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ANNUAL REPORT 1979-80

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH
NEW DELHI

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annual report
1979-80

COUNCIL OF SCIENTIFIC &
INDUSTRIAL RESEARCH
NEW DELHI

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COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

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CSIR, New Delhi

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COUNCIL'S ESTABLISHMENTS

PHYSICAL AND EARTH SCIENCES	
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	
National Chemical Laboratory, Pune	(NCL)
Central Electrochemical Research Institute, Karaikudi	(CECRI)
Central Salt & Marine Chemicals Research Institute, Bhavnagar	(CSMCRI)
Regional Research Laboratory, Hyderabad	RRL, (H)
Regional Research Laboratory, Jorhat	(RRL, Jorhat)
BIOLOGICAL SCIENCES	
Central Food Technological Research Institute, Mysore	(CFTRI)
Central Drug Research Institute, Lucknow	(CDRI)
Central Leather Research Institute, Madras	(CLRI)
National Botanical Research Institute, Lucknow	(NBRI)
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National Environmental Engineering Research, Institute, Nagpur	(NEERI)
National Aeronautical Laboratory, Bangalore	(NAL)
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INDUSTRIAL RESEARCH ASSOCIATIONS	
Tea Research Association, Calcutta	(TRA)
Electrical Research & Development Association, Bombay	(ERDA)

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Budget for 1979-80 (Rs. in million)

Plan	219.231
Non-Plan	320.583
Total	539.814

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INTRODUCTION

THE Annual Report of CSIR for 1979-80 highlights the contribution of the national laboratories and of various units at the headquarters to the different sectors of the national economy such as the public sector, the private sector, government departments, rural development, universities, etc. and in the areas of basic research, international collaboration, dissemination of information, instrumentation and national facilities, etc.

CSIR has been assigned, and over the past, taken on, a broad range of activities of relevance to national development. The primary objective of CSIR is, of course, to establish a base of scientific capability and excellence, over a wide spectrum of science and technology to enable it to carry out research of value for the development of industries as well as other sectors of economy. Having established such a base to a significant extent, CSIR has used it to provide national standards, testing facilities, consultancy services, and the undertaking of sponsored research, production of papers, monographs, technical and feasibility reports, carrying out evaluation studies and offering advice to government and industry, popularization of science and publication of scientific journals, support for the promotion of scientific research in the form of award of fellowships, operation of the Scientists' Pool, support to seminars and conferences, providing technical assistance to other developing countries, apart from generation of know-how which is made available for commercial exploitation and often patented. There may be an impression that the entire activity of CSIR relates only to the last-mentioned aspect which is measured in terms of premia and royalties earned. This, as can be seen from what has been said, is not the case and CSIR renders wide ranging services to support the national infrastructure in achieving self-reliance.

The areas of collaboration of CSIR with various ministries and departments have been increasing from year to year. A number of projects continued to be undertaken by the laboratories in collaboration with different ministries/departments of the government both at the centre and in the states. Design and consultancy capabilities in many specialised areas have been developed by the laboratories.

A number of collaborative programmes have been undertaken by the laboratories with various universities in specific areas. The setting up of national facilities by CSIR has added distinctively to the scientific and technological potential of the country as a whole.

In pursuance of the decisions taken earlier, Research Advisory Councils for the laboratories have been constituted. The Chairmen of these Councils are eminent scientists/technologists from outside the CSIR system. The Councils consider short and long term plans for the development and activities of the laboratories within the overall objectives set by CSIR.

A separate section dealing with the activities of the extension centres, which play a vital role in the dissemination of technologies developed by

laboratories has been added. Appendix IV giving details of all the regional centres, field stations, extension units of national laboratories will, it is believed, prove a valuable compilation for use by different segments of industry throughout the country.

The effort in the report has been to present the multifaceted endeavours of CSIR in contributing to all-round national development.

RESEARCH UTILIZATION AT A GLANCE

DURING the year, 37 new processes went into production (Appendix I) and 59 processes were released to industry for the first time (Appendix II). The total number of processes released to industry till the end of the year was 1234 out of which 537 processes were reported to be in production.

The following processes were released to parties abroad:

1. Spice oleoresin (CFTRI)	(i) Sri Sai Oils and Oleoresins, Sdn. Bhd. Malaysia (ii) Nepal Spice Products (P) Ltd. Nepalganj, Nepal
2. Defluoridation (NEERI)	International Centre for Community Water Supply, The Netherlands
3. Solar-dryer-design drawing (RRL, Jammu)	Republic of Malavi, Lilonge

Pilot plant for the manufacture of diosgenin and progesterone based on CSIR technology developed at RRL, Jammu was set up in Burma under the Indian Technical and Economic Co-operation Programme of the Government of India.

During the year, 653 sponsored research schemes having a contract value of Rs. 965.97 lakh were in operation in the CSIR laboratories. Work on 243 schemes was completed.

The laboratories had 270 consultancy assignments valued at more than Rs. 69.73 lakh; 149 assignments were completed.

Patents

During the year, 104 patent applications were filed, 41 patents were accepted and 121 patents sealed in India (Appendix III). Three patents were filed abroad.

Premia/royalties received through the National Research Development Corporation of India (NRDC) for the last three years were as follows:

(Rs. in lakhs)

	1977-78	1978-79	1979-80
Premia	6.452	4.112	5.758
Royalties	53.328	37.933	46.873
Total	59.780	42.045	52.631

BENEFITS TO INDUSTRY

Public Sector

NPL HAS developed (i) gun sight reflector glass and (ii) collimating sight glass for the Hindustan Aeronautics Ltd., Nasik, for use in the fighter aircraft MIG-21.

Development of high altitude carbon brushes sponsored by the Hindustan Aeronautics Ltd., Kanpur, as a substitute for the imported brushes was also successfully completed by NPL.

X-Ray analysis of residual strain in turbine rotor discs was carried out by NPL for a BHEL thermal power station at Harduagunj, Aligarh. These discs had become unusable due to over-speeding of the shafts. Residual strain measurements were made on the basis of accurate back-reflection X-ray data.

Know-how for an electronic information display system developed at CSIO for installation at railway stations, airports, parks, etc., has been passed on to Punjab Display Devices—a Punjab State Industrial Development Corporation undertaking—for exploitation.

