

III. RESEARCH AND DEVELOPMENT BY INDUSTRY (RDI)

The EPC Memorandum for the plan scheme, Research and Development by Industry, for the Eighth Plan Period (1992-97) was approved in 1992 with an allocation of Rs. 4 crores. The Scheme is continued in the Ninth Five-year plan period. The broad objectives of the scheme are to:

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

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

- A) In-house R&D by corporate/ commercial sector of Industry
- B) R&D by Scientific and Industrial Research Organisations (SIROs)
- C) Fiscal Incentives for Scientific Research

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

III.(A) IN-HOUSE R&D BY CORPORATE/ COMMERCIAL SECTOR OF INDUSTRY

1. RECOGNITION OF IN-HOUSE R&D UNITS

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

A scheme for granting recognition to in-house R&D units in Industry is operated by the Department of Scientific & Industrial Research. The incentives and support measures presently available to recognised in-house R&D units include:

income tax relief on R&D expenditure as per IT Act; weighted tax deduction for sponsored research programs in approved national laboratories, universities and IITs; weighted tax deduction on R&D expenditure in drugs, pharmaceutical, electronic equipment, computers, telecommunication equipment and chemicals; accelerated depreciation allowance on new plant and machinery set up based on indigenous technology, custom duty exemption on goods imported for use in Government funded R&D projects; excise duty waiver for 3 years on goods designed and developed by a wholly Indian owned company and duly patented in any two countries out of India, USA, Japan and any country of the European Union; exemption from price control for bulk drugs produced based on indigenous technology, 5 years tax holiday to commercial R&D companies; financial support for R&D projects; National Awards for outstanding in-house R&D achievements and commercialisation of results of public funded R&D and other indirect benefits.

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

The R&D activities are expected to be separate from routine activities of the firm such as production and quality control. The in-house R&D units should have at least some staff exclusively engaged in R&D headed by a full-time R&D manager who would have direct access to the Chief Executive or to the Board of Directors depending upon the size of the unit.

Number of in-house R&D units recognised by DSIR has increased steadily from about 100 in 1973 to about 275 by 1975, to over 700 by 1980, around 925 by 1985, over 1100 in 1990 over 1200 in 1995 and 1222 as on December 1998. Of these 1222 units, around 135 units are in public sector, 35 in joint sector, and the remaining in private sector. A revised and updated 'Directory of Recognised in-house R&D Units' was brought out during November 1998.

For the purpose of recognition, the R&D units have to apply to DSIR as per a standard proforma. The proforma and other details about the scheme are available in the DSIR

publication "Promotion and support to Indigenous Technology". The applications after scrutiny in the DSIR are circulated for comments to various other Departments/Agencies, such as, concerned administrative Ministries, DCSSE, CSIR, ICAR, ICMR, DBT, DCPC, DOE, DOT, DRDO and NRDC. The units seeking recognition are visited if need be, by expert teams comprising of representatives of DSIR as well as outside agencies like administrative ministries, CSIR, NRDC, ICAR, ICMR, DRDO, DOE, DOT, IITs and local educational and Research Institutions before they are taken up for consideration. The applications along with comments from outside agencies, visit reports, along with the Department's evaluation are considered by an Inter-Departmental Screening Committee constituted by the Secretary DSIR. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR based on its evaluation of R&D infrastructure and R&D activity of the applicant firms.

During the year 1998 the Screening Committee met 12 times and considered 81 applications for recognition; 59 R&D units were granted recognition and 22 applications were rejected.

The pendency at the end of December 1998 was 21. A statement giving monthwise receipt, disposal and pendency of applications for recognition of R&D units is given at Annexure III.A.1.

128 In-house R&D units were visited till the end of December 1998 by expert teams for a first hand assessment of the R&D work, infrastructural facilities and other claims made by the in-house R&D units. Also, nearly 300 discussions/meetings were held with heads of in-house R&D units.

2. RENEWAL OF RECOGNITION

Recognition to R&D units is granted for a period ranging from 1 to 3 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months) of the date of expiry of the recognition. Applications received for renewal of recognition are circulated to CSIR, NRDC and/or the concerned Administrative Department of Government of India for comments. The applications are examined in the Department taking into account the inputs received from other agencies for taking suitable decision on their renewal. During 1998, 528 in-house R&D units were due for renewal of recognition beyond 31 March 1998; of which 463 applications were received. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 447 R&D units. Recognition granted to 16 Companies could not be renewed because their R&D performance was not upto the mark. A statement showing monthwise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given at Annexure III.A.2.

