feasibility projects on selected items considered to be of interest to TIES.

IX. TECHNOLOGY TRANSFER

I. TRANSFER AND TRADING IN TECHNOLOGY

1.1 Objectives

The TATT Scheme aims towards promotion and support of activities for catalysing the exports of technologies and services. The main objectives are :-

- ~ Support to preparation of technology profiles for developing countries,
- ~ Support to preparation of reports related to capabilities and experiences of industrial units in technology export, quality brochures, video films, etc.
- ~ Organisation of Seminars/Workshops etc.
- ~ Arranging live demonstration of exportable Indian technologies in selected countries.

1.2 Activities

The TATT Scheme became operational during the year 1986-87 through the cell set-up for this purpose and by way of initiating and completing a large number of programmes and projects aimed towards meeting its aims and objectives. Eleven meetings of the Technical Advisory Committee on TATT have been held during 7th Five Year Plan. Technical Advisory Committee on TATT has been reconstituted. First meeting of the 8th Five Year Plan was held during the year. 10 new projects/programmes were approved & initiated through NICMAR, CEI, RITES, TDA, Symatec Associates Sycom Consultants, IIPT, NCB, Dalal Consultants etc. in addition to about 50 projects undertaken in the 7th five year plan. The thrust of the projects during the 7th five year plan has been towards projecting our technological expertise and capabilities, preparation of technology profiles of select developing countries, and to help the Indian exporters in enhancing their export efforts in the area of

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

(a) Technology Profile for Developing Countries

- (i) Final draft reports namely, "Technology Survey of developing countries - identification of thrust countries for technology exports" and "technology profile of select countries" were printed.
- (ii) Final draft of Technology profile reports on four developing countries namely, Kenya, Zimbabwe, Malaysia and Indonesia were printed.
- (iii) Technology profile reports on Thailand, Botswana, Nepal and Egypt were commissioned. The draft reports on Thailand, Botswana and Nepal were received and discussed in an evaluation committee.
- (iv) A desk study of potential areas of technology transfer from India to Vietnam was completed.

(b) Technology Export Capabilities and Experiences

Several projects primarily aimed towards assessing and projecting our technological activities and experiences through collection of data and preparation of reports, video films, etc., and disseminating the same to the concerned organisations including Ministries/ Departments, Indian Embassies abroad and foreign missions in India were completed or are in various stages of completion. Some of these projects/activities are indicated below :-

- (i) **Video Films on Indigenous Technologies**
 - ~ Four video films on exportable Indigenous technologies in the areas of Waste Utilisation,

Food, Leather and Agro based industries were completed in association with NRDC.

- Two Video films namely, "Concrete Construction practices" and "Formwork and Scaffolding" were successfully completed with the assistance of Indian Concrete Institute, Madras.

(ii) Popularising and encouraging the use of new scientific technologies related to Total Quality Management (TQM)

- DSIR assisted CEI in procuring Video films on Total Quality Management (TQM) from Japanese Union of Scientists & Engineers (JUSE), Japan and Batalas, UK for popularising use of quality control techniques in India. CEI is propogating TQM through various seminars/meets being organised on regular basis throughout the country. The idea behind sponsoring this activity is to increase the awareness about ISO 9000 standards amongst Indian industrialists and entrepreneurs, which is going to be pre-requisite for export of goods to European Economic Community from 1992 onwards. CEI is publishing a monthly brochure on Quality News which is widely disseminated to the engineering industry. A one day workshop "World Quality Day" was also organised in November 1990.

(iii) Technology Export Potential in Basic Drugs and Pharmaceutical Formulations

The draft report prepared with assistance of Dalal Consultants, Ahmedabad was discussed in a workshop held in October 1990 and finalised. The report lists products and process technologies where scope for export of technology from India exists. Suitable entrepreneurs having requisite know-how/technology and potential markets abroad are identified.

(iv) Technology Export Potential in Chemical Process Industry

The draft report prepared with the assistance of Dalal Consultants was discussed in an evaluation committee meeting. The report lists products and process technologies where scope for export of technology from

India exists. Suitable entrepreneurs having requisite know-how/Technology and potential markets abroad are identified. A workshop is being organised to discuss the draft report widely.

(v) Technology Export Capabilities of Agricultural Machinery from India

The draft report prepared with the assistance of M/s Technology Transfer and R&D, New Delhi was discussed in an evaluation committee meeting and finalised. The report gives profiles of leading manufacturers of farm tractors and agricultural implements and discusses advantages of adopting technology from India. It also profiles a few African, Asian and Latin American countries where export of technology can be initiated.

(vi) Compendium on India's Industrial, Technological and Consulting Capabilities in Powder Metallurgy

A seminar on technical, economic and social aspects of powder metallurgy and its applications was organised by ESCAP in February 1989 which was hosted by DSIR. One of the recommendations of the seminar was that DSIR should compile and distribute a compendium on expertise available in India for providing consultancy and other services in the field of powder metallurgy to the regional countries. With the above objective a study has been sponsored to CDC. A draft report has been received which includes details regarding manufacturing methods of 10 types of powders and profile of major powder manufacturers, component manufacturers, equipment manufacturers, R&D organisations and consultancy organisations.

(vii) Technology Cell in EEPC

DSIR has supported establishing a Technology Cell in EEPC. This is to serve as nodal point for information necessary in promotion of Technology upgradation and export. The Cell has initiated a few programmes towards promotion of export of technologies and services. It is proposed to bring out a Technology Market Series under the Cell, a monthly publication giving information on the new emerging markets for exports, policies, pro-

cedures for export etc. Further, discussion papers on export potential of certain select industrial sectors by various experts are being planned under the cell.

(viii) Trade and Technology Directory of India

With a view to project total Indian scenario with emphasis on technological development and transfer to the outside world, Centre for Studies on Technology & Trade, New Delhi was provided partial assistance to bring out the directory. The directory will have four parts, part I dealing with liberalising India in several inter-related sectors, part II devoted to statistical tables, part III covering profile of organisations of excellence and part IV presenting policy statements. The directory is expected to be released shortly.

(ix) Status and Future Thrust on Exports of Technology and Services

The objectives of this study is in highlight the status and strength of certain select sectors and to pinpoint the future thrust areas including policies etc. for promoting technology exports. It is expected, that the document will increase awareness among developing countries about source of technology from India. The sectors being covered are : (i) Agriculture including dairy, (ii) Food Processing, (iii) Health, (iv) Rural development, (v) Irrigation and water resources, (vi) Minerals, (vii) Energy, (viii) Chemicals & Pharmaceuticals, (ix) Leather manufacturers, (x) Transport, (xi) Telecommunications, (xii) Electronics & (xiii) Textiles. The study is being conducted by M/s. Centre for Studies on Technology & Trade, New Delhi.

(x) Technologies Available for Transfer (Selected Engineering Items)

A computerised data base of 44 products from 26 companies covering Engineering sector, Telecommunications, Electronics, Chemicals & Fertilizers and Power generation has been created with the assistance of National Foundation of Indian Engineers (NAFEN), New Delhi. Also, a draft report has been prepared which includes an overview of the sectors covered. The report would be finalized shortly.

(xi) Capabilities of Indian Industry for Technology Export in select areas of Food Processing Sector

The study will cover three areas namely, (a) solvent extraction of edible and non-edible oils, (b) processing of rice bran, by products and rice milling and (c) Dairy products. The study will highlight the industry status, technology growth pattern and technology export policies and procedures in each of the three areas. It will also outline the profiles of major companies engaged in the said areas. M/s ABC Consultants is assisting DSIR in conducting the study.

(xii) Export of Technology for Medicinal Plants and their Derivatives

A study was sponsored to M/s Eastern Enterprises, New Delhi to document the activities of government institutions, research laboratories and industrial organisations engaged in systematic cultivation, collection, extraction and processing of medicinal herbs. It will also assess the feasibility of setting up joint ventures and analyse the performance of industrialists already engaged in field of herbal drugs abroad. A draft report has been prepared which will be finalized shortly.

(xiii) Study on Indian Electrical Industry

A study was sponsored to M/s Symatec Associates, New Delhi to identify the technological strength of the Indian Electrical Industry with specific emphasis on (a) identifying specific products for which technologies can be transferred, (b) identifying entrepreneurs having capability to transfer technology and (c) formulating strategies for technology transfer. The data collection from about 125 companies in the field is in progress.

(c) Seminars/Workshops

The following Seminars/Workshops/ Technical Meetings were supported/ sponsored during the period :-

- (i) A workshop on technology export potential in basic drugs and pharmaceutical formulations was organised in October, 1990 through M/s Dalal Consultant.
- (ii) A workshop on strategy for technology exports was organised in December, 1990

through Engineering Export Promotion Council, New Delhi. The workshop was attended by about 100 participants from Government, Research Institutions, Public and private sector companies. The workshop highlighted the country's depleting foreign exchange reserves and stressed on the need for promoting technology led exports. It also drew the attention of the captains of the industry to the changing political situation in Eastern Europe and emergence of new markets.

- (iii) Partial support was extended to National Council of Cement and Building Materials, New Delhi for organising the Third international seminar on Cement & Building Materials in January, 1991.

(d) Indian Joint Ventures

- (i) A study on Experience of Indian Joint Ventures on Technology transfer to four developing countries namely, Singapore, Thailand, Malaysia and Indonesia is commissioned to IIFT, New Delhi. A visit to these countries is being organised to collect first hand data.
- (ii) A study on Indian Joint Ventures Abroad was sponsored to IPE, Hyderabad, to map-out the pattern and quantum of export of technology that takes place for India. The report was discussed in an evaluation committee. The report examines aspects, such as, factors of motivation for setting-up joint ventures abroad and future potential for technology export.

(e) Live Demonstration of exportable Indian technologies

Inviting 8 member industrial delegation from Somalia

Engineering Export Promotion Council (EEPC), New Delhi has been entrusted to invite 8 member delegation consisting of 6 members from Somalia Industrial Manufacturers Association (SIMA) and 2 members from Ministry of Industry of Somalia. The delegation will be taken around a number of industries in 10 sectors, some of which are Tannery, Textiles, Utensils, Mechanical workshop, Sugar plants, deep sea fishing, Agri-

cultural Machinery etc. for live demonstration of Indian manufacturing and processing technologies. Subsequently, a one day workshop will be organised where Somalian delegates will meet Indian industrialists face to face for detailed discussion to work out a methodology for technical collaboration.

1.3 Publications

A list of reports/publications brought out under TATT during the period is given below :-

- (i) Handbook of statistics-1989 - CEI
- (ii) Technology export potential in Basic drugs and pharmaceutical formulations - Dalal Consultants
- (iii) Technology Profile on Thailand (draft) - Dalal Consultants
- (iv) Technology Profile on Botswana (draft) - Dalal Consultants
- (v) Technology Profile on Nepal (draft) - Sycom Consultants
- (vi) Technology export potential in Chemical process industry (draft) - Dalal Consultants
- (vii) Technology export capabilities of Agricultural Machinery from India (draft) - M/s Technology Transfer and R&D.
- (viii) Handbook of Statistics-1990 - CEI
- (ix) Export directory of Indian Engineering Industry - CEI
- (x) Export of Technology for Medicinal plants and their derivatives (draft) - M/s Eastern Enterprises
- (xi) Compendium on India's Industrial, Technical and Consulting capabilities in Powder Metallurgy (draft) - Consultancy Development Centre.

2. 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.

2.1 UNCTAD

In order to assist in the presentation of report to the General Assembly, Secretary General UNCTAD invited a number of experts to Geneva to give advise on the nature and consequences of the present negotiations on the draft international code of conduct on transfer of technology and suggest appropriate solutions to the issues outstanding as well as possible measures of concluding the negotiations. Adviser, DSIR representing the developing countries of the Asian region as a whole, attended the Informal Expert Group meeting on the Draft International Code of Conduct on Transfer of Technology held at UNCTAD, Geneva during 3-5, September, 1990.

2.2. 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 the Ministry of Commerce. The Department of Scientific and Industrial Research continued to play the role of a focal point for the APCTT. DSIR prepared a brief covering technological issues for the use of the Indian delegation to the 46th Annual Session of ESCAP, held at Bangkok (Thailand), during March, 1990. The foundation stone for the building of the APCTT was laid on 24th May, 1990 by Prof. MGK Menon, Minister of State for Science and Technology in the Technology Bhawan Complex, New Delhi. The dignitaries present during the function among others included: Shri S. Nagai, Deputy Executive Secretary, ESCAP, Shri Erling



IX.1 Prof. MGK Menon, Minister of State for Science and Technology laying the foundation stone for the building of APCTT.

Dessau, Resident Representative, UNDP, Shri Ardhanareeswaran, Special Secretary, Ministry of Commerce, Dr. Ove Chr. Bugge, Director, APCTT, Ambassadors/High Commissioners of ESCAP countries and Secretary, DSIR. The Sixth Technical Advisory Committee Meeting and the Fifth Governing Board Meeting of the APCTT were held at Bangkok, Thailand, during 4-7, December, 1990. A brief covering the issues of APCTT was prepared in connection with these meetings for the use of Indian delegation.

3. PROMOTION AND SUPPORT TO CONSULTANCY SERVICES

Promotion and Support to Consultancy Services is one of the initiatives during the Seventh Five Year Plan.

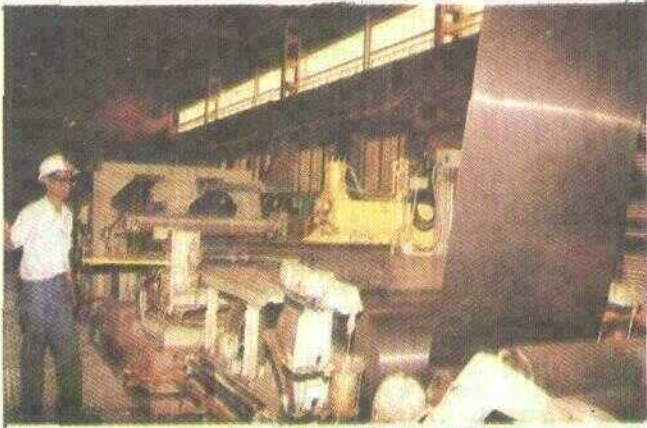
3.1 Objectives

The objectives of the Scheme are :-

- Providing incentives to Consulting Engineering Firms to document, their useful experience in major projects, particularly abroad.
- Support to proposed Consultancy Development Centre.
- Empanelling Eminent Engineering Professionals on retainer basis for consultancy.
- Providing fellowships to bright and promising engineers as apprentice with eminent



IX.2 Coke Dry cooling plant.



IX.3 Processing line, PT cold Rolling Mills.

consultancy organisations, arrange training etc.

- Support R&D efforts of consultancy organisations.
- Organise Seminars, Workshops, etc.

3.2 Activities

Eleven meetings of the Technical Advisory Committee (TAC) including one during the year 1990 have been held till Dec. 1990 in which about 90 programmes/projects including 15 in the current year were recommended which were at various stages of implementation. The thrust of the Scheme has been to identify the needs of consultancy organisations as well as users of consultancy specially small ones, studies on status of consultancy capabilities sectorwise, and then initiate programmes accordingly and development of skills as well as human resources to build-up a professional cadre on long term basis. Creation of awareness for the needs and capabilities of the



IX.4 Delta Steel Complex.