A semi-commercial plant for the production of butenediol was commissioned by Hindustan Organic Chemicals Ltd. (HOC), Rasayani. This plant has a capacity of 150 tonnes per annum and is based on the work done in NCL in a joint development programme. The catalyst development and pilot plant studies were carried out in NCL. The process involves two major steps. The first step for the production of 2-butynediol from acetylene and formaldehyde is working satisfactorily. Work on the second step of hydrogenation to produce butenediol will commence shortly. Subsequently, HOC proposes to install a plant of the capacity of 1500 tonnes per annum giving a product valued at Rs. 7.5 crore annually.

Using RRL Jorhat know-how, approximately 250 tonnes of cold-bonded pellets were prepared and evaluated by the R&D Division of Hindustan Steel Limited, Ranchi, in collaboration with Kalinga Iron Works at Barbil, Orissa, using their 5 tonnes/hour disc pelletizer and a low shaft furnace of 100 tonnes per day (tpd) pig iron production capacity. The results have been found highly satisfactory.

Work on the development of some of the critically important glues and sealants used in aircraft production is being carried at NCL on behalf of the Hindustan Aeronautics Ltd., Nasik Division, since 1976. The development of a substitute for hermetic sealing compound used for metallic joints and couplings has been completed. Substitutes for binder used in glass laminates of Radone nose cones foam plastics used in float valves and binding organic glass to kapron cloth in canopy manufacture have also been developed. The performance of the substitute developed at NCL is found comparable to that of imported glues. Work on some other glues used in aircraft industries is in progress.

The Kerala Agro-Industries Corporation (KAIC) is being assisted by CFTRI in setting up a fruit and vegetable processing unit (3 tonnes/shift) at Punalur under a project consultancy arrangement.

A survey of resources and potential of four districts of Madhya Pradesh was carried out by CFTRI under a consultancy programme for the Madhya Pradesh Development Corporation and a report submitted indicating the potential for starting 160 food processing units from local materials.

Low temperature storage of pears and peaches grown in Himachal Pradesh, Jammu and Kashmir has been worked out by CFTRI to help the trade. Palatable ready-to-serve beverage and squash have been prepared at the instance of the Punjab Agro-Industries Corporation from Malta oranges grown in Punjab.

At the request of Bharat Heavy Electricals Limited, Bhopal, an exploratory survey of the health of workers employed in its mica section, coil and insulation manufacture division and thermal treatment plants has been conducted by ITRC and the report made available to the management.

Dust survey was carried out by CMRS at Khetrinagar of Khetri Copper Complex to assess the magnitude of dust problem and evaluate the variation of dustiness in the plant.

At the instance of Bharat Heavy Electricals, Tiruchirapalli, SERC undertook a detailed checking of the structural design for a typical 210 MW boiler supporting structure.

At the request of the National Buildings Organization, New Delhi, a project report on lightweight aerated cellular concrete was prepared and furnished by SERC.

A consultancy project was sponsored by the Maharashtra State Mining Corporation Ltd., for evaluation of aluminous minerals from Bhandara, Maharashtra, by CGCRI. The materials were found suitable for making high alumina refractories containing up to 72 per cent alumina.

On sponsorship from the Indian Petrochemicals Corporation Ltd. (IPCL), Baroda, a research project on the development of a reformation catalyst was taken up and one phase of the work was completed by RRL (Bhu) satisfactorily. IPCL, Baroda have now provided funds to extend the scope of the earlier work. The present work involves the preparation of carrier grade alumina by the technique of precipitation from homogeneous solution (PFHS).

Large and Medium Scale Industries

A programme of collaboration was entered into by NPL with DCM Chemical Works, New Delhi, for production of solar grade silicon, with the objective that eventually it may be possible to make solar grade silicon in the country on a large scale. The firm has started production of trichlorosilane, and this has been converted into polycrystalline silicon in NPL.

An electronic Comber Counter for comber machine used in textile industries has been developed by CSIO as a substitute for the presently used mechanical system. The system developed incorporates digital circuits to count and register the length of yarn in the comber machine. The device is useful in finding the efficiency of the combing process in textile industries. It has been tried by a textile machine making company at Coimbatore and the performance found satisfactory.

A convenient method has been developed by NCL for the isolation of the anticancer drug, vinblastine, from the leaves of *Vinca rosea*. A simple and efficient synthesis of 4-demethyldaunomycinone, an intermediate for the synthesis of 4-demethoxydaunomycin has been achieved. 4-Demethoxydaunomycin has attracted worldwide attention as a potential anticancer drug. Both the schemes have been supported by the Government of Maharashtra.

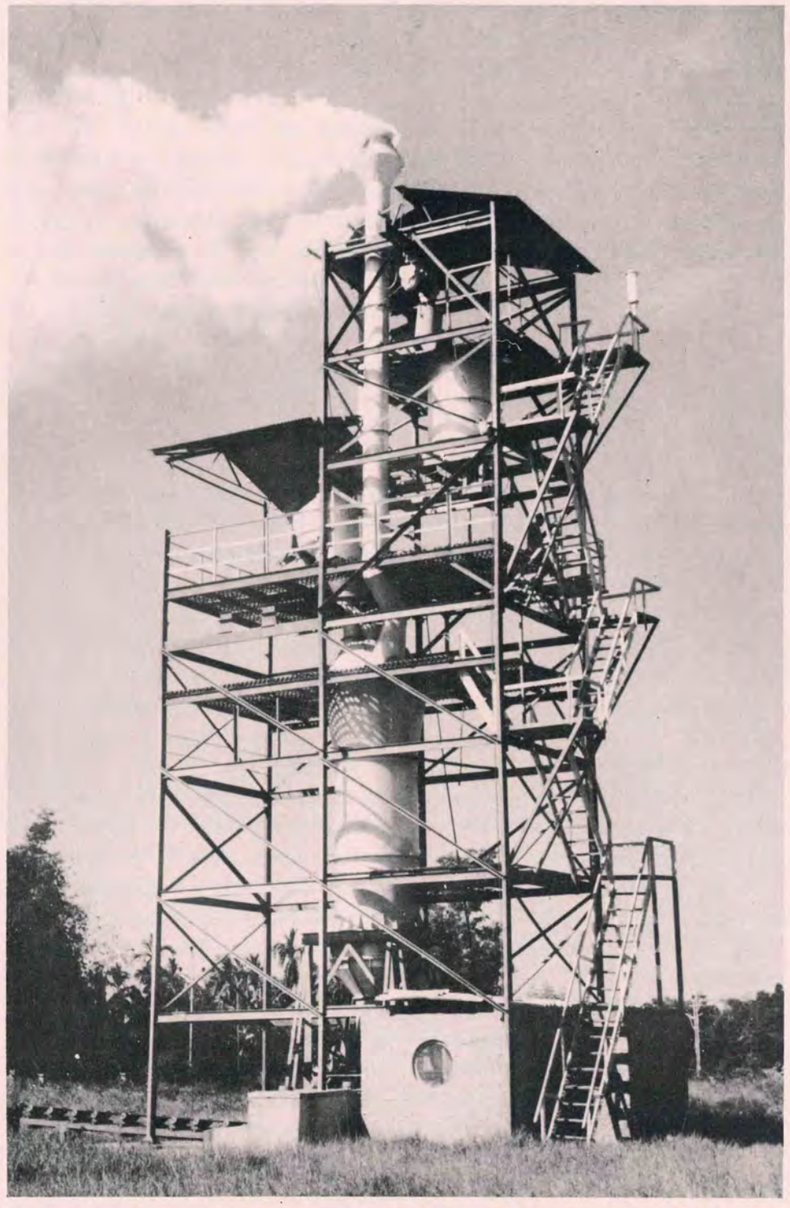
Monocrotophos, an important systemic insecticide of organophosphorus group with high activity against aphids, mites and worms has been developed by RRL (H). Designs have been worked out for NOCIL, Bombay, and Sudarshan Chemical Industries, Pune, who will set up their commercial plants with a capacity of 600 tonnes per annum with a turnover of Rs. 5 crore.