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

The in-house R&D units are distributed throughout the country. There are around 200 units in the Northern Zone (Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir), around 100 units in Western Zone (Rajasthan and Gujarat), around 450 units in the Central Zone (Maharashtra, Madhya Pradesh and Orissa), around 350 units in the Southern Zone (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and around 125 units in the Eastern Zone covering Bihar, West Bengal, Assam and other north eastern states.

4. R&D EXPENDITURE

The expenditure incurred by in-house R&D units in industry has steadily increased. During 1980-81 it was of the order of Rs. 300 crores. In 1985-86, it was of the order of Rs. 500 crores. It is estimated that the present R&D expenditure of the 1222 recognised R&D units is of the order of Rs. 1800 crores. The share of public and joint sector is about 35 % and that of private sectors about 65%. 250 in-house R&D units spend over Rs. 1 crore each on R&D, 340 in-house R&D units spend between Rs. 25 lakhs to Rs. 1 crore each per annum on R&D. The list of these R&D units is given in Annexure III.A.3 and III.A.4 respectively.

5. R&D INFRASTRUCTURE

The in-house R&D Centres have created impressive infrastructural facilities for R&D including sophisticated testing facilities, laboratory equipment and pilot plant facilities. Analytical facilities such as HPLCs, IR spectrophotometers, UV-Vis spectrophotometers, NMR spectrometers, electron microscope, high temperature test and evaluation facilities, CAD-CAM facilities, and EDM's are available with many in-house R&D units.

6. R&D MANPOWER

There has been a steady increase in R&D manpower employed by the in-house R&D units. By 1975-76 about 12,000 R&D personnel were employed by recognised in-house units; by 1981-82 the figure was over 30,000. The present estimated manpower for the 1,222 in-house R&D units is around 50,000 out of which around 17,500 R&D personnel are employed in public sector in-house R&D units and around 32,500 R&D personnel are employed in the private sector in-house R&D units. Of the total 50,000 R&D personnel, around 2700 are Ph.D's, 16,500 Post Graduates, 14,000 graduates and the rest are technicians and support staff.

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

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

- i) Chemical and Allied industries

- 425

ii) Electrical and Electronics industries	- 325
iii) Mechanical Engineering industries	- 240
iv) Process industries (Metallurgical, Refractories, Cement, Ceramics, Paper, Leather and others)	- 180
v) Agro and food processing industries and others	- 50

8. IN-HOUSE R&D UNITS: OUTPUT

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

Chemical and Allied Industries

- Development of process for the manufacture of sparfloxacin, antifungal-terbinafine hydrochloride, anti-histamine-lorotadine, anti-phycotic-resperidone and anti inflammatory-nimesulide.
- Development of HIV Elisa test kit, HIV rapid test kits.
- Development of ayurvedic drug formulation for anti-Parkinson's disease.
- Development of processes for, amlodipine besylate (anti-anginal), azithromycin (anti-bacterial), cefixime cefuroxime axetil and clarithromycin.
- Development of Livoplus/Hepafyt, targeted specifically at alcohol induced hepatotoxicity.
- Development of process for extraction of humic acid from lignite.
- Development of process for the manufacture of amyl meta cresol and 2, 4 dichloro benzyl alcohol.
- Development of process for para hydroxy phenol glycerine, 3,4,5 -trimethoxy benzoic acid methyl ester.
- Development of process for continuous tow dyeing of acrylic fibre.
- Development of epoxy preweld primer for naval ships and epoxy polyurathane for fertilizer plants.
- Development and commercialisation of gear oil for transmission and rear axle.
- Development of process to prepare high grade pectin from lemon and papaya fruits.
- Development of a process for high quality yeast extract 'tryptoni'.
- Development and commercialisation of paraffins dehydrogenation catalyst and multi-metallic reforming catalysts.