Indian Consultants, and assessment of the futuristic needs of consultants and industry, and preparedness to meet the same, has been an area of importance. One of the major initiatives has been to support Consultancy Development Centre (CDC) which is functioning from Qutab Hotel, New Delhi.

Some of the programmes carried-out during the year are briefly described below :-

a) Documentation of Experiences

- i) A Directory of Members of National Association of Consulting Engineers (NACE) giving details about the expertise and experiences of its 53 members was brought out through NACE. The Directory gives information on addresses, key personnel, technical expertise, areas of specialisation and competence, projects handled in India and abroad.
- ii) Studies on Indian Consultancy Capabilities in the areas of Food Processing Industry, through UPICO, Foundry and Forging Industry, through MANTEC, Auto Ancillary Industry, through CDC, Plastic Processing Industry, through GITCO, were completed. The Reports assess and evaluate the consultancy capabilities of Indian consultants in the respective areas and gaps existing vis-a-vis to foreign consultancy in the industry, and give information concerning consultancy capabilities of Indian consultants, leading foreign consultants, as well as supporting agencies including major research and inspection agencies. A report on Consultancy capabilities in Cement Industry has already been printed and disseminated earlier.
- iii) A Study on Consultancy Capabilities in the State of Uttar Pradesh through UPICO was completed. The Report assesses and evaluates the consultancy capabilities of consultants based in U.P. and gaps existing in various aspects of consultancy as well as profiles of leading consultants in UP.
- iv) A Study on Promotion of Consultancy Services for Export of Technology, Projects and Services to Malaysia through ITCOT, was completed. The Report essentially assesses industrial status policies for development of industries and Consultancy capabilities in

Malaysia, and potential for export of consultancy services to Malaysia from India.

- v) A publication on "Guidelines for Procedures for Export of Technology. Projects and Services" through CDC was published which contains information concerning to rules and regulations of various Ministries/Departments/Organisations, promotional measures/incentives available for the export of technology, projects and services.
- vi) A special issue on "Consultancy in Chemical Industry in India : An Overview (1989-90)" was published through Blackdale, Bombay. The publication highlights capabilities of Indian consultants in the Chemical Sector in India.
- vii) A Compendium of Specialised Test Facilities in India, was prepared through CDC and printed in final form. The compendium contains details of 129 organisations who are willing to make available their facilities to those who need them.
- viii) Four issues of ACE(I) Newsletter "VIEWPOINT" were supported, highlighting the achievements and experiences of Indian consultants as well as the articles about developments taking place and professional ethics.
- ix) A Video-Film on Consultancy Ethics was prepared through ACE(I) which highlights achievements and capabilities of independent consultants, and role played by them in the development of the country.
- x) Other projects, at various stages being implemented were : studies on Consultancy Capabilities in Fertilizer Industry. Telecommunication and Electronics including Computers. Civil Engineering, Pollution Control : Studies on Consultancy Capabilities in the States of Bihar, Delhi, Gujarat, North-Eastern Region, Orissa, Rajasthan and West Bengal; and Studies on Technological Assistance for Upgradation of Pumps and Foundry Sector. Promotional measures available for strengthening of Consultancy in selected overseas countries : publication of ACE(I) Manual on Consultancy, publication of Special issues on Consultancy in Chemical Industry and ACE(I) Newsletter VIEWPOINT : Creation of Technology Information Centre at two Technical Consultancy Organisations (TCOs), etc.

b) Consultancy Development Centre (CDC)

The Consultancy Development Centre (CDC), set-up in January 1986, has started functioning from Qutab Hotel, New Delhi, with a nucleus staff of one Senior Technical Officer with supporting staff, and is now implementing the various projects and programmes sponsored by DSIR under its various Plan Schemes, such as, NRFC, TAAS, TATT, etc. and other organisations. Some of the salient features of the activities carried-out by the Centre are :-

- i) A 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, was evolved and operationalised through CDC. Some of the incentives under the Scheme include :-
 - National Awards for Young Consultants : Awards for 1989 were given away. Applications received for awards 1990 were scrutinised and necessary action being taken for annual awards.
 - Use of Approved Consultants & Flying Consultancy Services : One Consultant in Mechanical Engineering was retained at CDC to provide services to small units. His services were being utilised by some small units. Action was being taken to recruit another consultant in order to have a wider coverage of expertise at CDC. To provide consultancy services to SMEs at source, Flying Consultancy Services Scheme has been evolved.
 - Support for Participation in Seminars/Workshops/Conferences : support was provided to seven consultants/consultancy organisations to attend various workshops, seminars, etc.
 - Support for participation in Trade Fairs/Exhibitions : Support was provided to three consultants/consultancy organisations to attend Trade Fairs and Exhibitions.
 - Trainee Consultants : Eight engineers were given one-year training at CDC during 89-90 and another batch of nine trainees was under going training at CDC during 90-91

and more training programmes are being planned on continuing basis.

- Regional Training Programmes : Four regional training programmes, on "Computer Data Management, Consultancy Effectiveness for Consultants, Selection and use of Consultants, and Marketing of Consultancy Services" were held in different parts of the country.
 - Consultancy Awareness/Contact Programmes : Seven programmes on "Consultancy in Kerala's Development", "Technical Audit in Civil Engineering Projects", "Consultancy in HRD : Perspective and Challenges", "Fee and Service Guidelines", "How to do Consultancy", "Opportunities for Young Consultants", and "Management Consultancy" were held in different parts of the country.
 - International Training Programmes : A Programme on Effective Use of Consultancy was being planned for March-1991.
 - Special Lectures : Two Special Lectures on Repair and Rehabilitation of Concrete Structures were arranged at different places in India by three American experts from American Concrete Institute.
- ii) Computerised Information and Computer Aided Design (CAD) facilities were created at CDC and the Centre is now equipped with *these facilities to help the small industries/consultants in this area*. Special Computer Training Programmes were organised for computer personnel and consultants. This facility is mainly for the trainees at CDC.
 - iii) CDC undertook various studies, such as, Compendium on India's Industrial, Technological and Consultants' Capabilities in Powder Metallurgy, Technology Status in the area of Water and Effluent Treatment Plants, follow-up of Foreign Collaboration agreements 1986. Compendium of Specialised Test Facilities in India, Guidelines for Export of Technology, Projects and Services, etc.
 - iv) CDC, in association with Asia and Pacific Centre for Transfer of Technology (APCTT) organised a three-day Regional Workshop on

"Role of Consultants in Transfer of Technology, and the Centre was also associated in the organisation of ESCAP Workshop on Strengthening and Development of Engineering Design and Consultancy Services for the Promotion of TCDC/ECDC, held on 3-7 Sept. 1990 in New Delhi.

- v) CDC has been allotted two hectares of land in NOIDA, and 1000 sq. mt. built-up space at India Habitat Centre, Lodhi Road, for office and other activities of the CDC, on permanent basis.
- vi) 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) and local consultants for the UNFSTD supported Project on Technology Incubation Centres in India.

c) Fellowships/Training

With a view to develop a cadre of professional consultants, and attract young engineers for the consultancy profession, three types of training programmes were undertaken.

- i) *One year Consultancy Training for young Engineers in India* : Eight Engineering graduates in the area of Electronics/Electricals, Civil Engineering, Mechanical Engineering, were given one year training at CDC, and another batch of nine Engineers was undergoing one year training at the Centre. Efforts were on to identify suitable trainees in various disciplines and develop a cadre of consultancy personnel on continuing basis.
- ii) Short duration Training Programmes : Four Programmes in the form of Workshops and expert lectures of one to three days duration, were organised through CDC in which about 100 consultants and users of consultancy, were given training on various aspects of consultancy.
- iii) Overseas Training for Young Consultants : Three young consultants availed of this facility. Efforts were on to popularize the programme and identify areas for overseas training.

d) Seminars/Workshops (organised/ supported)

In addition to the Workshops/Seminars organised by CDC under its various programmes, the following workshops/seminars were supported/organised :-

- i) A Seminar on Management of Urban and Rural Water Supply Systems was organised through NPC, New Delhi, to discuss the management of water supply system.
- ii) A Seminar on Management of consultancy in the Nineties was organised through ACE(I) in May 1990.
- iii) A National Seminar on Consultancy in Food Processing & Agro-based Industry - December 1990, New Delhi, inaugurated by Hon'ble Minister for Chemicals and Petroleum.
- iv) A Seminar on Technology Status and Norms in Foundry Industry and Consultancy in Foundry & Forging Industry in India, December, 1990.
- v) An International "TCDC Workshop on Strengthening and Development of Engineering Design and Consultancy Services for the Promotion of TCDC/ECDC" was organised on 3-7 September, 1990 in New Delhi, in association with ESCAP, Bangkok in which participants from Eight ESCAP region countries, ITC, World Bank, UNDP, and leading Indian Consultants/Consultancy organisations, financial institutions etc. participated.

e) Technology Business Incubator Centres in India

A Technology Business Incubator is essentially a shared physical facility to promote small entrepreneurs particularly those with innovative technologies, and providing low-cost facilities for the first few years of an enterprise, thereby reducing the risk for the entrepreneurs. UNFSTD had approved a programme relating to Feasibility Study for setting-up Technology Incubators in India. Dr. J.C. Allen, a UNFSTD expert had visited DSIR for ten days, in connection with the preparation of Feasibility Report for setting up TBICs in India. A Meeting was also organised by DSIR to discuss the needs and relevance of Technology Incubators in India. Mr. Lalkaka, Senior Adviser, UNFSTD, and

Dr. Peter Bearse had also visited DSIR in connection with the further implementation of the Programme. Feasibility Report for the setting of TBICs has been completed in which specific sites have been identified and mode of operation indicated.

Institutional Support

Apart from supporting CDC for its recurring and capital expenses, support was given to the Association of Consulting Engineers (ACE) India, New Delhi, towards creating infrastructure and office equipments for their effective working. ACE(I) Secretariat is working with a core staff of one Registrar and one Assistant. A proposal of Association of Consulting Civil Engineers (ACCE) for support has also been approved and similar proposals from MCAI and others were under consideration.

3.3 Publications

The following publications have been brought-out during 1990 :-

- i) Directory of Members, through National Association of Consulting Engineers (NACE), New Delhi.
- ii) Guidelines for Procedure for Export of Technology, Projects and Services, CDC, New Delhi.
- iii) A Compendium of Specialised Test Facilities in India
- iv) A Special Issue on Consultancy in Chemical Industry in India : An Overview - Blockdale, Bombay.
- v) Four issues of ACE(I) Newsletter "VIEW-POINT" - ACE(I), New Delhi.
- vi) Proceedings of the Seminar on Effective Use of Consultancy - CDC, New Delhi.
- vii) Proceedings of the Seminar on Emerging Technologies for New Metals and Super Alloys - CDC, New Delhi.
- viii) Proceedings of "TCDC Workshop on Strengthening and Development of Engineering Design and Consultancy Services for the Promotion of TCDC/ECDC, 3-7 September, 1990, New Delhi.
- ix) Consultancy Capabilities in Food Processing Industry in India - UPICO, NOIDA (Draft)

- x) Consultancy Capabilities in Automotive Ancillary Industry in India - CDC, New Delhi (Draft)
- xi) Consultancy Capabilities in Foundry & Forging Industry in India - MANTEC, New Delhi (Draft).
- xii) Consultancy Capabilities in Plastic Processing Industry in India - GITCO, Ahmedabad (Draft).
- xiii) Consultancy Capabilities in the State of Uttar Pradesh-UPICO, NOIDA (Draft).
- xiv) Study on Promotion of Consultancy Services for Export to Malaysia - ITCOT, Tamil Nadu (Draft).

3.4 Other Advisory Services

Advisory services were made available to various Ministries and Departments in relation to evaluation of their project proposals and other activities. An indication of the areas and subjects dealt with could be had from DSIR participation in various Committees, workshops/seminars and exhibitions as well as examination of several project proposals on various related matters.

3.4.1 Committees

- i) Governing Council, Membership, and CDPA Committees of CDC.
- ii) Consultancy Committee of FIEO.
- iii) Programme Advisory Committee of Technology Systems Group of DST.
- iv) Programme Advisory Committees of National Council of Building Materials.
- v) Board of Director of U.P. Industrial Consultancy Ltd., Kanpur, U.P.

3.4.2 Proposals : Following proposals received from various Departments/Organisations were examined :-

- i) Ministry of Human Resource Development concerning the training of Iraqi Technical personnel under Cooperative Agreement.
- ii) Establishment of Centre for Structural Ceramics at Delhi University and Research Centre of Sandvik Asia under UNDP Assistance.
- iii) Setting-up of a Design, Development and Facilities Centre for Ceramics at Faridabad from Department of Industry, Haryana, under UNDP Assistance.
- iv) UNDP Assistance for NCB Proposal for enhancement of Productivity in Cement Industry and Technology Upgradation of Vertical Shaftkilns.
- v) MDI Proposal for course contents for their publication Enterprises Management Programme.
- vi) M/s Ion Exchange Proposal to send three scientists for research work at IMRI, Canada.
- vii) Two proposals received from DID for engagement of consultants under BESO/CESO Programmes.

3.4.3 Other Seminars/Workshops/Meetings

- Meeting on Technology Transfer, Cooperation between India and USSR, arranged by Embassy of USSR in cooperation with UNESCO.
- CEI Workshop on Medical Equipment Industry.
- Training Programmes at Management Development Institute, Gurgaon.

X. NATIONAL RESEARCH DEVELOPMENT CORPORATION

1. INTRODUCTION

The National Research Development Corporation, a Public Sector Company has been specially created to develop and commercialize indigenous know-how, inventions, patents and processes emanating from various R&D institutions in the country. The Corporation continued to maintain improvement in performance in all areas of operation during 1989-90. The most distinctive achievement of the year was the earning of an all time record income of Rs. 109.76 lakhs from lumpsum premium and royalty on licensing of technologies.

2. PROFIT

The Corporation has earned a gross profit before tax of Rs. 21.71 lakhs compared to Rs. 25.09 lakhs during 1988-89.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

The Corporation continued its efforts to widen its technology portfolio by increasing the in-flow of processes from R&D Institutions. An outstanding development during the year was that some leading private sector companies having in-house R&D Centres recognised by the Dept. of Scientific & Industrial Research also entered into MOUs with the Corporation whereby they agreed to assign to the Corporation technologies which they had developed in-house for licensing and commercialisation by the Corporation, both at home and abroad. Together with the continuing in-flow of technologies from the CSIR laboratories, the Corporation was able to secure assignment of 40 new processes during the year.

Some of the important technologies assigned to the Corporation during the year were :

- * Preparation of Modified Lead Zirconate Titanate Ceramics
- * Spiral Grooved Grinding Wheel
- * Carbon Paper

4. MAJOR TECHNOLOGIES LICENSED

Some of the major technologies licensed by the Corporation during the year involving industrial projects with capital costs in the range of Rs. 1-10 crores were :

- * High Alumina Ceramics
- * Fly Ash Bricks
- * Nickel Cadmium Batteries
- * Electrolytic Manganese Dioxide
- * Cardanol and Cashewnut Shell Liquid based Surface Coatings
- * High Pungent Fraction and Colour from Chilli Oleoresins
- * Monocrotophos Pesticide
- * Phosphamidon Pesticide

These technology licences involve payment of lumpsum premia amounting to Rs. 19.00 lakhs. Substantial royalties are also expected from these technologies in the coming years.