Process design for a broad-spectrum insecticide (diazinon) effective against a large variety of orchard, vegetable and soil pests, flies and bugs has been given by RRL (H) to Sudarshan Chemical Industries, Pune. The capacity of the commercial plant is expected to be 250 tonnes per annum with a turnover of Rs. 2 crore.

DDVP is an organophosphorus pesticide effective against household pests. Process know-how has been developed and demonstrated by NCL to Sudarshan Chemical Industries, Pune. The commercial plant will have a capacity of 90 tonnes per annum with an annual turnover of Rs. 2 crore.

A process has been developed for briquetting of char fines using starch-based binder to produce smokeless fuel for domestic and industrial use. The process has been given to Coal Chemicals Complex, Naspur, A.P., who had earlier taken the RRL (H) process for low temperature carbonization (LTC) of coal and set up a 900 tpd LTC plant.

A techno-economic feasibility report on quinalphos, an important organophosphorus pesticide, has been supplied to Nagarajuna Agro & Steel Corporation, Vijayawada. RRL, Jorhat, in collaboration with RRL (H), developed the process know-how for quinalphos under an integrated programme of CSIR laboratories for the development of technologies for manufacturing pesticides to minimize the import of such technologies. The process know-how on quinalphos was demonstrated to Shriram Pesticides Limited (a division of Shriram Bearing Limited), New Delhi, at RRL (H) from 30 April to 20 May 1979. Scientists from RRL, Jorhat and RRL (H) participated in



The Vertical Shaft Kiln for Cement Manufacture Designed by the Regional Research Laboratory, Jorhat

the demonstration. The process has been released also to Sudarshan Chemical Industries, Pune, and Punjab United Pesticides and Chemicals, Chandigarh. The three firms are expected to produce 900 tpa of the pesticide with a total turnover of about Rs. 18 crore.

Fertilizer (Planning & Development) India Ltd., Sindri, used the 2 tpd and 30 tpd vertical shaft kilns of RRL, Jorhat, for the development of process know-how for the decomposition of pyrite shale and sulphur recovery with active involvement and support of the scientists of the laboratory. Following successful results Pyrite Phosphate and Chemicals Ltd., Bihar have decided to set up a 1 tpd demonstration unit at Ajmer. Fertilizer (P&D) India Ltd., Sindri, will do the necessary engineering feasibility, including commissioning of the plant.

RRL, Jorhat, has commissioned the production of a beneficiation additive in three consecutive batches in the production unit set up by Allied Resins & Chemicals Ltd. (ARCL), Calcutta, licensee of the Jorhat process. With the chemical manufactured by ARCL, R&D Centre for Iron and Steel Authority of India Ltd., is going ahead with sustained trials on the beneficiation of iron ore at the Barsua iron ore mine of the Rourkela Steel Plant. With the completion of this major assignment, India becomes the first country in the world to employ a chemical additive for iron ore beneficiation.

Fact Engineering & Design Organization (FEDO), Cochin, a division of the Fertilizer & Chemicals, Travancore Ltd., Udyogamandal, Cochin has been appointed the prime consultant for the mini cement technology developed by RRL, Jorhat. FEDO has entered into a collaborative agreement with RRL, Jorhat and NRDC of India for offering mini cement plants of 30, 60 and 100 tpd capacity on turn-key basis to prospective clients.

NCL has developed a novel, controlled-release, selective, pre-emergent and cheap herbicide formulation for the control of parthenium and other weeds. The product prepared in the laboratory has been tested by a number of agricultural research institutes and industries and has been found effective in controlling parthenium and other weeds in grazing, irrigated and agricultural fields where crops such as sugarcane, maize, wheat, jowar and rice are cultivated.

A process know-how for a bromine plant was released to Dharangadhra Chemical Works Ltd., Dharangadhra, by CSMCRI.

A 6 tonne per shift plant for the manufacture of energy food has been set up and commissioned by CFTRI, at Mysore, under a consultancy agreement with the Karnataka Agro-Corn Products, Bangalore. Work on the setting up of similar units at Belgaum, Bellary, Raichur and Chitradurga is in various stages of implementation. Twelve tonnes of energy food produced in two shifts per day in each unit can cover 1,20,000 beneficiaries under the supplementary feeding programme of the state government.

Know-how for the production of l-ephedrine, a drug widely used for the treatment of bronchial asthma, was released by CDRI to the Indian Yeast Company, Calcutta and demonstration of the process for its intermediate, levoacetyl-phenylcarbinol, was given.

The process for lidocaine, a local anaesthetic, developed earlier, was demonstrated to Jagson Pal and Company, New Delhi.

A process for the anti-leprosy drug, dapsone, was released to Inga Laboratories, Bombay for commercialization.

A process for the new anti-leprosy drug, lamprene, presently imported, was demonstrated to the sponsor, IDL Chemicals Ltd., Hyderabad. Scaling up of the process is now being carried out by CDRI jointly with the firm.