Electrical and Electronic Industries

- Development of an advanced land navigation system.
- Design and development of Doppler Very high frequency Omni Range equipment with Remote Monitoring & Maintenance facility (DVOR with RMM).
- Development of Omni directional antenna (collinear array), grided paraboloid antenna, co-axial resonator and microwave band pass filter.
- Development of Hull Mounted Sonar Advanced (HUMSA), very low frequency receiver (CLF Rx), Secure telephone (SECTEL), Artillery Combat Command & Control System (ACCCS) and Automatic Electronic Switch (AES) Mk II.
- Development of LCD based cockpit display system for LCA, integrated fish finder radar cum navigational guidance system, APARNA radar for navy, electronics for gunners main sight for indigenous battle tank Arjun, night driving goggles.
- Development of mathematical models for simulating a fighter aircraft of Indian defence services.
- Development of batteries for Nag missiles, electric locomotive batteries.
- Development of tactical fibre optic link for Indian army, optical fibre end polishing machine.
- Development of torpedo simulator and video surveillance system.
- Development of Micro barograph.
- Development of 130 MW air cooled turbo generator suitable for rail transportation.
- Development of solar powered automatic light emitting diode (LED) for traffic signal system.
- Development of multiaxis blood collection monitor, composcale and plasma expressor, R.F. tube sealer and blood bank management software.
- Development of Compact Fluorescent Lamps; 11W, 3W, 10W, 13W, 4 in 1 electronic ballast for 10W, 14W, electronic converter gears.
- Development of laser based systems for non-contact diameter gauging, positioning, laser line marking, Surgical microscope for ENT application, NAVAL command and control system.
- Development of laser based contact lens guage and alignment measurement system (LGMS-1) for railway track recording.
- Development of vertical gyro and altitude encoder.

- Development of point of sales terminal using smart card, automated teller machine and express money transfer systems.
- Development of multi function console (MFC) for INDRA-II, TV demodulator.
- Development of 8 MB optical line terminal equipment.
- Development of upgraded superfledermaus radar (USFM), naval fire control system, CFM-SCPC flyaway terminals & hub station and VHF Trans receiver.
- Development of textile design CAD software for woven and jacquard system.
- Development of computerised braille transcription system.
- Development of cordic chip based portable ultra sonography meter.

Mechanical Engineering Industries

- Development of Advanced Light Helicopter.
- Development and indigenous manufacture of 6 seater aircraft.
- Development of CNC Double Disc Grinder, Twin Spindle CNC Chucker, Dual Spindle CNC Chucker, Vertical Machining Centre.
- Design and Development of CNC control system for injection moulding machines and passenger car/light commercial vehicle radial tyre building m/c.
- Design and development of a new compact floor washing machine.
- Development of 350 diameter clutch for Leyland Hino engines.
- Development of roof mounted packed AC in all stainless steel structure for railway passenger coach.
- Design and development of 44 ton rear dumper, 70-ton rear dumper and 300 HP wheel loader.
- Development of computerised gear rolling tester.
- Development of axial piston pump technology for truck hydraulics, 3 way tipping system for trucks.
- Development of cooking gasifiers.
- Development and execution of off shore and mobile flare systems and a waste incinerator system, low Nox burners and efficient combustion system.

- Development of Tilting Disk Heart Valve Prosthesis.
- Development of rice husk gasification unit and solid biomass gasifier.
- Design and development of environment control system & equipment, hydraulic system components & undercarriage door actuators, wheels & brakes system and engine fuel control system components.
- Development of automated carding engine.
- Development of CFC free centrifugal chiller.
- Development of clutch testing machine for automobile clutch assembly coaches; 1.5 ton vertical slip on stainless steel body and copper fins on condenser and evaporator for defence mobile shelter applications.

Processing Industries

- Development of doped tungsten powder, swaged tungsten bars and tungsten wire for lamp filament application.
- Development of process for Electro refining of crude gold.
- Development of Fe-Co-V soft magnetic alloy with high saturation flux density and curing temperature for space application.
- Development of process for manufacture of glass fibre reinforced plastic containers for Prithvi Missile programme of DRDO.
- Process for development of recovery of lead & silver from lead sulphate and manganese, lead and silver from anode mud.
- Development of partially stabilized zirconium oxide ceramics.
- Processing of cold rolled non-oriented electrical steel coil through continuous casting route.
- Recovery of Palladium from spent gold electrolyte & process intermediates.
- Development of "Interstitial Free Steel" for automobile sector.
- Development of process for manufacture of chewing gum warp with tatoo; odourless PET laminate for snack food and gold coloured cigarette foil with menthol resistant ink.
- Development of process for manufacture of 44 GSM Newsprint in wider range of quality and grade; low cost good quality economy/standard grade newsprint from waste paper; superior grade writing, printing paper.



III.A.5 ACE-LCX-4 CNC Chucker



III.A.6 Dr. Murlidhar Joshi, Union Minister for HRD and S&T addressing the delegates at the inaugural session.



III.A.7 DSIR National Award Winners



III.A.8 Prof. M.M. Sharma, F.R.S. and FNA addressing the delegates at the valedictory session.