5. TECHNOLOGY DEVELOPMENT PROJECTS

5.1 Completed Projects

Gallium

The Corporation had entered into an agreement with M/s. Madras Aluminium Co. (MALCO), Mettur

Dam in 1978 to set up a pilot plant of 30 kg/annum capacity for the recovery of Gallium from Bayer's Liquor based on a process developed by the Central Electro Chemical Research Institute, Karaikudi. After the plant was commissioned in 1986 and commencement of production of 3N Gallium, the special materials group of the Nuclear Fuel Complex (NFC), Hyderabad was brought in to develop a process to purify the 3N Gallium to 5N Gallium.

Subsequently, having successfully achieved 5N purity level, DSIR/NRDC/MALCO decided to study the techno-economic viability of setting up on a commercial basis, a Gallium extraction plant of 500 Kg/year capacity at the MALCO Plant. Keeping in view the strategic importance of the project, DSIR/NRDC brought in M/s. Engineers India Ltd. (EIL) to work in tandem with CECRI, MALCO and NFC to prepare a detailed Feasibility Report for an integrated plant capable of producing 500 Kgs/year of 5N purity Gallium. Last year, EIL submitted the draft Feasibility Report to the Corporation.

Due to the power shortage in the State of Tamil Nadu, and the high power tariff rates, the MALCO plant which is located at Mettur Dam in Tamil Nadu, was declared a sick unit. MALCO, therefore, expressed their inability to go ahead with the 500 Kg. per annum 5N Gallium extraction plant.

The Corporation is now exploring the possibility of licensing the know-how and providing the feasibility report with suitable modifications to other aluminium manufacturers in the country such as NALCO, BALCO etc.



X.1 Sennova Tea Processor.

Rice Husk Particle Board

The Indian Plywood Industries Research Institute (IPIRI), Bangalore had developed a laboratory scale process for the manufacture of Rice Husk Particle Board. The process, developed through funding from Department of Science & Technology was licensed by the Corporation to M/s. Padmavathy Panel Boards Pvt. Ltd. (PPBL), Bangalore in June 1988.

The project, having a capacity of 600 tonnes per annum of Rice Husk Particle Board was commissioned in late 1989 with significant technical inputs from NRDC. It is now producing approximately 2 tonnes of Rice Husk Particle Boards per day. With the active support of NRDC, these Boards have already been introduced by our licensee M/s PPBL, in the Bangalore market, and have been readily accepted by customers. It is expected that the Company will manufacture and sell around 600 tonnes of Boards during 1990-91 valued at around Rs. 80 lakhs.

The process has been licensed to one more party in Haryana. This technology, which utilises waste materials and helps in conserving scarce national forestry resources, is thus poised to make a significant impact on the economy in the coming years.

Fly Ash Bricks

Based on a process for the manufacture of Fly Ash Bricks developed at the Central Fuel Research Institute, Dhanbad and licensed by the Corporation



X.2 Fly ash brick making press.

a pilot plant with a production capacity of 10,000 bricks/day has been set up by M/s. Jagatdhatri Brick Industries, (JBI), Barrackpore, West Bengal. While the pilot plant was able to produce bricks of the necessary technical characteristics during 1987-88, it was necessary to increase the capacity of the plant to 22,000 bricks/day so as to fully establish the techno-economics of the process and plant for commercial viability. This required the development and engineering of a larger press, which is the key machine involved in the manufacturing process. The Corporation had accordingly provided a Development Loan of Rs. 5 lakhs to JBI for this purpose.

The new press which has a design capacity of 1000 bricks per hour has been installed and commissioned and is giving an output of approx. 850 bricks per hour. Efforts are being made to improve the press so as to run continuously at its rated capacity. Meanwhile, the process has also been licensed to one more party viz. Bright Engineering Works, Raichur who is in the process of setting up a plant of 20,000 bricks per day capacity.

Spirulina Algae

Spirulina is a high quality food supplement containing Vitamin B1, B2, B6, B12, C, E besides Beta-Carotene which is the precursor for Vitamin A. Spirulina is used all over the world. It has tremendous potential for use in Health foods, Cosmetics and Health Care applications. It activates skin metabolism and regenerates skin cells and has many pharmaceutical uses viz. in controlling sugar levels, in reducing cholesterol levels. Being rich in proteins, vitamins and essential Amino-acids it is of great nutritive value as food supplement and animal feed and also used in pisciculture, sericulture etc. The process for the manufacture of Spirulina Algae has been developed at the Murugappa Chettiar Research Centre (MCRC), Madras who had set up a pilot plant of 7.5 TPA capacity at Saveriyarpuram in Tamil Nadu. The plant, however, needed to be modified and the process and plant also optimised not only to attain its rated 7.5 TPA capacity but also to reduce the cost of production. The Corporation, recognised the importance of making available Spirulina Algae on a large scale and at a reasonable price, particularly for feeding children through the Mid Day Meal pro-

gramme of various states such as Tamil Nadu (use of 1-2 grams of Spirulina per day eliminates Vitamin A deficiency in children). Accordingly, it provided MCRC with a grant of upto Rs. 25 lakhs for process and engineering optimisation of their pilot plant. During the year, the Corporation released Rs. 12.20 lakhs to MCRC and also provided technical inputs through in-house experts and also by bringing in experts from Engineers India Limited for engineering design. With the inputs from the Corporation, MCRC has been able to run the plant at rates corresponding to a production capacity of 6 tons per annum and also to reduce the cost of production by 14%.

The Corporation has also finalised arrangements for licensing the knowhow to M/s. New Ambadi Estates Pvt. Ltd. Madras as also for acquisition by them of the existing pilot plant of MCRC and for scaling it up to a production capacity of 20 tonnes per annum capacity. A work plan has also been prepared by the Corporation in association with MCRC and the Department of Biotechnology for the promotion of this technology on a national basis.

5.2 On Going Projects

Electrolytic Manganese Dioxide

The process for the manufacture of Electrolytic Manganese Dioxide (EMD), a key material used in the manufacture of Dry Cells was developed by the National Metallurgical Laboratory of CSIR. Since over 3000 TPA of EMD are being imported today, the Corporation identified M/s. Magno Mining Co. Ltd. (MMCL) for licensing the know-how for this process and setting up a Demonstration Plant having a capacity of 300 tons per annum at a cost of Rs. 4.23 Crores. After this Demonstration Plant, has been successfully set up and run, the licensee would expand it on a modular basis in stages to release a 2,500 tonnes per annum commercial plant. For setting up the Demonstration Plant, the Corporation provided equity assistance of upto 26% of the total equity of Rs. 100.6 lakhs while IDBI committed to provide equity assistance of Rs. 10 lakhs and a Venture Capital loan of Rs. 328.41 lakhs. The Corporation has accordingly signed an investment agreement with M/s. MMCL for equity participation and has released a sum of Rs. 5.90

lakhs as equity. IDBI has also released the first instalment of Rs. 105.20 lakhs on account of venture capital loan. Using those finances, MMCL has started civil works at the site and ordered the major items of plant and machinery.

Drivers' Reflexes Testing System

Based on the development of a range of human reflexes measuring sensors and associated micro-processor-based data processing and logging electronics by the Central Scientific Instruments Organisation (CSIO) of CSIR the Corporation had invested Rs. 3.00 lakhs in a joint technology development project with M/s. Punjab Tractors Ltd. (PTL), Chandigarh for development of four fully engineered prototypes of a Drivers' Reflexes Testing System. The system provides for measuring the simple and complex reaction time, depth perception, side vision acuity, night vision and glare recovery of automobile drivers. The corporation configured the project with CSIO as the design organisation, Punjab Tractors Limited as the production agency and the Central Road Research Institute of CSIR as the consultancy and evaluating agency. The first complete prototype incorporated in the driver's cabin of a Swaraj Mazda light commercial vehicle has been used for testing over 100 drivers of the Delhi Transport Corporation and based on the results, two more prototypes have been made. These prototypes would be used for not only validating the test data by testing a large number of road vehicle drivers but also to set standards under our conditions which a driver should pass for being eligible for obtaining a heavy/medium vehicle driving licence.



X.3 Drivers' reflexes testing system.

Heart Valve

The original development work using the Sapphire Disc in the design and development of a Heart Valve at the Sree Chitra Tirunal Institute of Medical Sciences (SCTIMST), Trivandrum, under financing from the Corporation had to be restructured due to unexpected wear problems in the Titanium Cage and subsequent fracture of the Disc which became apparent only during animal trials. Last year Ultra High Molecular Weight Polyethylene (UHMWPE) material having very low wear rate and good tissue compatibility was identified for the fabrication of the disc and accelerated durability tests were carried out successfully. For this work, the Corporation released an additional grant of Rs. 2 lakhs to SCTIMST. After inspection of the animals with the modified implanted valves, SCTIMST would be placing the matter before the Ethics Committee of the Institute in the near future for giving clearance for taking up human trials. In the meantime, the Corporation has identified a suitable party who would take up the production of the Heart Valves.

5.3 New Projects

Precipitated Silica

The process for the manufacture of Precipitated Silica from Rice Husk Ash was developed at the Indian Institute of Technology, Kharagpur. After the process was assigned to the Corporation it was licensed to Prof. B.K. Mohanty, who formed a company, M/s. Unique Silica Development Pvt. Ltd., Cuttack for setting up a 240 tonnes per annum plant. The plant commenced trial runs in November 1989. Since this process has considerable commercial potential, a number of visits by the Corporation's engineers were made to the plant so as to help the licensee overcome technical problems. As a result, it was found that the process could be made much more cost effective by extracting two by-products viz. Calcium Sulphate and Activated Carbon. To carry out the development work for recovery of these by-products the Corporation has sanctioned a development loan of Rs. 1.8 lakhs to M/s. Unique Silica Development, Pvt. Ltd. The development work is under way.

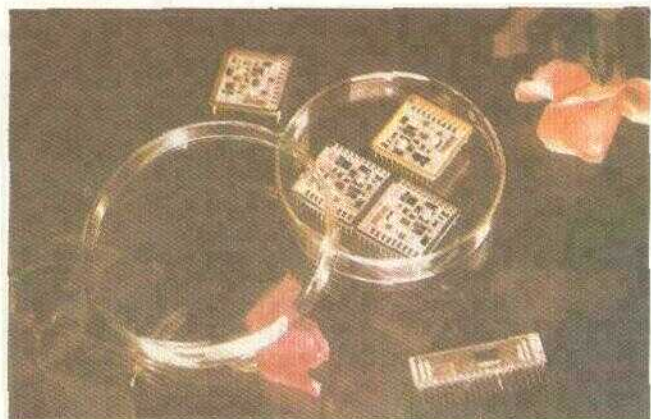
6. MARKET SURVEYS

Market information alongwith the technical know-how not only makes the techno-commercial "package" more complete and attractive but also helps in assessing the realistic price of the technology for licensing. The Corporation therefore started this important activity in 1987-88 by commissioning professional market survey agencies on some of its major technologies. Continuing this activity during 1989-90, professional market survey agencies were commissioned to carry out detailed market surveys on the following indigenous technologies assigned to the Corporation :

- * Collagen Sheet
- * Spirulina Algae
- * Selected Electronic Products

7. DEVELOPMENT AND PROMOTION OF RURAL TECHNOLOGIES

The Corporation initiated this programme five years back with a view to apply Science and Technology to (a) improve the living conditions of our rural people (b) increase employment potential by utilising local resources (c) upgrade the traditional skills. Continuing the activity during the year the Corporation compiled and computerised over 4000 names and addresses of voluntary agencies engaged in rural development. These agencies have been included in the mailing list of the Corporation's publication "Gram Shilp" so that information about rural technologies is widely disseminated.



X.4 Thick Film hybrid microcircuits.

A Get-Together, the first of its kind, of representatives of NRDC Rural Technology Demonstration-cum-Training (RTDT) Centres, was organised at Karaikudi, Tamil Nadu to exchange experiences among the personnel of the RTDT Centres set up under this programme. Based on the feedback from the Get Together the Corporation provided a number of additional equipment to selected RTDT Centres to demonstrate new technologies relevant to rural populations in their respective areas. A new RTDT Centre was also set up at Bharatpur during the year.

8. EXPORTS

Aggressive marketing efforts put in by the Corporation on technology and project exports involving indigenously developed technologies during the past three years have started yielding results. Against stiff international competition, the Corporation has been able to secure contracts for export projects based on indigenous technology worth Rs. 195 lakhs (all payments are to be made in free foreign exchange) during 1989-90 from Indonesia, Vietnam and Thailand.

The Corporation has also been commissioned by a Canadian Company for the preparation of Feasibility Reports on setting up of 3 Mini Cement Plants in Madagascar at a project cost of around Rs. 1.25 Crore each and Caffeine from tea waste in Iran by the Government of Iran at a project cost of around Rs. 1 Crore.

Senior technical executives of the Corporation also visited Ghana, Senegal, Zambia, Malaysia and Indonesia to develop business relations and contacts with a view to promoting export of our technologies to these countries.

9. FOREIGN EXCHANGE RECEIPTS AND OUTGO

During 1989-90, the Corporation earned foreign exchange amounting to Rs. 33.05 lakhs as compared to Rs. 8.23 lakhs during 1988-89, while the total foreign exchange spent, amounted to only Rs. 5.22 lakhs.

10. INVENTION PROMOTION

To promote the spirit of inventiveness amongst Scientists, Workers, Students and Inventors, the Corporation continued its programme of Awarding Prizes for the development of novel processes/products/inventions.

During the year, 160 applications for such prize awards were received of which, the Corporation announced on Independence Day 1989 cash awards amounting to Rs. 2.8 lakhs to 41 inventors for 10 meritorious inventions. On Republic Day 1990, Cash awards amounting to Rs. 2.55 lakhs to 13 inventors for 9 meritorious inventions were announced.

Some of the meritorious inventions recognised through Awards given during the year were :

- * Space Qualified Multicavity Interference Filters
- * Respiratory Flow Meter
- * An improved (modular) Cell for production of Magnesium Metal by Fused Chloride Electrolysis.
- * ELGAI (Enrichment of Iron Percentage of Aluminous Iron Ore and Production of Alumina from such ore)
- * SENNOVA Tea Processor

The Corporation is the agency nominated by the World Intellectual Property Organisation (WIPO) for selecting suitable Indian inventions to be awarded the annual Gold Medal and Silver Medal Awards of WIPO for inventions suitable for developing countries. The WIPO Gold Medal for 1989 was awarded to the inventor of "CHIP CHAP Microprocessor Educational Kit" and the Silver Medal to the inventors of "Special Attachments which enables the Blind to use Lathes".

11. PATENT ASSISTANCE

The Corporation continued to provide technical, legal and financial assistance to individual inventors in drawing up patent specifications of their inventions, processing their patent applications, etc. During the year, the Corporation received 42 applications from individual inventors for such

assistance for filing patent application in India of which assistance was granted to 10 inventors based on the patentability of the inventions involved. 8 patent-applications were also filed on behalf of different R&D organisations which approached the Corporation for techno-legal assistance on patenting.