A large scale joint sector project (Gujarat Leather Industries Ltd) in leather industry has been set up in Ankleshwar, Gujarat. The total investment is around Rs. 1.75 crore. The project report was prepared and also implemented by CLRI. The plant is now ready to go into production. The plant is expected to process 3 million sq. ft. of leather per annum and the value of the product is around Rs. 3 crore.

M/s Kathiawar Industries, Chorwad, Saurashtra, a sick firm, approached CLRI for technological assistance. An on the spot study was made and a new process started in this unit. The volume of production is worth around Rs. 3 lakh; now quality leathers are being produced and these are suitable not only for local market but also for export market. The benefit to the unit is calculated around Rs. 3 lakh per annum. In addition, plans for a new layout as well as the required inputs and machinery for a modern chrome tannery were made available.

Three big units have been established in Jammu for the utilization of pine resin. Consultancies have been provided for the hydrogenation and disproportionation of rosin and production of products like hardened resin, estergum, maleic resin, alkyds, etc. Consultancy was also provided by RRL, Jammu, for the resin distillation plant.

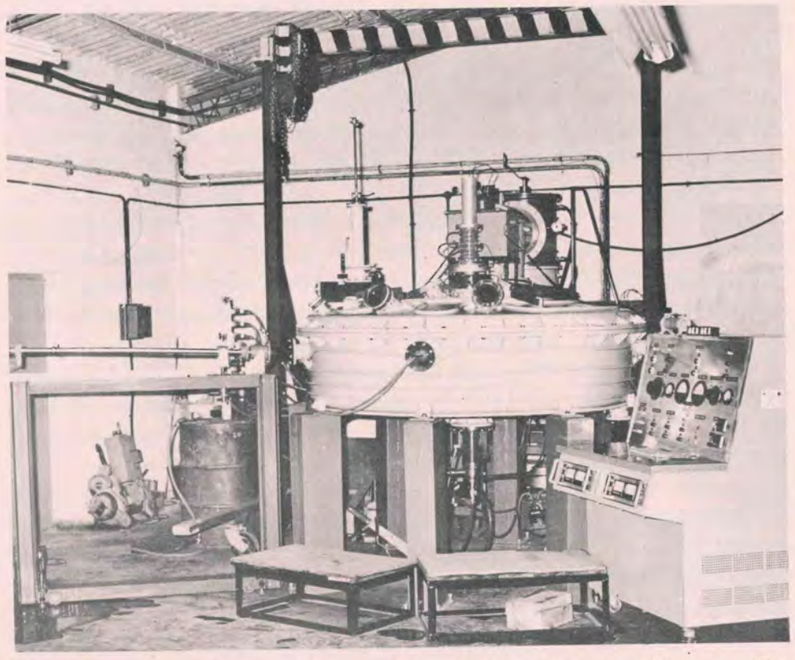
NML has developed a technology for heat-resistant alloy cast iron designated NML-Pyrology-1000 for high temperature applications of up to 1000°C. This is under commercialization at the Tata Iron & Steel Company, Jamshedpur. Nearly 400-500 carrier blade castings have been successfully produced and further castings are under manufacture.

Industrial plant scale trials of NML know-how on smelting of vanadium bearing iron ores, located in the vicinity of Bhadravati in Karnataka, were successfully completed in collaboration with Visvesvaraya Iron and Steel Ltd., at their works in Bhadravati. About 1050 tonnes of the ore were smelted during September 1979; the vanadium-rich slag thus obtained could be further processed to produce ferro-vanadium for their captive use. The results have fully established the parameters for attaining standardization and viability of

the process. The firm has initiated action to set up a plant at an estimated cost of Rs. 45 lakh for the manufacture of 100 tonnes of ferro-vanadium per annum based on NML technology.

NAL has designed, developed and commissioned a 2 m diam. stainless steel vacuum atomization chamber with complete accessories. The unit is capable of producing 10 kg of titanium alloy powder per day. The unit is being used for the production of spherical powders of reactive metals such as titanium, using the electron beam melting technique. This is a joint activity of the laboratory with the Defence Metallurgical Research Laboratory, Hyderabad, for developing the technology for the production of titanium alloy powders and their compaction and subsequent processing for use in gas turbines.

CGCRI has developed a process for the production of high-alumina ceramics (92% Al_2O_3) and the process is ready for commercial utilization. The process when commercially utilized will enable production of alumina ceramics for various applications like grinding media, ball mill lining, kiln furniture, ignition boats, laboratory wares, rods and tubes, cylindrical pins (insulating), thermostat switches, crucibles, flow controllers, wire drawing guides, thread



The 2 m Diameter Steel Vacuum Atomization Chamber for the Production of Titanium Alloy Powder Designed by the National Aeronautical Laboratory, Bangalore

guides, inert gas welding nozzles, blasting nozzles, chemical slurry nozzles, agricultural spraying nozzles, and friction rings.

The institute has also developed, on laboratory scale, transparent heat absorbing glass from the system alkali oxide-alkaline earth oxide-alumina-silico-boric oxide-phosphorous pentoxide. Compositions of the suitable glass fall within a narrow range. Controlled melting conditions are employed in electrical, gas-fired or oil-fired furnaces. Glasses are shaped by casting, pressing or slumping. Shaped glasses are free from devitrification and other surface defects. Heat absorbing glasses find wide applications in projectors to protect the films from heat effects caused by intense light sources and in shadowless lights used in surgical operation theatres.

Mechanical load brakes were designed by CMERI for 200 tonne main hoist and 50 tonne auxiliary hoist of an overhead travelling crane manufactured by Hindustan Motors. The brake for the main hoist is inside a single reduction helical gear box for a maximum hook speed of 1.4 m/min. using a 89 hp motor. The brake for the auxiliary hoist is inside a double reduction helical gear box for a maximum hook speed of 5 m/min. using a 69 hp motor. The mechanism is an additional safety device, since the load will drop down even if the external brake fails at any stage.

The know-how for the manufacture of membrane and chloroscope has been released by NEERI to Indian Chemical Specialities, Nagpur. Indigenous manufacture of filters will save valuable foreign exchange and these will be available at low cost in India. The filters are primarily used for bacteriological examination of water. The chloroscope is used for the measurement of residual chlorine in disinfected water.