III.A.1 State-of-the-art 'Sterile' Bulk Manufacturing facility



III.A.2 Automated Teller Machine



III.A.3 Pilot Plant for Fluidised Heat Exchanger



III.A.4 Lube Extraction Pilot Plant

Agro and Food Processing Industries

- Development of probiotic feed supplement for poultry & cattle; vermi culture; compost culture; seed coating technique and enzymes as feed supplement.
- Development of CMS lines for hybrid seed production in onions and cabbage.
- Development of high oil content & yield in varieties of Indian mustard.
- Development of digested organic supplement enriched with micro nutrients.
- Development of process for manufacture of cold-soluble instant tea.
- Development of BRASSINOSTEROIDS - New generation plant growth promoters for enhancing crop productivity.
- Development of a new bio-fertilizer strain for sugarcane crop - *A. diazotrophicus* and mixed Bio fertilizer.
- Development of a process for manufacture of Azadirachtin Tech (neem based pesticide).

9. IMPORTS MADE BY R&D UNITS

The recognised in-house R&D units have imported a variety of equipment, raw materials and samples for their R&D activities. These include: Laser based particle size analyzer, digital distortion analyser, dielectric loss analyser, schering bridge, scanning spectrometer, computerised organic carbon analyser with high performance liquid chromatograph, atomic absorption spectrophotometer, X-ray spectrophotometer, virtual digital circuits, ASIC development system, CAD and UNIX work stations, oscilloscope with instant plotter, and automatic dew point meter and analyser and Sterio Zoom Microscope, single beam UV-VIS-NIR Fibre-Optic spectrophotometer for absorbance, transmittance, reflectance, Karl Fischer Titrator, UV-VIS Dual Beam Spectrophotometer, film casting unit, cryptometer colour computer for colour matching, NMR, GLC, IR, HPTLC, high speed centrifugal counter current and droplet counter current chromatographs, Beta Scope, Perkin-Elmer GC-FTIR system, FT-NMR spectrometer, inverted phase contrast fluorescence microscope, 4 channel 100 MHz Oscilloscope, Microsheen Digital Opacity reflectometer Colour image analysis system, CO Sensor and Filter, portable digital pneumatic calibrator, vacuum coating unit with electronic beam gun, rapid prototype machine, EDM, microprocessor double ended inertia dynamometer, dual channel FFT sound analyser, static / dynamic seat strength testing system and impact testing equipment, computer controlled eddy current dynamometer, CAD system logic analyser, fibre optics evaluation kit,

intelligent universal programmer, development system for micro controllers, Laser Power meter, DIN Abrasion testing machine.

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

Bulk drugs manufactured through process know-how developed through in-house R&D are eligible for exemption from the Price Control for a period of five years after their introduction in the market. The Department examines the requests of the in-house R&D Units for issuance of a certificate of indigenous technology development for seeking price control exemption. The examination is through detailed discussions, inputs and views of experts in the field of drug development and discovery, and visits by expert teams. Taking into account the various inputs and also considering the novelty and innovativeness of the process, the certificate of indigenous development of process know-how is issued for seeking price control exemption to deserving cases. No request for price control exemption for drugs based on indigenous technology was received during the year.

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

The Department provides assistance to recognised in-house R&D units in a number of ways, such as cases of industrial R&D units requiring remittance of foreign exchange for deputing experts to attend international symposia and seminars, exhibitions, trade fairs, international R&D collaborations, engagement of foreign experts for R&D and for maintenance/commissioning of imported R&D equipment requiring such expertise, allotment of special controlled materials for R&D, permission to export of specialised products reserved for small scale industries by medium scale industries for test marketing in other countries are examined for making suitable recommendations to concerned agencies.

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 and permission to export of specialised products reserved for small scale industries by medium scale industries for test marketing in other countries were examined and the decisions of the Department conveyed.

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

Names, addresses and also location of in-house R&D units as well as validity of recognition of all the recognised in-house R&D units are computerised and updated. As on 31 December 1998, there were 1222 in-house R&D units recognised by DSIR and whose data are entered in the computer.