12. TRAINING PROGRAMMES

As a part of its efforts to promote greater awareness of the various facts by technology transfer in industry and R&D Institutes the Corporation organised training programmes on the "Management of Technology Transfer, Patent and Information System" at Lucknow, Calcutta, Madras and Goa. The participants of these programmes were drawn from Universities, Research Organisations, Public and Private Sector Industries and Government Departments.

13. PUBLICATIONS

An important activity of the Corporation is to disseminate information on new processes and developments in indigenous technology, to industry, the scientific community and the general public. One of the means of doing so is through publications of various types. During the year, the Corporation brought out the following publications :

- * Golden Book : The Management of Technology Transfer, Patents and Information Systems.
- * Four issues of the Technology Digest each on a specific industry

April-June, 1989	Food Processing
July-September, 1989	Medicinal Plants & Drugs
October-December, 1989	Technologies for Rural Areas
January-March, 1990	Polytechnology Centres of CSIR
- * Catalogue of Technological Opportunities (English & French)

The Corporation circulated these publications to R&D laboratories and industries, chambers of Commerce & Industry Associations, Rural Techno-

logy Demonstration-cum-Training Centres of the Corporation, Science & Technology Entrepreneurship Parks, Central and State Financial Institutions, etc.

The Corporation also brings out a number of publications in its effort to foster inventiveness in the country. The monthly magazines AWISHKAR (in Hindi) and INVENTION INTELLIGENCE (in English) which entered their 20th and 25th years of publication respectively during 1989-90 are becoming increasingly popular. The quarterly magazine GRAM SHILP (in Hindi), started 10 years ago and devoted to the dissemination of information on rural technologies, is also becoming increasingly popular.

14. EXHIBITIONS & PUBLICITY

The Corporation has been participating in selected Exhibitions, Seminars and Get-Togethers both at home and abroad to communicate concrete instances of what S&T has contributed and can contribute to rural and industrial development. During 1989-90, the Corporation took part in the following Exhibitions :

- * Nehru & Science Exhibition, Hyderabad (4-18 August, 1989)
- * Challenging Opportunities in Science & Technology, Calicut (Exhibition-cum-Seminar) (Support STED-Calicut) (29-31 August, 1989)
- * Science & Technology Demonstration Campaign, Ottapalam (Kerala) (1-12 September, 1989)
- * Nehru Kisan Mela, Allahabad (11-19 November, 1989)
- * India International Trade Fair, 1989 Pragati Maidan, New Delhi (14-29 November, 1989)
- * India Industrial Exhibition, Jakarta (Jan. 26 to Feb. 2, 1990)
- * Rotary Industrial Fair '90, Pune in collaboration with MITCON, Pune (18-21 January, 1990)
- * WISITEX '90, Bombay (4-10 February, 1990)
- * Industrial India Trade Fair, Calcutta (22- December-1 January, 1990)
- * Science & Technology Exhibition, Parliament Annexe, New Delhi (1st March 1990)

15. COMPUTERISATION

Computerisation has particularly significant benefits for an engineering and technical services company like NRDC. Therefore, top priority has been assigned during the year to build up the physical facilities, skills, systems and procedures to maximise the utility of computerisation of the Corporation's activities.

Application Software packages for many of the core activities of the Corporation e.g. System Establishment Accounting (SEA), Legal Information Processing System (LIPS), Technology Release Information System (TRIM), Decision Monitoring System (DMS) were developed, debugged and put into regular use.

It is expected that almost all the other major activities of the Corporation e.g. Monitoring of Technology Development Projects and Pilot/Demonstration Plants, Legal Proceedings, Prize Awards and Financial Accounting and Budgeting will also be computerised during 1990-91 and 1991-1992.

11 executives and 14 staff of the Corporation were deputed to take computer awareness courses at reputed institutions like National Informatics Centre, New Delhi, All India Management Organisation, Institute of Chartered Financial Analysts, New Delhi and Administrative Staff College, Hyderabad.

16. WORKING RESULTS

The paid-up capital of the Corporation as on 1st April, 1989 was Rs. 237.31 lakhs. With the addition of Rs. 15.00 lakhs received from the Government during the year, it rose to Rs. 252.31 lakhs as on 31st March, 1990. Further, a sum of Rs. 14 lakhs received from the Government as share deposit during 1989-90 has been shown as advance received towards equity capital, pending allotment of shares.

The unsecured loans at the end of the year stood at Rs. 147.32 lakhs (including Rs. 0.01 lakhs towards interest accrued but not due as on 31st March, 1990) as compared to Rs. 153.36 lakhs at the end of 1988-89.

The gross income of the Corporation from all sources including premia and royalty but excluding Grants-in-Aid, was Rs. 190.24 lakhs as compared to Rs. 166.42 lakhs in the previous year.

XI. 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, Electronic Telephone Exchanges, Projection Television etc.
- (iii) Selected Electronic Components - Professional (Soft) Ferrites, Electronic Ceramics, Piezo Electric Elements and Microwave Components.

CEL has been 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 1989-90

2.1 OPERATING RESULTS

The production and sales achieved by the Company in 1989-90, rounded off to the nearest lakh to rupees compared with those of the previous year are given below :

	1988-89	1989-90	Increase/ Decrease
	(Rs. in Lakhs)	(Rs. in Lakhs)	
Production	1800	2237	(+) 24%
Sales	1739	2188	(+) 26%

Though the production and sales achieved during the year have shown considerable increase over those achieved during the previous year, they fell short of the corresponding targets for the year as per the Revised Estimates for 1989-90 (of Rs. 2695 lakhs and Rs. 2811 lakhs respectively) by 17% and 22% respectively.

2.2 HIGHLIGHTS OF OPERATION

In the Solar Photovoltaic (SPV) Group the actual production of solar cells during the year was restricted to 661 KWp, though the actual sales was about 960 KWp thereby resulting in considerable reduction in the inventories. A total of 2573 SPV systems deployed by the Company around the country by March 1990 to 16903. Major efforts were committed on the implementation of the *turn-key supply order for the installation of 200 SPV-powered Deepwell Submersible Pumps* against an order from the Department of Rural Development (DRD) under the National Literacy Mission for Drinking Water received towards the end of the previous year. Over 180 sites distributed over 10 States were surveyed involving nearly 700 man-days of efforts. Of those 180, sites numbering 110 were found suitable and of those clearance for only 90 sites could be obtained from the Department of Rural Development DRD). All the 90 SPV systems were supplied and were in various stages of installation by 31 March 1990. 1200 Nos. of SPV power packs for lighting, using PL-9 lamps were manufactured and supplied against the turn-key order from the Ministry of Human Resource Development, for the National Literacy Mission. These lighting systems consisting of 4 PL-9 lamps each along with SPV panels and battery back up were installed at Adult Education Centres in various farflung areas distributed over 14 states. Over 50% of these systems had been installed by the end of the year. An order for the supply of 1000 Nos. of SPV power source for VHF single channel

rural radio communication links were received from the Department of Telecommunication (DOT) towards the end of the year in March 1990. 17 more systems of SPV operated Obstruction lights for Airports were manufactured and installed at Aurangabad, Imphal, Tirupati and Calicut against an order from the National Airport Authority (NAA). In January 1990, the Company successfully commissioned over 40 Nos. of SPV domestic lights, street lights, community lighting and TV systems at village Hitam-ulu in Indonesia under an order from the Ministry of Transmigration of the Government of Indonesia. Towards further pursuing export avenues for SPV, the Company participated in the India Industrial Fair organised by Trade Fair Authority of India (TFAI) at Jakarta, Indonesia in January 1990 and followed it up by further promotion efforts for export of SPV products to Indonesia and Australia.

In the Systems Group 10 turn-key installations of SPV powered Cathodic Protection Systems were completed for ONGC's Gujarat Oil Pipelines. A notable feature in the operations of the Company in this business group was the opening-up of a new market segment with large growth potential in the area of Railway Electronics. This was amply confirmed by the Company receiving, during the year, orders for turn-key installations valued over Rs. 3.0 crores from the Railways. These orders included the installation of Axle Counters in the Itarsi-Bhusaval section of Central Railway and Nagda-Bhopal section of Western Railway. It also included the supply and installation of Block Working Systems using Axle Counters and Multiplexer units in the Jhansi-Bina Section of the Central Railways. This Block Working System was being introduced for the first time by the Railways. In addition, 20 SPV powered Radio Warning Systems for level crossing, trade marked SOLAGARD, were supplied to all the Zonal Railways against an order from the Railways for conducting exhaustive operational trials of this system before volume introduction of this system in the Railways.

In the Components Group, the second continuously operating Tunnel Kiln in the Professional Ferrite Plant which had been shut down in August 1988 was completely relined, commissioned and put back into operation and made fully operational



XI.1 EPABX model based on C-DOT design.

in December 1989. As a result the division was able to obtain about 4 months of additional ferrite production from this kiln. The RM-6 core which was developed through in-house R&D for use by Indian Telephone Industries (ITI) was successfully introduced into production during the year. After the successful completion of R&D activity earlier in the year, the Company received its first trial order for 100 Nos. of Microwave Ferrite Phase Shifters for Radars from the LRDE Bangalore of the Defence Research & Development organisation (DRDO).

3. DESIGN AND DEVELOPMENT

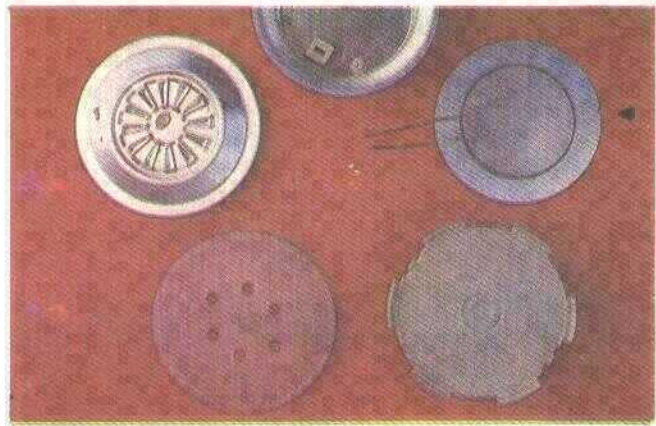
The Company continued its design and development (D&D) activities in each of its major operational areas viz. SPV, Systems and Components Groups. The D&D activities were carried out with funding both from the Company's internal resources and in the form of Grants-in-aid from DSIR and other Government agencies. During the year, the Company received an amount of Rs. 215 lakhs from the DSIR specifically for the projects on : Multi-crystalline Solar Cells, New SPV Systems, High Permeability Ferrites and Railway Electronic Equipments.

In the SPV area, efforts were put in to effect major changes in solar cell processing through in-house R&D activities and these process changes were parallelly inducted into the production line. This resulted in the slowing down of the production activity and consequently in reduced output. In the Multicrystalline solar cells project being carried out over the previous 2-3 years in collabora-

tion with National Physical Laboratory (NPL), New Delhi, modules were fabricated with solar cells made of multicrystalline silicon (both imported and grown indigenously) and the modules were being subjected to extensive trials and evaluation during the year.

The Development of SPV operated small and low power refrigerators for use specifically in the Immunization Mission was continued to be carried out in the Company. Having demonstrated the initial feasibility of the system and as a means of ensuring reliable supply of refrigerators in bulk, CEL entered into a collaboration with M/s. Hyderabad Allwyn Limited, Hyderabad, for developing special refrigerators suitable for SPV operations. Two of the units fabricated by M/s. Allwyn were tested with encouraging results. Development of "Maximum Power Point Trackers" for CEL's standard 360 Watt peak SPV Water Pumping systems was undertaken and satisfactory results achieved. The indigenous inverters earlier successfully tested for use with normal Indian Domestic Refrigerators were modified for their use with imported Refrigerators of higher capacity deployed in large numbers in a number of States by UNICEF & Ministry of Health, Government of India under the National Immunization Mission. Street lighting systems for Dusk to Dawn operation were developed and put under field trials. SPV Battery Chargers for Defence applications using light weight foldable SPV modules and special electronic circuits were developed.

The first Block Working System using Axle Counters and Multiplexer Units installed at one site in the Jhansi-Bina trunk line was field tested jointly by RDSO and CEL. The trial system was to type test RDSO the Multiplexer unit which had been fully developed by CEL to meet the Railway Block Proving requirement. Two more models of the projection Television systems were indigenously developed - one of 3 Mtrs. large screen with high resolution for suitability as a Computer Monitor (80 character display capability on a curved high gain screen) and the other a large screen model (4.5 Mtr. diagonal) for large audience viewing. The bill of materials for the models were frozen and component orders finalised for bulk production of these models and introduction in the market in the following years.

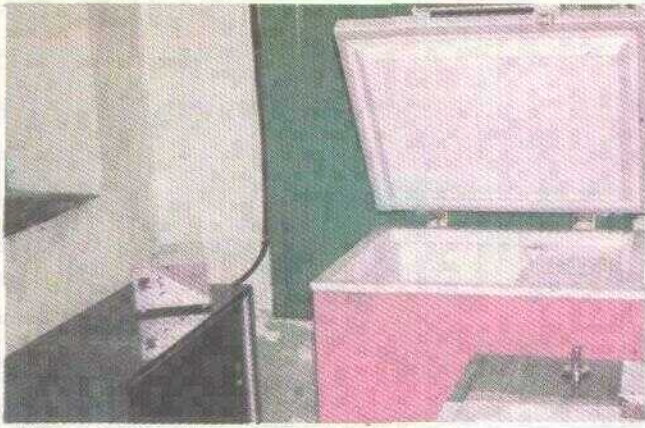


XI.2 PZT Transducer Element alongwith the parts of the transducer assembly.

4. TECHNOLOGY ABSORPTION, ADAPATATION AND INNOVATION

The Company had been vested by its charter, with the task of productionizing indigenous technology developed on a laboratory scale in the National Laboratories, while it also carried out in-house development in its present areas of operation. The Company has ably fulfilled this special task assigned to it and has as of to-day, successfully productionised the Professional Ferrites technology developed on laboratory scale at National Physical Laboratory (NPL), New Delhi, developed in-house technologies in the areas of Electronic Ceramics, PZT and Solar Photovoltaics. Further, all these technologies are fully absorbed into the respective production lines in the company. Continuous efforts are also being put towards improvements and updating of these technologies through innovative developments carried out in-house.

The Company had for the production of Projection Television Systems, entered into a collaboration Agreement with M/s. ITT, West Germany and had introduced one model of PTV for the first time in the country during 1986-87. Not only was the technology fully absorbed by the Company, but 2 more models of PTV have been developed by the Company's in-house effort carried out during this year. One of these models is a high resolution model suitable for use as Computer monitors. New models will be produced in bulk and introduced into the market next year.



XI.3 SPV Refrigerator for storing vaccine.