Significant among the sponsored research projects completed by NEERI are the following: (i) assessment of stack emissions from the Bhilai Steel Plant on behalf of the Steel Authority of India, Bhilai; utilization of pulp and paper mill waste water for agriculture on behalf of Orient Paper and Industries Ltd., Amla; (ii) treatment and disposal of effluents from the fertilizer factory of FACT, Cochin; (iii) characterization and treatment of coffee pulping wastewater for the Central Coffee Research Institute, Chikmagalur; and (iv) destruction of non-issuable cancelled currency notes by pyrolysis for the Reserve Bank of India, Nagpur.

Notable among the many consultancy assignments completed by the Institute are (i) treatment and disposal of wastewaters for Bush Boake Allen (India) Ltd., Madras; (ii) treatment and disposal of industrial and domestic effluents for Bharat Electronics Ltd., Bangalore; (iii) performance of 1.50 m surface aerator for Richardson Cruddas Ltd., Madras; (iv) assessment of stack emissions from the ferromanganese alloy plant at Tumsar for Universal Ferro and Allied Chemicals Ltd., Tumsar; and (v) feasibility report on the treatment of mine water from Rajaura-Dariba mines for Hindustan Zinc Ltd., Udaipur.

Small Scale Industries

CEERI Extension Centre, Madras has developed an electronic tala (rhythm) generator (new gadget for musicians). It helps music students in getting self-trained in four talas with adjustable speeds. It gives visual LED display in four colours. The unit is compact with a minimum number of controls and the required tala can be selected with the beginning of the tala cycle. It can also be used to provide basic *shruti* (scale).

Processes developed by CCMB for the manufacture of crystalline papain (recommended scale of production, 500 g/year) and papain concentrate (recommended scale of production, 1200 kg/year) have been released to two small scale industries on non-exclusive basis. The turnover is expected to be about Rs. 19 lakh per year. Crystalline papain and papain concentrate were not being manufactured in India earlier. The chief uses of these two products are in the pharmaceutical industry, either in digestive formulation or in the preparation of protein hydrolysates from meat, liver and casein; in meat tenderizers; in the preparation of toothpastes and cosmetics; and in the leather and textile industries.

CIMAP helped a large number of parties by supplying the required agrotechnologies pertaining to medicinal and aromatic plants. As a result of such activities, the country saved about Rs. 8.63 lakh of foreign exchange.

Ergot production was started by CIMAP on farmers' land in Kashmir valley in collaboration with Indo-German Alkaloids, Bombay. The inputs were provided by the firm, while technical guidance and inoculum were provided by CIMAP. It is estimated that about 7 tonnes of ergot valued at Rs. 5.8 lakh would have been produced. Ergot was cultivated by farmers on a land where the farmers would have got a very poor yield of any other essential agricultural crop.

In Devenahalli area of Bangalore district, 12 private farmers took up the cultivation of citronella, geranium and patchouli at CIMAP's persuasion. Thirtyfour kilogrammes of oil was distilled by CIMAP for the farmers.

A unit for the manufacture of 14 tonnes of pectin, 24 tonnes of calcium citrate and 1.8 tonnes of oil (value Rs. 1.6 million) every year, from lime fruit using the integrated process of CFTRI, has been set up at Tirupati by Nandita Citrus Products (P) Ltd.

A simple process has been developed by CFTRI for the production of tamarind powder (a food acidulant) and released to four entrepreneurs through NRDC during the year. Tamarind powder packed in polyethylene pouches is a convenient product which can help in overcoming kitchen drudgery, particularly in metropolitan cities. The machinery and equipment needed for this product are available in the country.

RRL, Trivandrum has given consultancy to five parties for canning and bottling of green pepper.



New Pedal Pump Designed by the Central Mechanical Engineering Research Institute, Durgapur, for the Small Scale Industry

BENEFITS TO INDUSTRY

CLRI has developed a lacquer formulation known as "Lacquer CA" used for top coat finishing of leather. With the government policy aimed at export of finished leathers, the demand for lacquers has increased. The demand for the product envisaged by the laboratory is around 2000 tonnes/annum. A plant having a capacity to produce 150 kg/shift (single shift operation only) of Lacquer CA will be an economical unit.

Pine needles, a waste product in the forests, can now be converted into pine wool by the process developed by RRL, Jammu. Three parties in Himachal Pradesh are producing pine wool with the consultancy provided by the laboratory.

The Nilagiris Cooperative Marketing Society is setting up a potato chips manufacturing unit (500 kg product/shift) and CFTRI has been retained as the technical consultant.

CMERI has developed a new pedal pump whose average discharge is 6000 litres/hr at a head of six feet. This medium head, high discharge pedal pump, is likely to find wide application in lift irrigation, as the unit cost of the pump and its maintenance will be well within the reach of an average Indian farmer. The pedal pump designed and developed at the laboratory can be operated by a person standing on the foot pedal. As the person changes his body posture, his body weight is transferred causing movement of a diaphragm whereby suction is created in one chamber for lifting water, and at the same time, discharge of water from another chamber takes place. Depending on the operator's capacity, pump head can be increased to 10 feet. The overall dimensions of the pump are length, 875 mm; width, 490 mm; and height, 575 mm. The unit weighs about 35 kg. The design of the pump is available for commercial exploitation. It is estimated that a small industry with a capital investment of Rs. 2 lakh can produce 200 units/month. Each unit will cost about Rs. 400.

The indigenous low-cost technology specially suited for the production of fibreglass in small scale sector was further improved. The production rate was increased from 1.8 to 2.2 kg/hr. Two full scale commercial modules having production capacity of 4.4 kg/hr were set up at CGCRI. A new roving machine fabricated in collaboration with a local firm could make more than 10 kg of roving per hour.

The process for the production of sodium silicate using rice husk ash was finalized and passed on by CGCRI to NRDC for release to interested parties. Ten kilogrammes of sodium silicate could be produced per batch of 4 kg rice husk ash in 4 hr, in batch scale production. The major advantages of the process are that it is simple, involves low fuel consumption and low capital investment and is easily adaptable by the tiny sector of industry even in the rural areas.