13. CONFERENCES, AWARDS, PROJECT SUPPORT AND PUBLICATIONS

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

Department of Scientific and Industrial Research (DSIR) organised the Twelfth National Conference on in-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) on 22-23 December 1998 in New Delhi. Attended by nearly 500 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial Research Organisations (SIROs), Consultancy Organisations, Government Departments, the Conference was inaugurated by Union Minister for HRD and S&T in the FICCI Golden Jubilee Auditorium, New Delhi. The Union Minister for HRD and S&T gave away the 1998 DSIR National Awards for Outstanding in-house R&D achievements to six industrial units and released the DSIR special publications "Compendium on in-house R&D Centres (1998)" and "Outstanding in-house R&D achievements (1998)". The valedictory address was delivered by Prof. M.M. Sharma.

b) National Awards for R&D Efforts in Industry

In order to provide recognition to the efforts of the industry towards innovative research and technological development, the DSIR had instituted National Awards for R&D Efforts in Industry in 1987. These awards are in the form of shields made of sterling silver and are presented along with citations at the inaugural session of the Annual National Conference on in-house R&D in Industry. During 1988, National Awards were presented to 7 firms; in 1989 to 9 firms; in 1990 to 12 firms; in 1991 to 8 firms; in 1992 to 9 firms; in 1993 to 9 firms, in 1994 to 12 firms, in 1995 to 15 firms, in 1996 to 7 firms, in 1997 to 6 firms and in 1998 to 6 firms for outstanding R&D achievements.

Following is the list of the award winners in 1998:

Chemical and Allied Industries

Indian Petrochemicals Corporation Ltd., Vadodara

Drugs and Pharmaceuticals Industries

Ranbaxy Laboratories Ltd., New Delhi

Bio - tech Industries

Shantha Biotechnics Pvt. Ltd., Hyderabad

Mechanical Engineering Industries

Hindustan Aeronautics Ltd. (RWRDC), Bangalore

Processing Industries

Avasarala Tungsten Ltd., Mysore

Successful Commercialisation of Public Funded R&D

Bharat Electronics Ltd., Bangalore

c) Compendium on in-house R&D Centres - 1998

Efforts have been initiated to assess the contributions made by the in-house R&D units. Since 1985, DSIR has brought out publications highlighting the achievements claimed by the in-house R&D Centres in order to generate awareness of these developments. The first publication of "Compendium on in-house R&D Centres" was brought out during 1985 covering 193 in-house R&D Centres, second in 1986 covering 132 Centres, third in 1987 covering 209 Centres, fourth in 1988 in 4 volumes covering 589 Centres, fifth in 1989 covering 188 Centres, sixth in 1990 in two volumes covering 448 Centres, seventh in 1991 in two volumes covering 439 Centres, eighth in 1992 in two volumes covering 384 Centres, ninth in 1993 covering 291 Centres, tenth in 1994 in two volumes covering 491 Centres, the eleventh in 1995 in two volumes covering 376 Centres, the twelfth in 1996 covering 283 Centres and the thirteenth in 1997 in two volumes covering 391 Centres.

The Compendium on in-house R&D Centres - 1998 was compiled by DSIR based on the information and material received from 376 in-house R&D Centres along with their applications for renewal of recognition beyond 31 March 1998. This publication is in two volumes.

d) Outstanding in-house R&D Achievements - 1998

DSIR had brought out a special publication "Outstanding in-house R&D Achievements (1988-1991)" during December 1991 covering the award winning achievements of 36 companies. A second publication "Outstanding in-house R&D Achievements (1992 & 1993)" was brought out during November 1993, covering the award winning achievements of 18 companies. A third publication "Outstanding in-house R&D Achievements (1994 & 1995)" was brought out during November 1995, covering the award winning achievements of 27 companies. A fourth publication "Outstanding in-house R&D Achievements - 1996" was brought out during December 1996, covering award winning achievements of 7 companies. A fifth publication "Outstanding in-house R&D Achievements - 1997" covering the award winning achievements of 6 companies was brought out during October 1997. The sixth publication "Outstanding in-house R&D Achievements - 1998", covering the award winning achievements of 6 companies was released during the inaugural session of the Twelfth National Conference on in-house R&D in Industry on 22 December 1998.

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

As the number of in-house R&D Centres has increased while the activities of DSIR have also diversified significantly

with respect to in-house R&D units, it was felt appropriate to devise a communication system between DSIR and in-house R&D units. Accordingly, the DSIR started bringing out a quarterly Information Update on in-house R&D in Industry on a regular basis since April 1988. The Information Update is intended to provide a communication link between DSIR, in-house R&D units and SIROs and serve to disseminate

useful and important information relevant to R&D in Industry.

During 1998-99, four issues of in-house Update on R&D in Industry were brought out in April, July, October 1998 and January 1999. These have been widely disseminated to industry, SIROs, Government Departments, missions abroad and others and are well received.