5. CEL AND NATIONAL MISSION

5.1 ROLE IN NATIONAL TECHNOLOGY MISSIONS

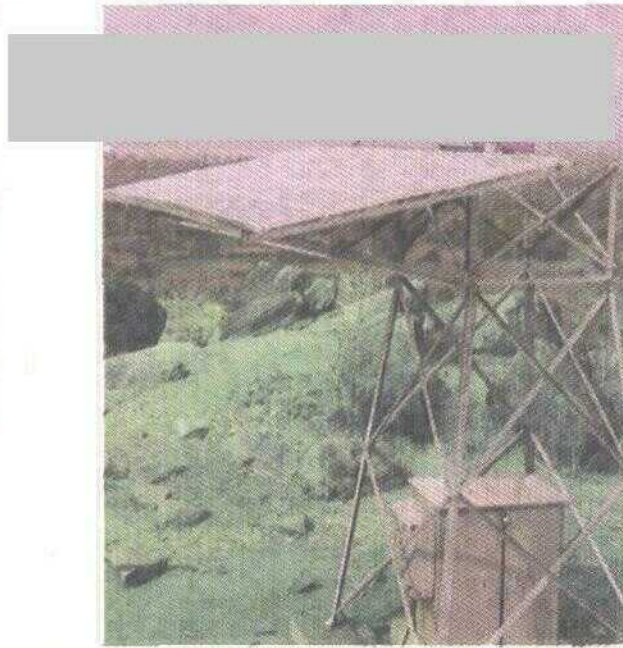
The Company has been contributing substantially to the different national technology missions through the deployment of various products of the Company, specially SPV systems and Projection Television units (PTV). SPV drinking water systems are being used for the National Mission on Drinking Water while SPV powered Street Lights/Community Lights and Projection Television systems (PTV) are products being used in the National Mission on Literacy and SPV powered Refrigerator systems for storing Vaccine in the village health centres are in use as part of the National Mission on Immunization.

5.2 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 1990, the total number of employees in these categories was 254 which represents about 27% of the total strength of the company.

5.3 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.



XI.4 SPV powered obstruction warning light at Khajuraho Airport.

6. INDUSTRIAL RELATIONS AND HUMAN RESOURCES DEVELOPMENT

The last Wage Agreement with the recognised Workers' Union of the Company had expired in December 1986, the Company held extended discussions with the Union spread over almost a year and finalising a new 5 year Wage Agreement. While a Memorandum of Understanding between the Management and the Workers on the agreed wage proposal was signed in July 1989, the actual Wage Agreement was subsequently signed by both parties in February 1990 after obtaining the necessary Government approvals.

Employees participation in management continued through the forums of Shop Level and Plant Level Committee constituted for the purpose. 15 meetings of the Shop Floor Committees and 4 meetings of the Plant Level Committees of the different divisions of the Company were held during the year.

7. REVISED PLAN FOR 1990-91 AND TARGETS FOR 1991-92

The Company's Revised Production and Sales targets for 1990-91 are Rs. 26 Crores and Rs. 27.6 Crores respectively and the corresponding budgetary Estimates for 1991-92 are Rs. 34.4 Crores and Rs. 34.35 Crores respectively.

XII. NATIONAL INFORMATION SYSTEM FOR SCIENCE & TECHNOLOGY

I. INTRODUCTION

The tremendous growth in the output of scientific and technical information and in the number of users of information has brought about the need for an effective system for information transfer. The increasing role played by science and technology in the economic and social development of the country has created a pressing demand for quick transfer of technology to industries. In addition to getting access to information generated in 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, require to be coordinated and organised into an integrated system following uniform national and international standards to avoid haphazard growth and duplication of activities.

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 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. The programme also contemplates experimentation with the introduction of modern information handling tools and techniques and development of endogenous capabilities for the purpose.

Since the year 1985, the responsibility of implementation of NISSAT programme has been with the Department of Scientific and Industrial Research.

I.1 OBJECTIVES

NISSAT functions with the following objectives :

- a) Provision of national information services to meet the present needs of generators, processors, disseminators and users of information.
- b) Optimum utilisation of existing information services and systems and the development of new ones.
- c) Promotion of national and international cooperation and liaison for exchange of information.
- d) Support and active encouragement for the development of facilities for education and training in information science and technology.
- e) Support of, and active participation in research, development and innovation in information science and communication to enhance both the efficiency of information services and quality of the information provided by these services and
- f) Support and promotion of research, development and innovation in information technology.

2. SECTORAL INFORMATION CENTRES

2.1 Existing Centres

The major instrument for information resources development and dissemination is a sectoral information centre. Following nine centres were established with objectives to create information awareness and to meet the information needs of academicians, scientists, technologists, entre-

preneurs, management executives and decision makers in the area of specific sector.

Sectoral Centre on	Institution
i) Leather Technology (NICLAI)	Central Leather Research Institute, Madras.
ii) Food Technology (NICFOS)	Central Food Technological Research Institute, Mysore
iii) Machine Tools (NICMAP)	Central Machine Tools Institute, Bangalore
iv) Drugs and Pharmaceuticals (NICDAP)	Central Drugs Research Institute, Lucknow
v) Textiles and Allied subjects (NICTAS)	Ahmedabad Textile Industry's Research Association, Ahmedabad
iv) Chemicals & allied industries (NICHEM)	National Chemical Laboratory, Pune
vii) Bibliometrics (NCB)	Indian National Scientific Documentation Centre, New Delhi
viii) Advanced Ceramics (NICAC)	Central Glass and Ceramics Research Institute, Calcutta
ix) Compact-Disk (NICDROM)	National Aeronautical Laboratory, Bangalore

The Sectoral Centres were built around the existing information resources and facilities. They were, however, provided with a wide range of documents, sophisticated equipment and manpower so that they could provide information services on a national scale. They maintain an extensive collection of published and unpublished documents in the form of books, periodicals, research reports, development and trade reports, monographs, conference proceedings, standards, patents etc., pertaining to the relevant subject areas. Regular monthly technical publications from these centres include Current Awareness, Industry Highlights, Current Highlights, Patents Awareness, Current Indian Titles in respective sectors and also semi-technical and popular ones in the form of digests. Besides, the centres have also brought out ad hoc publications like Buyers Guides, Directories of Agents, Research, Foreign Collaborations etc. The centres have also developed Information Management tools like Thesaurus.

The sectoral centres are maintaining several databases to cater to the information requirements of their clientele. For example, NICDAP maintains Natural Product database, letters of Intent & Industrial Database, Research Product database, Union Catalogue of periodicals in Lucknow city etc.; NICLAI maintains database on Leather Science and Technology and Allied areas (LESA), Holdings of Periodicals, Thesaurus of Leather Technology; NICFOS maintains Food Science & Technology Abstracts (FSTA), FTA database, Indian Food Industry Directory, Food Patents, CFTRI publications and database on Bibliographies; NICMAP maintains database on Metal working, Patents, World Machine Tool Statistics, Indian Machine Tool Production Statistics & Import/Export Statistics Database; NICDROM has Library & Information Science Abstracts (LISA) database on CD-ROM version etc.

Services provided by these centres also include document supply, preparation of special bibliographies, patents search, reprography and micrography, industrial inquiry and translation services. As a part of creating awareness among library and information professionals and user community in the use of modern information technologies, they conduct seminar/conference, workshop/training programmes; participate in exhibitions etc.

These centres also act as focal points of the local information centres for ensuring resource sharing activities like inter-library loans, referral service and document supply service.

2.2 New Centres

To ensure adequate use and effective communication, a number of information systems have been established to provide the channels and linkage mechanism between the generators of information and the users of information. These systems are specially computer-based, and depend on electronic data processing techniques which allow large quantities of information, both numeric and non-numeric to be manipulated with ease and speed. The performance of the information communication system depends on the efficiency of the software that are used, and the variety of manipulation and activity that they allow. To achieve this a software resource centre was established at

Visakhapatnam namely National Resource Software Centre (NSRC). The centre will acquire systematically information handling software packages from International and national organisations; acquire public domain software available from universities and user groups, acquire or develop software for protection against computer viruses and for their removal and offer extension services in the sector.

3. INFORMATION ANALYSIS AND DATA CENTRES

Information analysis centres and data centres have been planned under NISSAT scheme for undertaking the task of acquiring, evaluating, integrating, condensing and analysing factual and numeric information in contrast to a sectoral centre which is expected to provide mainly bibliographic support.

The first data centre on crystallography was established at the Madras University. This is formally known as National Information Centre for Crystallography (NICRYS). The centre obtains global information on organic and organo-metallic compounds compiled and collated at Cambridge on magnetic tapes. These data pertain to X-Ray & Neutron diffraction, structural as well as bibliographic information of about 70000 compounds.

During the past twelve years, NICRYS handled 675 enquiries involving over 4750 searches, from nearly 265 scientists/65 institutions. The Center also extended services to a large cross-section of scientists in 6 major institutions who are provided with copies of data files on bulk charge basis for their full institutional utilisation. The Center receives requests for information on hard data such as structure of the molecule, atomic coordinates and the like. Protein Crystallographic structural data, Nucleic acid sequence data (Genebank) are also currently available.

The University Grants Commission (UGC) also provides complementary support to NICRYS. In the scheme of things, NISSAT, UGC and Madras University share the cost equally.

A National Information Centre on Advanced Ceramics (NICAC) – a sectoral information center as well as hard data centre, was established in the Central Glass and Ceramics Research Institute (CGCRI) at Calcutta with the following main objectives :

- To prepare and maintain a computerised database on Superconducting Ceramics, High-tech Ceramics, Optical Materials, Ceramic composites etc.
- To establish linkages with data centres on Ceramics and related subjects in the rest of the world.
- To generate and provide information services on the subject etc.

4. NATIONAL UNION CATALOGUE OF SCIENTIFIC SERIALS IN INDIA (NUCSSI)

In view of the importance of the NUCSSI as an access tool to support various information programmes, NISSAT has incorporated a plan of action for updation and maintenance of NUCSSI. The NUCSSI data will be converted into a database form so as to make it appropriate for online searching. Production of secondary databases, namely holdings of libraries in specific regions, institutions, subject area etc. would be made available on floppies for use through PC/AT/XT. It is contemplated to load NUCSSI database on INDONET, NICNET etc. for Online search & retrieval. Efforts are also being made to prepare catalogues on specific type of materials such as cover-to-cover translated periodicals and Indexing and abstracting periodicals.

5. RATIONALISATION OF PERIODICALS THROUGH CONSULTATIVE COMMITTEE

The purpose of a consultative committee approach to rationalise the acquisition of periodicals in metropolitan cities is to evolve a mechanism to bring several librarians in these cities together and to discuss, their acquisitions especially renewal of subscriptions of periodicals, and resource sharing possibilities. The exchange of notes would lead to rationalised acquisitions and savings to the institutions or the group of cooperating libraries.

The cost of S&T periodicals increases at a rate of 15-20%, whereas the library budget in most

institutions remain almost static. The net result is a reduction in acquisition of titles. On the other hand, our scientists and technologists are getting into newer areas. Their activities naturally demand acquisition of new set of periodicals.

Six Consultative Committee meetings were organised in Ahmedabad, Bangalore, Pune, Hyderabad, Lucknow and Delhi. The process of rationalisation has led to a national saving amounting to Rs. 22 lakhs by dropping about 100 costly duplicate foreign periodicals.

6. ONLINE AND SDI SERVICES

In order to bring the information support services available to the scientists and technologists in India at par with those available to their counterparts in the developed countries, NISSAT has taken up the establishment of online search facilities on a permanent basis in the country. The five regional access centres (NACIDs) established and indicated below are operational now :

New Delhi	Indian National Scientific Documentation Centre (INSDOC)
Pune	National Chemical Laboratory (NCL)
Bangalore	National Aeronautical Laboratory (NAL)
Madras	Central Leather Research Institute (CLRI)
Calcutta	Indian Association for Cultivation of Science (IACS)

The NACIDs use a normal telephone line with STD Facilities (PSTN) with telex as stand by. As per plan these centres will also be linked with International Data Centres through INDONET and NICNET facilities. Since the establishment of the International Gateway (GPSS) in Bombay, the NACIDs have also access to Dialog Information Services through the GPSS at VSNL, Bombay. The NACIDs are now open to the regional/national community of users. The NACIDs have so far provided fee-based search services to over 650 individual/institutional users from all the parts of the country. In the coming years, these search services are projected to double in number and returns.

During the initial stages, a NACID recovered only the database and computer costs (about one

third of total cost of a search) from users; and NISSAT absorbed costs of communication and hits. Presently, the users pay for the entire cost of a search. The Centres also provide SDI services on such databases for which the demand is not sufficient to justify their installation on Indian Networks.

7. LIBRARY NETWORKING

NISSAT has taken the initiative for the development of metropolitan library networks

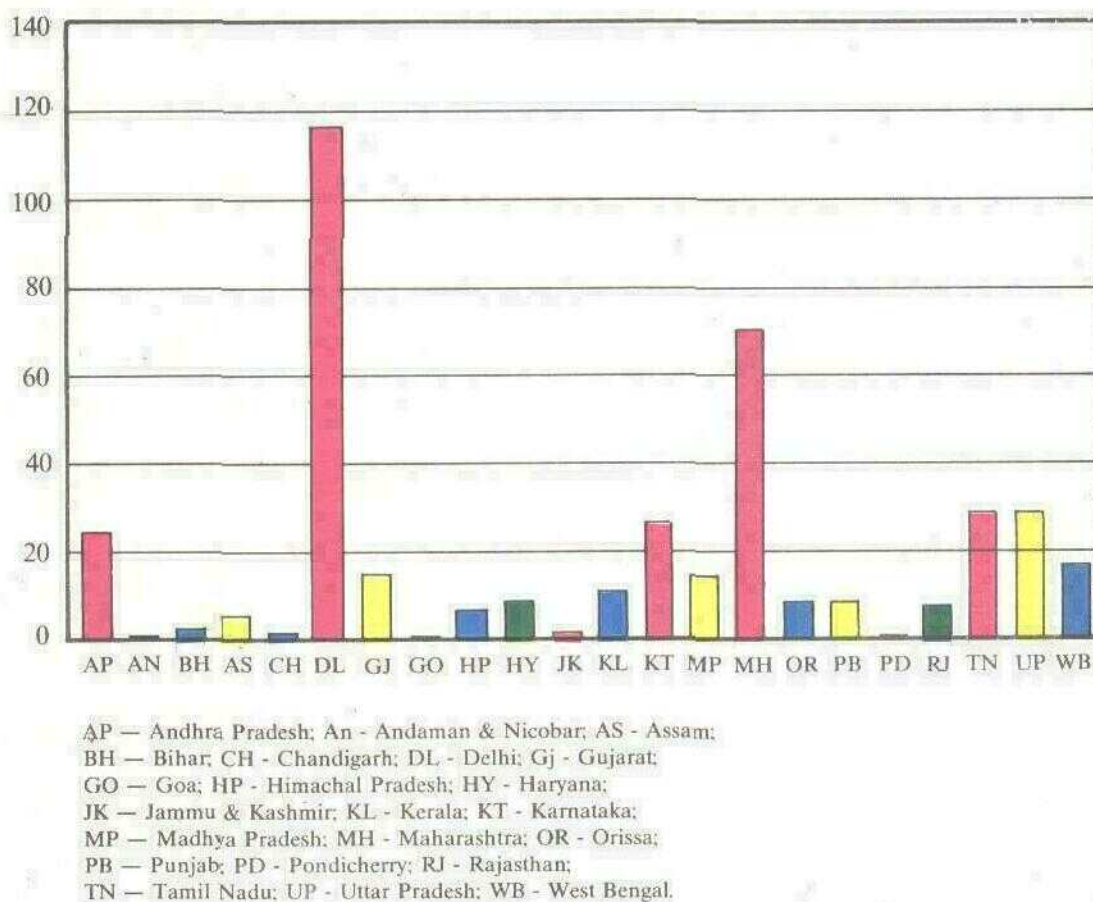
- to ensure better utilisation of S&T information resources through resource sharing
- to moderate functional load of information centre management and to take care of motivational factors to a large extent by better means of communication.