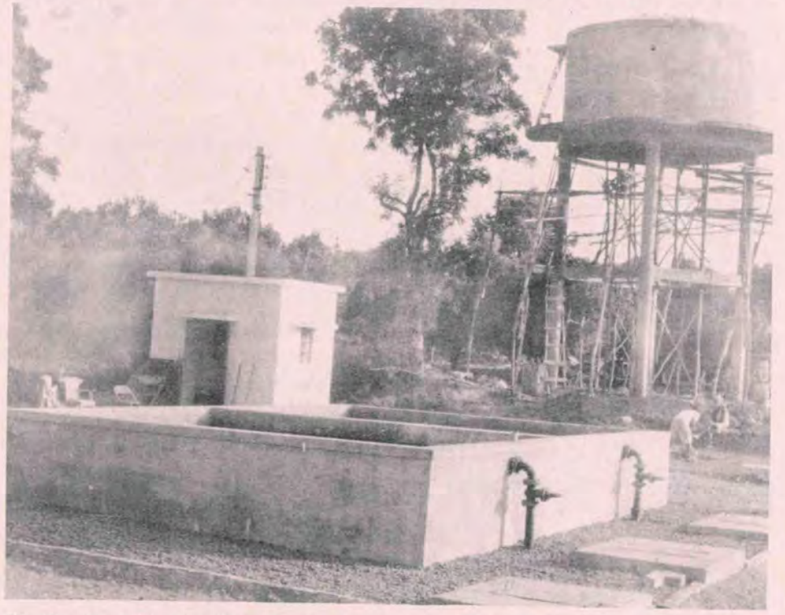
A process for the production of isatoic anhydride from phthalimide has been developed by RRL (Bhu) and released through NRDC to Synchroma Chemicals Ltd., Dandeli, Karnataka, for commercial exploitation.

RURAL DEVELOPMENT

TECHNOLOGY for the cultivation of mushroom which fetches high prices from hotels and restaurants has been demonstrated by CFTRI to 160 people—farmers, housewives and students—in 4 batches. The CFTRI know-how enables cultivation of edible mushroom (*Pleurotus sajar caju*) even in thatched huts. The preparation of each bed costs about Rs. 5 and 2.5-3 kg. of mushroom valued at Rs. 25-30 can be obtained per flush. The mushroom can be kept at room temperature (25-30°C) for 24 hr, in refrigerator for 3 days, and in pickled form for 6-8 months.

Forty practical demonstrations were conducted in important rural tanning centres all over India with the enthusiastic participation of village tanners through the regional extension centres of CLRI located at Bombay, Calcutta, Jullundur, Kanpur and Rajkot. A wide range of leathers were produced based on improved CLRI village tanning techniques. The improvements were with respect to cutting down time of production, increasing the yield, appearance and get-up of leathers.

A slow sand filtration demonstration plant was inaugurated at Burujwada, 29 km from Nagpur, on 20 November 1979. Maharashtra is the third state in India to receive the technical assistance of NEERI for the



The Slow Sand Filtration Plant Installed by the National Environmental Engineering Research Institute, Nagpur at Burujwada. Set up at a cost of Rs 2.70 lakh, the Plant was Inaugurated on 20 November 1979

construction of a slow sand filtration plant. The first demonstration plant was commissioned at Abu Shehar, a group of villages in Sirsa district of Haryana, in November 1978. The second plant was commissioned at Kamayagoundanpatti village, near Madurai (Tamil Nadu), in March 1979.

Under the rural sanitation programme of NEERI, the entire population of Burujwada has been provided with hand-flushed water-seal latrines. Also, the village wells have been chlorinated with a view to improving the general health status of the rural population.

A five-day workshop on 'Gaon ke Karigar aur Science' (Village Artisans and Science) was organized at Bardoli (Gujarat) during 29 October to 2 November 1979 by the Management Development Unit, CSIR Hq., in collaboration with the Agricultural Tools Research Centre, Bardoli. The purpose of the workshop was to build rapport between artisans and scientists and identify areas where scientists could make further indepth study of definite problems, suggest solutions and draw up projects for finding technologies to solve these problems. Forming part of the workshop was an exhibition of the CSIR processes and products capable of being utilized by the rural sector. Twelve national laboratories, Jantra Vidyalaya, Bardoli, Agricultural Tools Research Centre, Bardoli, and Surat Zila Khadi-Gramodyog Kendra took part in the exhibition. NML gave a demonstration on tempering of steel.

COLLABORATION WITH MINISTRIES/DEPARTMENTS

SPECIAL interference filters (28 Nos) have been developed by NPL and supplied to the Space Applications Centre, Ahmedabad, for their ground-based radiometric work. Special interference filters with steep rise and fall transmission characteristics, having a flat top (technically called 'multicavity' filters), have also been successfully developed for ISRO.

Black stamp cancellation ink has been developed by NPL for the P & T Department with a view to effecting saving in petroleum products. A new formulation utilizing industrially underutilized materials has been used for the production of this ink, with a view to replacing the earlier composition wherein petroleum-based products were utilized.

NIO has played an important role in the development of offshore areas of the Bombay High and Bassein oilfields for the Oil and Natural Gas Commission (ONGC). Several surveys were undertaken for drilling the sea bed on Kori Bank and for jacking up the drilling vessel *Gettysberg* on Direction Bank and adjoining areas. A detailed survey from Bombay High/Bassein to Tarapur and Hajira was carried out at the request of ONGC for gas pipeline to be buried in the sea bed.

At the request of the Tamil Nadu Electricity Board, Madras, some baseline information for the selection of a site for the Ocean Thermal Energy Conversion (OTEC) plant was provided by NIO.

Airborne magnetometric and scintillometric surveys involving 10,000 line-km were carried out in the Cuddapah Basin for the Geological Survey of India. This formed a part of the proposed airborne geophysical survey covering 30,000 line-km in the area. The technical know-how and instrumentation for such surveys were earlier developed indigenously at NGRI.

Geophysical surveys were also conducted by NGRI for the Central Electricity Authority in Pugga Valley, Ladakh, with a view to studying the geothermal resources in this area.

Know-how for prismatic binocular, 15 mm cine projection objective and opthalmoscope has been released to the Government Instruments Workshop, Trivandrum, by CSIO.

Batch supplies of precision hemispherical glass domes for pyrenometers and pyronographs (radiation instruments) were made by CSIO to the India Meteorological Department, Pune, and optical work on tank prisms was undertaken for the Ordnance Factory, Dehradun. Glass alignment targets and other optical components were developed as per specifications of the Indian Space Research Organisation, Bangalore.

On request from the Union Ministry of Health, on-job training in the repair of microscopes was arranged by CSIO for the benefit of technicians deputed by the various state governments under the National Malaria Eradication Programme.