The implementation of Calcutta Library Network (CALIBNET) is being taken up in two phases. During the CALIBNET Phase-I, the Network Services Center at RCC, Jadavpur University and 7 participant library/information centres would be networked. The necessary hardware procurement, software development and site preparations are underway. Meanwhile, NISSAT in collaboration with RCC, Calcutta and Regional Center, INSDOC, Calcutta is taking up manpower development for the CALIBNET.

On similar lines, the establishment of DELNET has been conceived for about 30 libraries in Delhi. On the recommendation of an expert committee, CMC Limited have carried out the DELNET feasibility study. Initially DELNET Phase-0 is taken up to connect about 10 library/information centers with electronic mail and will be operational by January, 1990. NISSAT had organised a familiarisation course for the representatives of (15) participant organizations during August, 1990.

8. COMPUTER BASED BIBLIOGRAPHIC INFORMATION

The objective of modernisation of library and information services is to provide access to the world of knowledge at a reasonable cost and lead time. The application of computers and com-



XII.1 Distribution of Micro-ISIs (Statewise).

munication technologies are means to achieve this objective.

The need for computerisation is felt at all levels and in all activities. The nature of activities which demand use of computers may vary from automation of routine management function in libraries to information retrieval or analysis of global databases. Unfortunately, application of this tool is still not significant in India.

Realising this, NISSAT has accorded high priority to all aspects of computer based bibliographic information processing.

NISSAT has acquired a proven software package ISIS-Microversion 2.32 and IDAMS statistical package from UNESCO. Official distribution rights for these in India was also obtained from UNESCO.

CDS/ISIS software package version 2.32 was distributed to selected scientific libraries, information centres and non-profit institutions in India with adequate training support. The implementation of the aforesaid software in these institutions was monitored regularly through exchange of information and user's group meetings. The state wise distribution of recipient institutions are given in figure XII.1. Currently, there are 450 CDS/ISIS ver

2.32 installations. NISSAT secretariat has also acquired the VAX version of this package, tested and distributed to five institutions.

In order to get the feedback on the application of CDS/ISIS, exchange notes and introduce the Version 1.0/2.3. Two user group meetings were organized – the first in New Delhi during Nov. 11-13, 1987 and the second in Bangalore during January 8-12, 1990.

9. MANPOWER DEVELOPMENT

With a view to improve upon and update the skills of the information professionals on a continuing basis, NISSAT has been organising short term courses regularly.

NISSAT provided support to Documentation, Research and Training Centre (DRTC), Bangalore to conduct three 6-week courses per year on subjects like : Programming with library applications, Library automation, Computerised information retrieval, Computerised vocabulary control design. These courses provide a background knowledge in library systems analysis, computer science, computer programming and in the use of software.

The University of Poona conducted three 2-week NISSAT courses per year on Computer Applications to Library and Information Centres. The objective of the course is to give librarians an understanding of the principles of computer systems, the terminology and concepts embodied in the working of these principles; and give participants practical knowledge of appropriate applications. The course will consist of three modules, namely, Basics of Information Processing, Wordstar and dBase III and specialised packages for libraries.

Besides, various workshops, courses and seminars were conducted of Information & library Network, AACR II, Technical Communications, Computer Applications using CDS/ISIS software at Lucknow (13-15 April, 90), Delhi (1-9 March, 90; 6-7 Aug, 90 & 8-21 Aug, 90), Jodhpur (28-31 Aug, 90), Kurukshetra (2-6 July, 90), and Calcutta (8-14 Oct, 90).

Recognising that the skills for computer application in the library and information science environ-

ment is seriously lacking in the country, NISSAT has taken initiatives to increase the output of students from INSDOC course by augmenting the infrastructural facilities for conduct of courses. The two-fold objectives of the project are :

- to enhance facilities so that the annual output of students could be raised from existing level of 15 to 25.
- to run eight short-term courses of 4 weeks duration during 90-91 on subjects like Library Automation, Information Storage and Retrieval, Management Information systems in information institutions, DBMS etc.

They have conducted six 4-weeks courses (2 April 90; 9 Jul, 90; 20 Aug 90; 19 Nv 90; 7 Jan 91; and 4 Mar 91); one 1-week course (22 Oct 90) and one 2-week course (10 Feb 90).

10. STUDIES/DIRECTORIES

NISSAT in its plan projections, has a programme of promoting and supporting basic and applied research in information science. It took up initiatives for conducting studies and evolving methodologies/tools/information science as a subject and for granting research fellowships and incentives.

During the year, NISSAT completed the following studies :

- a. Library & Information Manpower needs in India
- b. Availability of high cost periodicals in S&T Libraries in Calcutta
- c. Availability of high cost periodicals in S&T Libraries in Mysore
- d. Database of library & information centers

NISSAT has initiated the production of Video-films on NISSAT and NACID Centers and the preparation of a compendium on NISSAT activities.

The publications of NISSAT during this year are

- i) Marketing of Information products & services by libraries & information centers
- ii) Directory of foreign language scientific and technical translators in India
- iii) Implementation notes for users of the Common Communication Format (CCF)

11. INTERNATIONAL ACTIVITIES

The activities of ASTINFO (The Regional Network for the Exchange of Information and Experiences in Asia and the Pacific) of 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 :

- a) The Regional node as well as the national node of APINMAP have been located at Publication and Information Directorate, New Delhi. The Indian contribution is about 30% of the APINMAP database with its 33000 records. India now provides about 1500 records a year on floppies to AIBA. Activities on information dissemination are picking up; and the number of queries served is about 600 through mail and another 200 per year through personal contact. Services include preparation of bibliographies, supply of photocopy of documents, provision of abstracts etc. A token pricing has also been introduced.

For preparation of a database on medicinal and aromatic plants, a HP 3000 system has been provided by ASTINFO. To coordinate the flow of inputs from various research laboratories in the country, a national committee has been constituted.

- b) Considerable progress has been made on the project for the development of an oceanographic information system at National Institute of Oceanography, Goa. A micro computer has been acquired, two years subscription to the ASFA database on CD-ROM including rental of a CD-ROM reader has been taken and NIO staff trained. The project has also been evaluated recently.
- c) At the request of PGI, information specialists of the National Chemical Laboratory undertook a detailed survey of existing databases and software for storage and retrieval of chemical reaction data and prepared a feasibility report for creation of a micro-computer-based chemical reactions database

within the framework of the International Chemical Information Network (CHIN). The recommendations are being actively followed up by PGI Unesco.

- d) It may also be mentioned that the ACU has forged a close working relationship with the National Social Science Documentation Centre (NASSDOC) which is the nodal agency for APINESS in India.
- e) NISSAT is facilitating a nation wide document delivery service for S&T literature under a 3-year programme supported by UNESCO-ASTINFO-National Library of Australia. While the users are catching up with this facility, it also helps us to save foreign currency as the fragment in rupees.
- f) NISSAT is presently preparing standard course materials for all the ASTINFO participants on the following topics :
 - (i) Management Information System (MIS)
 - (ii) CDS/ISIS
 - (iii) CCF : the Common Communication format
 - (iv) Concepts in Marketing of Information services & products

12. NEWS LETTER

NISSAT, in cooperation with the Society for Information Science (SIS) has taken up the publication of NISSAT Newsletter during this financial year. This collaboration is an expression of the sincerity behind NISSAT's intention to mobilize the technical expertise available with professional bodies for implementation of the programme. The Newsletter covers wide ranging issues relating to information and the development of information networks and centres. Individuals and professional bodies are invited to contribute features and news items on 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. All the four issues of this quarterly were published in time in the calendar year 1990. Present circulation list includes over 4000 institutions and individuals.

XIII. ADMINISTRATION AND FINANCE

I. ADMINISTRATION

The administrative functions such as recruitment of personnel, provision of general facilities, redressal of grievances of employees, Parliament work and use of Hindi jobs are being performed by the Department of Scientific and Industrial Research. Other house keeping jobs are being performed by Department of Science & Technology for both the Departments.

2. PROMOTION OF HINDI

DSIR made the following efforts for the use & promotion of Hindi in the official work and implementation of official language policy of the Government :-

- The Meetings of the Official Language Implementation Committee were held regularly in DSIR.
- From 17 to 24 September 1990, the Hindi Week was observed in the Department. To promote the use of Hindi in the official work, essay, noting & drafting and speech competitions were organised in the Department during this period, and officers and officials of the Department were given prizes.
- The Hindi Souvenir was brought out in the Department to promote Hindi consciousness in the Department. Hindi articles/poems written by the officers/officials were published in the Souvenir.
- The Quarterly Progress Report regarding use of Hindi in the Department was sent to the

Department of Official Language regularly and in time.

- Under Hindi Teaching Scheme, non-Hindi knowing employees of the Department were nominated for Prabodh, Praveen and Pragya courses. Employees of the Department were also nominated for training in Hindi Stenography and Hindi Typing.
- Hindi version of Annual Report, Performance Budget, Parliamentary Assurances, routine correspondence, orders, notifications, Quarterly Journal of In-house R&D in industry, standard drafts and material of the Consultative Committee meeting were provided.

The number of employees in the different groups in the Department of Scientific & Industrial Research as on 1.1.91 is given below :

Groups of Post	Number of Employees			
	General	SC	ST	Total
Group A (Gazetted)	32	4	—	36
Group B (Gazetted)	6	2	1	9
Group B (Non-Gazetted)	10	1	—	11
Group C (Non-Gazetted)	15	3	2	20
Group D (Non-Gazetted)	10	1	—	11

3. FINANCE

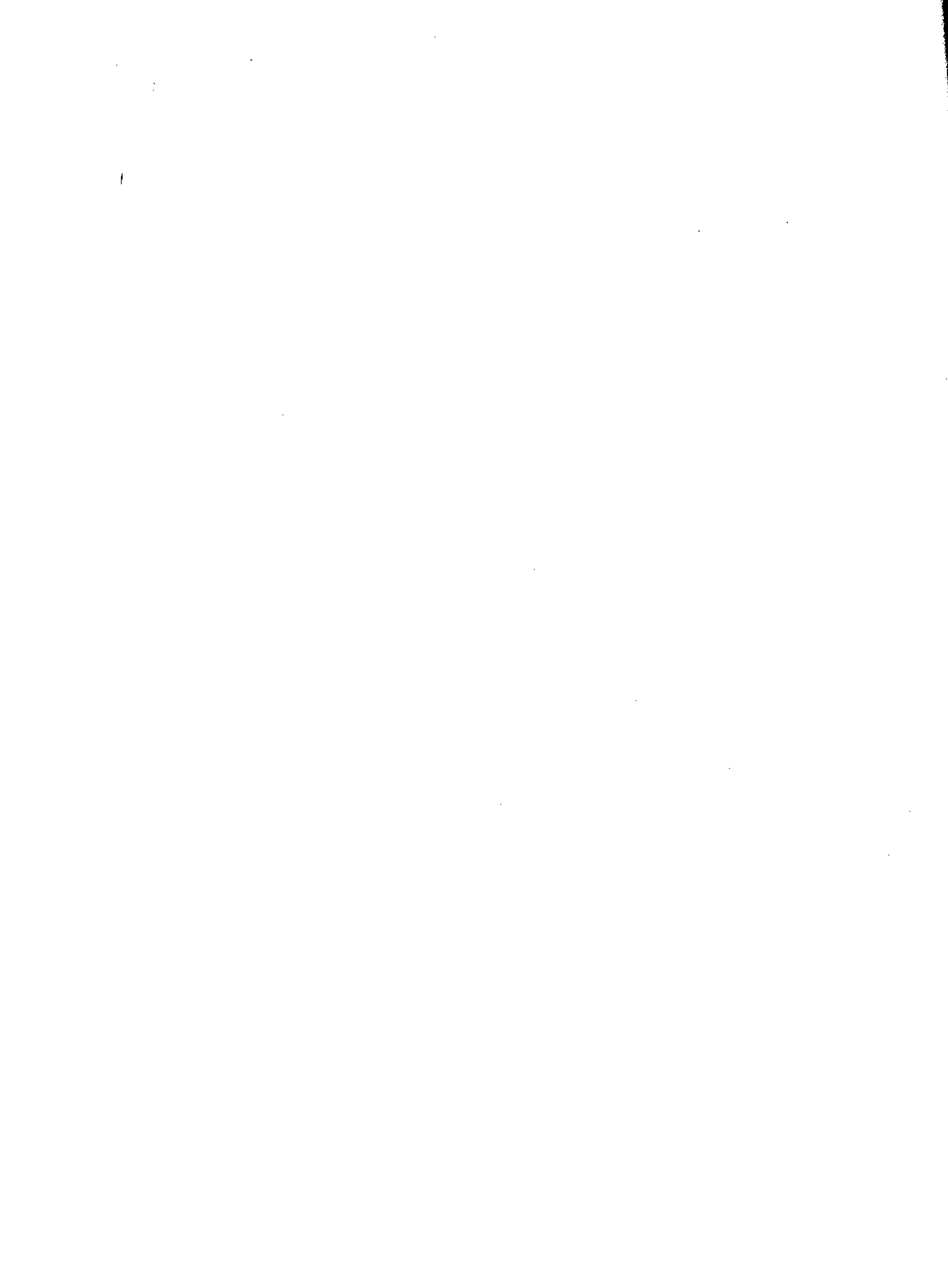
The total Budget Estimates 1990-91 Revised Estimates 1990-91 and Budget Estimates 1991-92 of the various plan and non-plan schemes including provision for CSIR are shown below :

Rs. in Crores

Budget Estimates 1990-91			Revised Estimates 1990-91			Budget Estimates 1991-92		
Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
104.00	144.23	248.23	96.59	142.58	239.17	118.68	153.30	271.98

ANNEXURES

ANNEXURES



LIST OF CSIR INSTITUTIONS

Physical and Earth Sciences Group

National Physical Laboratory, New Delhi	(NPL)
Central Electronics Engineering Research Institute, Pilani	(CEERI)
Central Scientific Instruments Organisation, Chandigarh	(CSIO)
National Geophysical Research Institute, Hyderabad	(NGRI)
National Institute of Oceanography, Dona Paula, Goa	(NIO)

Chemical Sciences Group

National Chemical Laboratory, Pune	(NCL)
Central Electrochemical Research Institute, Karaikudi	(CECRI)
Central Salt & Marine Chemicals Research Institute, Bhavnagar	(CSMCRI)
Indian Institute of Chemical Technology, Hyderabad	(IICT)
Regional Research Laboratory, Jorhat	(RRL-Jorhat)
Indian Institute of Petroleum, Dehradun	(IIP)
Central Leather Research Institute, Madras	(CLRI)
Central Fuel Research Institute, Jealgora	(CFRI)