RRL (Jorhat) has introduced *Mentha piperita* at Lungol and Kathike villages of Manipur in collaboration with the Forest Department and the Civil Administration of the Government of Manipur. Demonstration activities in both cultivation and distillation of essential oil bearing plants are carried out for the benefit of the growers. Experiments on lemongrass and *Java citronella* are in progress in the Tirap district of Arunachal Pradesh. In collaboration with the Forest Department of the Government of Tripura, investigations on commercial cultivation of *Dioscorea floribunda* were conducted at Sepahijala, Tripura. The results are encouraging. During the year one of the improved strains of lemongrass was also introduced at Sepahijala.

Consultancy services were rendered by CECRI to the Tuticorin Port Trust on the protection of steel pipelines under wet and dry conditions in the port. The port authorities have concurred with the recommendations and have again engaged CECRI as consultants for implementation of protective schemes for pipelines at the port of New Tuticorin.

Work has been taken up by RRL (H) on generation of data for designing plants for processing of byproducts from low temperature coal carbonization plants, in collaboration with Engineers India Ltd., New Delhi. Studies on extraction of phenols from ammoniacal liquor and tar oil fractions and distillation of low temperature tar and vapour-liquid equilibria of specified phenol-phenol and phenol-hydrocarbon systems have been completed. Further work is in progress.

As a result of NBRI's work on betelvine cultivation and at its recommendation, the Government of Uttar Pradesh has decided to bring 'pan' cultivation under its 'Drought Prone Areas Programme' (DPAP) and extend all benefits and concessions to 'pan' growers.

The state government has also decided to set up, with the help of NBRI, a 'pan' nursery at Mahoba, the biggest 'pan' cultivating centre in the state for the supply of disease-free propagating material to cultivators.

NBRI has been collaborating with the Central Council for Research in Ayurveda and Siddha (CCRAS) and the Central Council for Research in Unani Medicine (CCRUM) in R&D work on indigenous systems of medicine. Pharmacognostic studies have been made on a large number of indigenous herbal drugs, their correct botanical identity established and cultural practices for several of these developed.

Project feasibility reports have been prepared for the Mizoram Government for the production of ginger oleoresin and oil. The Tripura Government which has retained CFTRI as its consultant has also been assisted in setting up a 1000 tonne capacity cold storage, and fruit and vegetable processing unit including juice concentration with aroma recovery facilities and three dehydration units for ginger and turmeric.

An on-the-spot survey of the food resources and infrastructure facilities in Arunachal Pradesh has been conducted by CFTRI at the request of the state government and a project report prepared for establishing fruit and vegetable product industries. The Institute has been retained by the Arunachal Pradesh Government as a consultant for implementing the project on turn-key basis.

The Institute has assisted the Ministry of Agriculture and Irrigation through analysis of 18065 samples of fruit and vegetable products under the Food Products Order of the Government of India. Suitable advice was given to processors for product quality improvement, through the Regional Deputy Directors of the concerned zones.

The Indian Navy approached CGCRI with the problem of unsatisfactory performance of refractories in the boilers of their warships. Assistance was rendered towards evaluation of the refractories under usage, rationalization of the relevant specifications as well as indigenization of the refractories used.

A substitute for imported 'Maritine', a heat insulating material, used extensively by the aluminium industry, was developed by CGCRI at the instance of the Ordnance Factory, Nagpur. The performance test carried out on the product under actual service conditions was quite promising.

National Highways, PWD of the Govt. of Maharashtra, are adopting the techniques for corrosion prevention of RCC/BW and also coating over RCC to prevent corrosion, based on the know-how developed at CGCRI.

Practical demonstration of the precasting of funicular shells and ferrocement water tanks was organized by SERC at the Goa Housing Board, Panaji, Goa for the benefit of the engineers and contractors of Goa.

The Centre assisted the Madras Port Trust in assessing the damage caused by fire to the transit passenger shed and recommended suitable strengthening measures.

At the request of the Directorate of Weaker Sections Housing, Government of Andhra Pradesh, the Centre furnished detailed proposals relating to housing schemes for economically weaker sections at Koheda, Andhra Pradesh. Proposals for low cost housing were also furnished to Hindustan Shipyard Limited, Vishakapatnam.

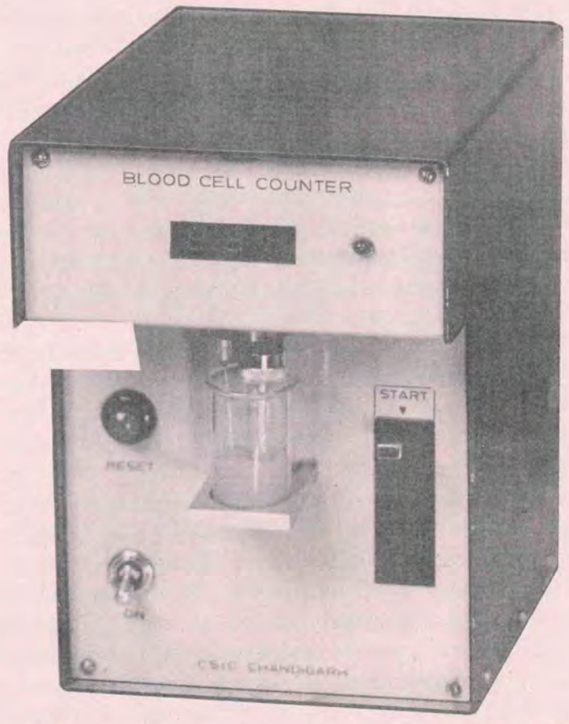
The paddy husk combustor-cum-heat exchanger is a system for drying paddy directly by hot air generated by burning paddy husk. The system appreciably substitutes furnace oil by paddy husk, thereby leading to economy in fuel consumption and import substitution. The development of the plant, therefore, besides bringing the waste husk into use, eventually reducing drying cost, will also help conservation of foreign exchange to a considerable extent. The technique also eliminates the chance of sulphur contamination of rice which normally occurs while drying in oil fired furnace. CMERI and CFRI jointly developed this paddy husk combustor-cum-heat exchanger at the instance of FCI and the Union Ministry of Food & Agriculture.

INSTRUMENTATION

A VERSATILE crystal puller has been designed, developed and fabricated by NPL for growing single crystals from melt, using the Czochralski technique. The crystal puller, along with the complete control panel assembly, was fabricated in three months for display at the India International Trade Fair held in New Delhi during Nov.-Dec. 1979. The equipment has been used for growing nearly perfect single crystals of alkali halides in the first instance.