Biological Sciences Group

Central Food Technological Research Institute, Mysore	(CFTRI)
Central Drug Research Institute, Lucknow	(CDRI)
National Botanical Research Institute, Lucknow	(NBRI)
Indian Institute of Chemical Biology, Calcutta	(IICB)
Central Institute of Medicinal & Aromatic Plants, Lucknow	(CIMAP)
Industrial Toxicology Research Centre, Lucknow	(ITRC)
Centre for Cellular and Molecular Biology, Hyderabad	(CCMB)
Regional Research Laboratory, Jammu	(RRL-Jammu)
Institute of Microbial Technology, Chandigarh	(IMTECH)
CSIR Complex, Palampur, HP	Palampur
CSIR Complex, for Bichemicals	(CFB)

Engineering Sciences Group

Central Building Research Institute, Roorkee	(CBRI)
Central Road Research Institute, New Delhi	(CRR)
Central Glass & Ceramic Research Institute, Calcutta	(CGCRI)
National Metallurgical Laboratory, Jamshedpur	(NML)
Central Mining Research Station, Dhanbad	(CMRS)
Central Mechanical Engineering Research Institute, Durgapur	(CMERI)
National Environmental Engineering Research Institute, Nagpur	(NEERI)
National Aeronautical Laboratory, Bangalore	(NAL)
Structural Engineering Research Centre, Madras	(SERC-M)
Structural Engineering, Research Centre, Ghaziabad	(SERC-G)
Regional Research Laboratory, Bhubaneswar	(RRL-Bhu)
Regional Research Laboratory, Trivandrum	(RRL-Triv)
Regional Research Laboratory, Bhopal	(RRL-Bhopal)

Information Science Group

Publications & Information Directorate, New Delhi	(PID)
Indian National Scientific Documentation Centre, New Delhi	(INSDOC)
National Institute of Science, Technology and Development Studies, New Delhi	(NISTADS)

Industrial Research Associations

Tocklai Experimental Station of TRA, Jorhat	(TESTRA)
Electrical Research & Development Association, Vadodara	(ERDA)

**LIST OF ASSOCIATIONS APPROVED BY THE SCREENING COMMITTEE
DURING 1990**

A. U/s 35 (1) (ii) of Income Tax Act

Sl No.	Name of the Institution	Approval valid upto
1.	Fredrick Institute of Plant Protection and Toxicology, Padappai (TN)	31-3-1991
2.	Amul Research and Development Association, Anand	31-3-1991
3.	Kalyani Gorakshan Trust, Karad	31-3-1992
4.	Paddy Processing Research Centre (TN) Society, Thanjavur	31-3-1992
5.	Centre for Development of Telematics, New Delhi	31-3-1992
6.	Council of Power Utilities, New Delhi	31-3-1992
7.	Environmental Research Laboratory, Lucknow	31-3-1992
8.	Gujarmal Modi Science Foundation, Modinagar	31-3-1991
9.	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	31-3-1992
10.	Mica Research and Development Centre, Patna	31-3-1992
11.	National Foundation of Indian Engineers, New Delhi	31-3-1991
12.	PDG Centre for Research in Electronics & Training, Secunderabad	31-3-1992
13.	National Institute of Construction Management and Research, Bombay	31-3-1992
14.	Non-Ferrous Materials Technology Development Centre (NFTDC), Hyderabad	31-3-1992
15.	Science and Technology Entrepreneurship Park, Roorkee	31-3-1992
16.	Sugarcane Research Institute, Pusa Samastipur (Bihar)	31-3-1992
17.	Shri B.V. Patel Pharmaceutical Education & R&D Centre, Ahmedabad	31-3-1992
18.	Tamil Nadu Veterinary and Animal Sciences University, Madras	31.3.1992
19.	Dr. M.G.R. Medical University, Madras	31-3-1992
20.	Himalayan Institute Hospital Trust, Rishikesh	31-3-1991
21.	Central Council for Research in Ayurveda & Siddha, New Delhi	31-3-1992
22.	Hastimal Sancheti Research Foundation, Pune	31-3-1992
23.	P.J. Institute of Cardio Pulmonary & Allied Medicine, Delhi	31-3-1992
24.	National Institute of Miner's Health, Karnataka	31-3-1992
25.	Cancer Care Trust & Research Foundation, Indore	31-3-1992
26.	National Health and Education Society, Bombay	31-3-1991
27.	The Foundation for Research in Community Health, Bombay	31-3-1992
28.	Centre for Research in Mental Retardation of V.D. Indian Society for Mentally Retarded, Bombay	31-3-1992
29.	Zandu Foundation for Health Care, Bombay	31-3-1992
30.	Kasturba Medical College Trust, Manipal	31-3-1992
31.	Foundation for Applied Research in Cancer, New Delhi	31-3-1992
32.	Society for Health Applied Research and Education India, Secunderabad	31-3-1992

B. U/s 35 (1) (iii) of Income Tax Act

Sl No.	Name of the Institution	Approval valid upto
1.	The Fiscal Research Foundation, New Delhi	31-3-1992
2.	The Indian Institute of World Culture, Bangalore	31-3-1992
3.	Research Foundation for Jainology, Madras	31-3-1992
4.	Indian Law Institute, New Delhi	31-3-1993
5.	Kuppuswami Sastri Research Institute, Madras	31-3-1992

STATEMENT OF RECOGNITION OF IN-HOUSE R&D UNITS

Month	Receipt	Comu. Receipt	Disposal	Comu. Disposal	Comu. Pendency of the end of month
December, 1989	—	—	—	—	32
January, 1990	9	9	14	14	27
February, 1990	15	24	8	22	34
March, 1990	14	38	8	30	40
April, 1990	10	48	18	48	32
May, 1990	12	60	14	62	30
June, 1990	10	70	10	72	30
July, 1990	9	79	12	84	27
August, 1990	8	87	15	99	20
September, 1990	10	97	7	106	23
October, 1990	3	100	14	120	12
November, 1990	9	109	4	124	17
December, 1990	11	120	8	132	20

STATEMENT OF RENEWAL OF RECOGNITION BEYOND 31-3-1990

Month	Receipt	Cumu. Receipt	Renewals granted/ rejected	Cumu. Renewals granted rejected	Cumu. Pendency at the end of month
December, 1989	25	25	—	—	25
January, 1990	270	295	—	—	295
February, 1990	27	322	—	—	322
March, 1990	50	372	130	130	242
April, 1990	5	377	137	267	110
May, 1990	1	378	76	343	35
June, 1990	5	383	28	371	12
July, 1990	3	386	15	386	Nil

**LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE OF
MORE THAN Rs. 100 LAKHS EACH**

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
1.	Alchemie Research Centre Private Limited	168
2.	Asea Brown Boveri Limited	103
3.	Ashok Leyland Limited	811
4.	Asian Paints (India) Limited	179
5.	Assam Electronics Development Corporation Limited	124
6.	Associated Cement Co. Ltd.	327
7.	Astra Research Centre India	217
8.	Atic Industries Limited	128
9.	Atul Products Limited	130
10.	Bajaj Auto Limited	168
11.	Bajaj Tempo Limited	157
12.	Bata India Limited	157
13.	Bharat Earth Movers Limited	1182
14.	Bharat Electronics Limited	2724
15.	Bharat Heavy Electricals Ltd. (Corporate R&D Unit)	2659
16.	Birla Inst. of Scientific & Industrial Research	122
17.	Boots Company (India) Ltd.	175
18.	Brakes India Limited	215
19.	CMC Limited	436
20.	Cadila Laboratories Limited	193
21.	Carborandum Universal Limited	124
22.	Central Electronics Limited	104
23.	Cibatul Limited	104
24.	Cipla Limited	220
25.	Crompton Greaves Limited	188
26.	Dalmia Institute of Scientific and Industrial Research	201
27.	Dunlop India Limited	300
28.	Eicher Goodearth Limited	181
29.	Electronic Research and Development Centre	140
30.	Electronics Corp. of India Ltd.	450
31.	Engineers India Limited	676
32.	English Electric Company of India Limited	245
33.	Escorts Limited Corporate R&D Centre	270
34.	Escorts Limited (Motor Cycle & Scooter Division)	111
35.	E.I.D. Parry (India) Limited	168
36.	Garware Plastics & Polyester Limited	120
37.	Gharda Chemicals Limited	168
38.	Glaxo India Limited	169
39.	Godrej & Boyce Mfg. Company Private Limited	344
40.	Grauer & Weil (India) Ltd.	109
41.	Gujarat Communication & Electronics Limited	296
42.	Gujarat State Fertilizers Company Ltd. (Polymer Unit)	301
		101

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
43.	HCL Limited (Communication and Computer Division)	302
44.	HMT Limited R&D Centre (Metal Cutting & CNC Unit)	158
45.	HMT Limited (Watch Directorate)	164
46.	Herdillia Chemicals Limited	152
47.	Hindustan Aeronautics Limited (Nasik)	182
48.	Hindustan Aeronautics Limited (Hyderabad)	482
49.	Hindustan Antibiotics Limited	149
50.	Hindustan Cables Limited	122
51.	Hindustan Lever Limited	471
52.	Hindustan Motor Limited	102
53.	Hindustan Organics Chemicals Ltd.	135
54.	Hindustan Photo Films Manufacturing Company Ltd.	104
55.	Hiremath Chemicals Limited	445
56.	Hoechst India Limited	590
57.	Hyderabad Aliwyn Limited	170
58.	ICI India Limited (Fibres Division)	157
59.	ICI India Limited (Chemical Division)	167
60.	ICI India Limited (Agro & Pharma Division)	100
61.	IDL Chemicals Limited	140
62.	ITC Limited	246
63.	Ion Exchange (India) Ltd.	101
64.	Indian Aluminium Company Ltd.	229
65.	Indian Drugs and Pharmaceuticals Ltd.	236
66.	Indian Oil Corporation Limited	1184
67.	Indian Organics Chemicals Ltd.	100
68.	Indian Oxygen Limited	120
69.	Indian Telephone Industries Limited	3582
70.	Instrumentation Limited	125
71.	Johnson & Johnson Ltd.	104
72.	Jyoti Limited	100
73.	J.K. Industries Ltd. (Sir Padampat Res. Centre)	282
74.	J.K. Synthetics Limited	282
75.	Kasila Farms Pvt. Ltd.	115
76.	Kegg Farms Limited	160
77.	Kelvinator of India Limited (Automotive Division)	108
78.	Kirloskar Brother Limited	112
79.	Kirloskar Cummins Limited	323
80.	Kirloskar Electric Company Ltd.	323
81.	Kirloskar Oil Engines Limited	126
82.	Larsen & Toubro Limited (Heavy Engg. Div.)	254
83.	Larsen & Toubro Limited (Switchgear Div.)	431
84.	Larsen & Toubro Limited (Mysore)	153
85.	Laxmi Machine Works Limited	106
86.	Lubrizol India Limited	233
87.	Lucas-TVS Limited	121
88.	MRF Limited	476
89.	Maharashtra Hybrid Seeds Company Limited	272

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
90.	Mahindra & Mahindra Limited (Tractor & Auto. Div.)	127
91.	Modi Rubber Limited	152
92.	Motor Industries Co. Limited	357
93.	Mysore Kirloskar Limited	281
94.	Nalco Chemicals India Ltd.	446
95.	National Mineral Development Corporation Limited	181
96.	National Organic Chemical Industries Limited	410
97.	National Rayon Corporation Limited	104
98.	National Thermal Power Corporation Limited	221
99.	Oil India Limited	126
100.	Oil & Natural Gas Commission (O.N.G.C.)	1294
101.	Parvara Sahkari Sakhar Karkhana Limited	304
102.	Peico Electronics & Electricals Limited	712
103.	Pfizer Limited	159
104.	Premier Automobiles Limited	260
105.	Procter & Gamble India Limited	140
106.	Projects & Development India Limited	835
107.	Punjab Tractors Ltd.	120
108.	Rallis India Limited (Agricultural Division & Agrochemicals Division)	161
109.	Ranbaxy Laboratories Limited	312
110.	Reliance Industries Ltd.	872
111.	Sandoz (India) Ltd.	200
112.	Semiconductor Complex Limited	871
113.	Shriram Institute for Industrial Research	224
114.	Siemens India Limited	840
115.	Steel Authority of India (R&D Centre for Iron & Steel)	3830
116.	Steel Authority of India Limited (Bokaro Steel Plant)	105
117.	TVS-Suzuki Limited	104
118.	Tata Hydro-Electric Power Supply Company Limited	479
119.	Tata Iron & Steel Company Ltd.	428
120.	Tata Tea Limited	110
121.	Unichem Laboratories Ltd.	137
122.	Venco Research & Breeding Farm Limited	107
123.	Venkateshwara Research & Breeding Farm Limited	112
124.	Voltas Limited	411
125.	Widia (India) Limited	124
126.	Wipro Information Technology Limited	336
127.	Wockhardt Limited	120

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

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
1.	Advani-Oerlikon Limited	76
2.	Aegis Chemical Industries Ltd.	26
3.	Afco Industrial & Chemicals Ltd.	27
4.	Alembic Chemical Works Company Ltd.	81
5.	Alembic Glass Industries Ltd.	28
6.	Alfa-Laval (India) Limited	82
7.	Ambalal Sarabhai Enterprises Ltd.	49
8.	Andhra Sugars Limited	77
9.	Andrew Yule & Company Limited	51
10.	Applied Electronics Limited	52
11.	Arlabs Limited	34
12.	Asian Cables Ltd.	60
13.	Atlas Cycle Industries Ltd.	40
14.	Audco India Limited	27
15.	Aurelec Trust	41
16.	BASF India Limited	43
17.	BPL Systems & Projets Limited	44
18.	Bakelite Hylam Limited	42
19.	Ballarpur Industries Limited	45
20.	Balmer Lawrie & Company Ltd.	45
21.	Bansilal & Sons	79
22.	Bayer India Limited	71
23.	Best & Crompton Engineering Ltd.	25
24.	BHEL (Pollution Control Res. Instt.)	85
25.	BHEL (Industrial Systems Group)	72
26.	Bharat Heavy Plate & Vessels Ltd.	90
27.	Bharat Pumps & Compressors Limited	30
28.	Bharat Refractories Limited	36
29.	Bharatia Electric Steel Company Limited	29
30.	Bhartia Cutler-Hammer Limited	25
31.	Bhilai Engineering Corporation Limited	31
32.	Bhoruka Steel Limited	28
33.	Bicycle & Sewing Machine Res. & Dev. Centre	71
34.	Bihar Alloy Steels Limited	50
35.	Blue Star Limited	39
36.	Bombay Tyres International Ltd.	41
37.	Britannia Industries Limited	45
38.	Bush Boake Allen (India) Limited	57
39.	Bush India Limited	60
40.	Cable Corporation of India	41
41.	Camphor & Allied Products Limited	56
42.	Ceat Limited	54

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
43.	Chloride Industries Limited	66
44.	Cochin Refineries Limited	53
45.	Colour-Chem Limited	91
46.	Continental Device of India Limited	25
47.	Coromandal Prodorite Limited	39
48.	Cosmo Ferrites Limited	51
49.	Coventry Spring & Engineering Co. Limited	39
50.	Cynamid India Limited	80
51.	Dabur Research Foundation	31
52.	Dai Ichi Karkaria Pvt. Ltd.	33
53.	Daurala Sugar Works (Unit of D.C.M. Limited)	36
54.	Dhampur Sugar Mills Limited	37
55.	Dharamsi Morarji Chemicals Company Limited	52
56.	Digital Electronics Limited	25
57.	Dr. Beck & Company (India) Limited	56
58.	Duphar Interfran Limited	52
59.	D.C.M. Limited (Data Products)	83
60.	Eddy Current Controls (India) Limited	46
61.	Eimco Elicon (India) Limited	32
62.	Electronic Research Pvt. Ltd.	28
63.	Elgi Equipments Limited	26
64.	Elpro International Limited	43
65.	Enfield India Limited	33
66.	Escorts Tractors Limited (R&D Centre)	46
67.	Etermit Everest Ltd.	39
68.	Ethnor Limited	39
69.	Eureka Forbes Limited	31
70.	Excel Industries Limited	68
71.	Fedders Lloyd Corporation Private Limited	38
72.	Fertilizers & Chemicals Travancore Limited	37
73.	Fort Gloster Industries Limited	67
74.	Franco-Indian Pharmaceuticals Pvt. Limited	26
75.	Garware Paints Limited	35
76.	Garware-Wall Ropes Limited	65
77.	Graphite India Limited	55
78.	Greaves Foseco Limited	54
79.	Grindwell Norton Limited	77
80.	Guest Keen Williams Limited	32
81.	Gujarat Alkalies & Chemicals Limited	38
82.	Gujarat Insecticides Limited	56
83.	Gujarat Narmada Valley Fertilizers Co. Ltd.	35
84.	HMT Limited	90
85.	Haffkine Inst for Training Res. and Testing	84
86.	Haryana State Electronics Dev. Corpn Ltd.	54
87.	Hawkins Cookers Limited	61
88.	Hico Products Limited	64
89.	High Energy Batteries (India) Limited	32

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
90.	Hindalco Industries Limited	36
91.	Hinditron Computer Systems Private Limited	31
92.	Hindustan Copper Limited	64
93.	Hindustan Dorr-Oliver Limited	28
94.	Hindustan Teleprinter Limited	53
95.	Hindustan Zinc Limited	95
96.	Hyderabad Batteries Limited	40
97.	Hyderabad Industries Limited	60
98.	IAEC India Limited	30
99.	IBP Company Limited	58
100.	ICI India Limited (Fibres Division)	65
101.	IVP Limited	53
102.	India Carbon Limited	30
103.	India Tele-Comp Limited	30
104.	Indian Dyestuff Industries Limited	53
105.	Indo National Limited	25
106.	Indofil Chemicals Company	29
107.	Indo-American Hybrid Seeds	34
108.	Indrol Lubricants & Specialities Limited	35
109.	Infar (India) Limited	47
110.	International Computers Indian Mfg. Ltd.	48
111.	International Data Management Limited	60
112.	Jamna Auto Industries	25
113.	Jaya Hind Industries Limited	26
114.	Jaya Hind Sciaky Limited	26
115.	Jaysynth Dyechem Private Limited	43
116.	Keonics Magnavision Computers Limited	56
117.	Kinetic Engineering Limited	77
118.	Kirloskar Pneumatic Company Limited	25
119.	Klockner Windsor (India) Limited	35
120.	K.C.P. Limited	79
121.	K.E.C. International Limited	30
122.	K.G. Khosla Compressors Limited	42
123.	Lakhanpal National Limited	27
124.	Lawkim Limited	27
125.	Lupin Laboratories Limited	52
126.	Lyka Labs Private Limited	37
127.	Machine Tools Aids & Reconditioning (I) Ltd.	53
128.	Maize Products	25
129.	Man-Made Textile Research Association	59
130.	Marine & Communications Electronics Ltd.	83
131.	Maruti Udyog Limited	57
132.	Merind Limited	30
133.	Modi Xerox Limited	29
134.	Modipon Limited	61
135.	Mukund Limited	54
136.	Murphy India Limited	29
106		

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
137.	NGEF Limited	30
138.	National Insulated Cable Co. of India Ltd.	31
139.	National Peroxide Limited	38
140.	National Radio & Electronics Company Limited	55
141.	Network Limited	70
142.	New Shorrock Mills	29
143.	Neyveli Lignite Corporation Limited	38
144.	Nirlon Limited	56
145.	OMC Computers Ltd	71
146.	Orient Paper Mills	51
147.	Orissa Cement Limited	27
148.	Orissa Industries Limited	27
149.	Orissa State Electronic Dev. Corpn. Ltd.	69
150.	Otis Elevator Co. (India) Ltd.	65
151.	PSI Data Systems, Limited	33
152.	Parke-Davis (India) Limited	50
153.	Peico Electronics & Electricals Ltd.	61
154.	Pennwalt India Limited	27
155.	Petrofils Co-Operative Limited	49
156.	Phillips Carbon Black Limited	65
157.	Polyolefins Industries Limited	87
158.	Ponds' (India) Limited	30
159.	Premier Cable Company Ltd.	36
160.	Premier Instruments & Controls Limited	48
161.	Prototype Development Training Centre	45
162.	Punjab Anand Batteries Ltd.	80
163.	Punjab Wireless Systems Ltd.	43
164.	Rainbow Ink & Varnish Mfg Co. Pvt. Ltd.	28
165.	Rajasthan Electronics and Instruments Ltd.	79
166.	Rallis India Limited	55
167.	Ralliwolf Limited	54
168.	Rane (Madras) Limited	30
169.	Raymond Woollen Mills Ltd	28
170.	Reckitt & Colman of India Ltd.	66
171.	Reliance Silicones (I) Pvt. Ltd.	46
172.	Roche Products Limited	26
173.	Ruston & Hornsby (India) Ltd.	25
174.	R.G. Ispat Limited	60
175.	SRF Limited	43
176.	Sandvik Asia Limited	63
177.	Searle (India) Limited	60
178.	Shalimar Paints Limited	29
179.	Shree Synthetics Limited	37
180.	Shriram Refrigeration Industries Limited	57
181.	Shrisha Fine Chem. & Pharm. (Karnataka) Ltd.	40
182.	Simbhaoli Sugar Mills Ltd.	34
183.	Simco Engineering Limited	35

Sl. No.	Name of the Unit	R&D Expenditure (Rs. in lakhs)
184.	Siris Limited	27
185.	Sirpur Paper Mills Limited	26
186.	Southern Petrochemical Industries Corpn Ltd.	45
187.	Sponge Iron India Limited	47
188.	Standard Industries Limited	27
189.	Standard Motor Products of India Limited	29
190.	Standard Research Centre	39
191.	Sundaram Fastners Limited	50
192.	Swadeshi Polytex Limited	37
193.	S.A.J. Froude Test Plant Limited	26
194.	TIL Limited	49
195.	Tamil Nadu Dadha Pharmaceuticals Limited	55
196.	Tata Oil Mills Co. Ltd.	48
197.	Tata Refractories Limited	45
198.	Tata-Yodogawa Limited	25
199.	Television & Components (P) Ltd.	27
200.	Thermax Limited	82
201.	Tractor Engineers Limited	28
202.	Transpek Industry Limited	38
203.	United Catalysts India Ltd.	35
204.	United Phosphorous Pvt. Ltd.	40
205.	Universal Biochemicals	30
206.	Uptron India Limited	65
207.	Usha Telehoist Limited	26
208.	U.S. Vitamin (India) Limited	57
209.	VXL India Limited	32
210.	Vidyut Metallica Limited	27
211.	Vijay Wires & Filament (P) Limited	70
212.	Vikrant Tyres Limited	27
213.	West Bengal Electronic Ind. Dev. Corpn Ltd.	27
214.	Weston Electronics Limited	40
215.	Wheels India Limited	37
216.	Worthington Pump India Limited	49
217.	Wyeth Laboratories Limited	41
218.	Yuken India Limited	25
219.	Zandu Pharmaceuticals Works Limited	77

**CERTIFICATES FOR ENHANCED INVESTMENT ALLOWANCE ISSUED
U/S 32-A (2B) OF I.T. ACT, 1961**

Sr. No.	Name of the Company	Lab where know-how developed	Rs. in lakhs	Items of manufacture
1.	Prestress (India) Pvt. Ltd., Bombay	Research Design and Standard Organisa- tion, Lucknow	30.00	Prestress Concrete Sleepers
2.	Unique Pharmaceuticals Laboratories, Pvt. Ltd., Bombay	In-house R&D	22.80	Oxyphenbutazone
3.	Dharamsi Morarji Chemicals Co. Ltd. Bombay	In-house R&D	58.63	Sulphuric Acid by DCDA Process
4.	Dharmasi Morarji Chemicals Co. Ltd. Bombay	In-house R&D	5.79	Sulphuric Acid by DCDA Process
5.	Bemco Sleepers Pvt. Ltd. Aurangabad	Research Design and Standard Organisation, Lucknow	48.91	Prestressed Concrete Slepers
6.	Coffee Lands Ltd. Saklaspur, Karnataka	Central Food Technological Research Institute, Mysore (NRDC, New Delhi)	4.26	Refined Coca Mass
7.	Rallis India Ltd. (Agro-Chemical Div.) Bombay	In-house R&D	21.41	Acephate Technical
8.	Gharda Chemicals Ltd., Bombay	In-house R&D	128.70	Oxyclozanide
9.	BASF India Ltd., Bombay	Central Salt and Marine Chemicals Research Institute, Bhavnagar	74.23	Effluent Treatment Plant
10.	Punjab Communications Ltd. SAS Nagar	Centre for Develop- ment of Telematics, New Delhi	12.02	EPABX/RAX
11.	Bharat Electric Pole Manufactur- ing Co. Aurangabad	National Council for Cement and Building Material (CRI)	12.00	Prestressed Concrete Electric Pole
			418.75	

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

Sr. No.	Name of the Company	Lab where know-how developed	Rs. in lakhs	Items of Manufacture
1.	Webel Electronic Communication System Ltd., Calcutta	In-house R&D	9.12	Automatic message Accounting Equipment (AMA), Electronic Director (ED) Translator
2.	Webel Electronic Communication System Ltd., Calcutta	In-house R&D	0.86	Automatic Message Accounting Equipment (AMA), Electronic Director (ED) Translator
3.	Gharda Chemicals Ltd., Bombay	In-house R&D	29.33	Cypermethric Acid Chloride, Cypermethrin (Technical), Cypermethrin 25% EC.
4.	Kinetic Engineering Ltd., Chichwad-Pune	In-house R&D	98.91	Variable Speed Drive
5.	Debikay Information Technology Ltd., New Delhi	Centre for Development of Telematics	18.86	EPABX of 128 Ports
6.	Punjab Tractors Ltd. SAS Nagar, Distt. Ropar	In-house R&D	76.66	Swaraj Tractors, Grey Iron Casting, Industrial Forklifts
7.	Punjab Tractors Ltd. SAS Nagar, Distt. Rpoar	In-house R&D	151.80	Swaraj Tractor Grey Iron Casting, Industrial Forklifts
8.	Pesticides India (Prop. The Mewar Oil and General Mills) Udaipur	In-house R&D	46.67	Difuran 3G (Granule Formulation of the Carbofuran Tech).
9.	Gharda Chemicals Ltd. Bombay	In-house R&D	35.15	Oxiclozanide
10.	Asea Brown Boveri Ltd., Bombay	Centre for Development of Telematics, New Delhi	45.79	EPBAX
11.	Electronics Corporation of India Ltd. Hyderabad-500762	In-house R&D	244.54	Printed Circuit Board, Semi-Conductor Device, technical ceramic
			757.69	

DETAILS OF CERTIFICATES ISSUED FOR EXEMPTION FROM MRTP ACT

Sr. No.	Name of the Party	Source of Technology	Item of Manufacture
1.	Vam Organic Chemicals Ltd., New Delhi	Indian Instt. of Chemical Technology, Hyderabad	Mono chloro Acetic Acid
2.	Rallis India Ltd., Bombay	In-house R&D Centre	Famotidine
3.	Atul Products Ltd.	In-house R&D Centre	Trimethoxy Benzaldehyde and Trimethoprim
4.	Dalmia Cement (Bharat) Ltd., New Delhi	National Council of Cement & Building Materials (NCBM)	Non-Shrink Grout
5.	Synthetics & Chemicals Ltd., New Delhi	In-house R&D Centre	Styrenated Phenol

DETAILS OF DELICENSING CERTIFICATES ISSUED

Sl. No.	Name of the Party	Source of Technology	Item of Manufacture
1.	Ericsson India Ltd., Sahibabad	AERF, NOIDA	Integrated Security System
2.	Real Time System (P) Ltd., New Delhi	In-house R&D Centre	EPABX
3.	Kinetic Engineering Ltd., Pune	In-house R&D Centre	Colour TV (Digital Technology)
4.	Tele Systems, Pilani	CEERI, Pilani	EPABX
5.	Accord Communications (P) Ltd., Meerut	CEERI, Pilani	EPABX
6.	Reddy Communications Products (P) Ltd., Bangalore	In-house R&D Centre	Electronic Push Button Telephone
7.	Shri Dinesh Mills Ltd., Baroda	In-house R&D Centre	Geo Textiles (Civil Engg. Fabrics)
8.	Nitu Electronics Pvt. Ltd., Muzaffarnagar	CECRI, Karaikudi	Ni-Cd Batteries
9.	Nitin Dhyandeo Dahake, Amravati	Central Power Research Inst. Bangalore	Electronic Choke

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	Consultants Development Centre
CEERI	Central Electronics Engineering Research Institute
CEL	Central Electronics Limited
CFTRI	Central Food Technological Research Institute
CFRI	Central Fuel Research Institute
CGCRI	Central Glass & Ceramic Research Institute
CLRI	Central Leather Research Institute
CMERI	Central Mechanical Engineering Research Institute
CMPDIL	Central Mine Planning & Design Institute Limited
CMRS	Central Mining Research Station
CRI	Central Road Research Institute
CSIO	Central Scientific Instruments Organisation
CSIR	Council of Scientific and Industrial Research
CSMCRI	Central Salt & Marine Chemicals Research Institute
CSTT	Centre for Studies on Technology and Trade
DGTD	Directorate General of Technical Development
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
IICB	Indian Institute of Chemical Biology
IIFT	Indian Institute of Foreign Trade
INSDOC	Indian National Scientific Documentation Centre
IPCL	Indian Petrochemicals Corporation Limited
ISPRO	Indian Space Research Organisation
ITI	Indian Telephone Industries
NAL	National Aeronautics Limited
NCAER	National Council of Applied Economic Research
NCL	National Chemical Laboratory
NEERI	National Environmental Engineering Research Institute
NGRI	National Geophysical Research Institute
NICMAR	National Institute of Construction Management and Research
NIDC	National Industrial Development Corporation
NISSAT	National Information System for Science and Technology
NML	National Metallurgical Laboratory
NPL	National Physical Laboratory
NRDC	National Research Development Corporation
NRFC	National Register of Foreign Collaborations
OCCI	Overseas Construction Council of India

RRL	Regional Research Laboratory
TAAS	Technology Absorption and Adaptation Scheme
TATT	Transfer and Trading in Technology
TPIC	Technology Policy Implementation Committee
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
WIPO	World Intellectual Property Organisation