A non-fade ECG monitor based on electromagnetic deflection CRT has been developed in the fully engineered form by CSIO. The instrument enables one to have a continuous non-fade, bright, flicker free, moving or standstill electrocardiogram waveform on a conventional cathode ray oscilloscope screen. Its first prototype model with an electrostatic CRT is under clinical trials.

A fully engineered prototype of digital speedometer has been completed by CSIO. The instrument is intended to be used for display of the speed of diesel locomotives of Indian Railways. Final trial/testing is proposed to be done by RDSO, Lucknow.



The Automatic Blood Cell Counter Developed by the Central Scientific Instruments Organization, Chandigarh

An ultrasonic instrument, cardiotograph, based on Doppler shift principle for computing foetal heart-rate, has been developed by CSIO and is under clinical trials at the Postgraduate Institute of Medical Education and Research, Chandigarh.

An automatic Blood Cell Counter for counting red cells, white cells and platelets has been designed and developed at CSIO. It is based on the Coulter principle. It has been used successfully in extensive clinical trials at the Postgraduate Institute of Medical Education & Research, Chandigarh.

Aeroscope, an apparatus to trap airborne pollen and spores and essential for the project on 'Aerobiological Survey of Pollen and Fungal Spores in India, Identification of Allergenes', has been designed and fabricated by NBRI with the help of the Lucknow branch of CSIO. About 50 pieces of this equipment were supplied to the participants in the project for undertaking surveys of their respective regions and localities.

NAL has designed, developed and supplied two units of probe traversing systems to the R&D Division of Bharat Heavy Electricals Ltd., Hyderabad. These systems find use in the automatic traversing of the aerodynamic probes to acquire all the relevant data on flow parameters at the upstream and downstream of a turbine stage.

NAL has developed a 48-channel pressure multiplexer system for the Indian Institute of Technology, Kanpur for their wind tunnel experiments. The system can sequentially scan up to 48 ft unknown pressures at different points and record them using a single electrical transducer and readout/printout.

The laboratory has developed and supplied four units of thrust-indicating and monitoring equipment to the National Fertilizer Corporation for measuring thrust in the bearings of a compressor at their Panipat Fertiliser Plant. The total cost of each system is approximately Rs. 23,000, while an imported equipment of similar specifications and performance costs around Rs. 75,000.

NATIONAL FACILITIES

In addition to a host of geophysical and radio communication prediction services rendered by the tropospheric and ionospheric communications group of NPL, an entirely new service to issue regular solar activity predictions every week has been started. This service was initiated at the request of ISRO, which needs the prediction to calculate accurately the look angles for orbiting satellites. A comparative study of the predicted and observed levels of solar activity during 1979-80 has shown that this prediction by NPL is one of the best available in the world. The predictions have immense application in satellite tracking, satellite orbital decay calculations and in radio communications.

A national facility for hydrostatic extrusion and shear spinning, front-line areas in metal forming technology, has been established at NPL.

An ion implantation machine from Kasper U.S.A. received under UNDP programme, was commissioned at CEERI, Pilani. This is the first industrial type of ion implantation machine in the country and services are available to a large cross-section of users in the country.

R.V. Gaveshani, the oceanographic research vessel of NIO, undertook 17 cruises in 1979-80 covering 31,000 line-km in the Arabian sea and Bay of Bengal. In these cruises, 725 stations were worked and valuable data on different oceanographic features of the seas around India obtained.

For the first time oceanographic cruises of the Andaman Sea were undertaken and interesting features noted.

The Indo-Swiss Training Centre of CSIO strives to educate and train young men in instrument technology up to the level of junior technologists. This year, the Centre produced 67 technologists with diploma in instrument technology, 9 with post-diploma in industrial electronics and 16 with post-diploma in die and mould making.

A photoelectron spectrometer has been commissioned recently at NCL. Although of very recent origin, the technique of electron spectroscopy has developed into a powerful research tool, particularly for studying surface phenomena which were so far almost inaccessible to any meaningful experimental study. The first of its kind to be installed in any CSIR laboratory, the instrument (type, ESCA-3 mark II; obtained from Vacuum Generators Ltd., UK) has several capabilities.

A Regional Computer Centre has been established jointly by NCL, the University and the College of Engineering, Poona. The ICL-1904 S computer system became operational in July 1979 and is capable of meeting the current computational needs of the three participating organizations as well as of other institutions in the region.

Spectroscopy (IR, NMR, Mass), absorption spectrometry, gas liquid chromatography, elemental analysis, electron microscopy, etc. of about 5380 samples were carried out at the DST supported Regional Sophisticated

Instruments Centre in CDRI, for universities, industry and research institutions.

Standard reference samples for accurate analysis of ferrous alloys and non-ferrous alloys that were supplied by NML to industries, educational and other research organisations, etc. amounted to about Rs. 1.43 lakh during 1979-80. To this extent, the quantum of import has been restricted.

The 1.2 m trisonic wind tunnel of NAL has continued to play a vital role in meeting the important needs of the aerospace industry. Despite severe power restrictions, 274 blowdowns were conducted during the year, thus bringing the total number of blowdowns conducted in the tunnel to 8015. Major test programmes executed for external organizations and meeting the in-house requirements include determination of effectiveness of leading edge and trailing edge flaps on a typical fighter aircraft configuration, study of transonic wall interference effects on the measure rolling moment on aircraft type models, etc. These tests have resulted in saving of considerable amount of foreign exchange.

ITRC and CDRI provided facilities for toxicological evaluation of new pesticides and pesticide formulations, for both public and private sectors. This is a statutory requirement for introduction of pesticides.

COLLABORATION WITH UNIVERSITIES

A MICROFOCUS X-ray generator has been fabricated by NPL for the Department of Physics & Astrophysics, University of Delhi.

X-ray analysis of about 100 specimens of urinary and gall calculi was carried out by NPL in collaboration with the L.L.R.M. College, Meerut University. These were obtained from patients in the 'stone-belt' area of West U.P.

CSIO is one of the Practice School Stations of the Birla Institute of Technology & Science, Pilani. Sixteen students conducted their research programmes at CSIO during the year. In addition, about 40 students from educational institutions underwent on-job training in areas such as electronic, medical, process control and optical instrumentation.

The Microbiology Department of the Osmania University is collaborating with RRL (H) in the screening of new compounds synthesized and plant extracts for their antibacterial and antifungal activities.

Under the collaborative research programmes between CFTRI and the Punjab Agricultural University, Ludhiana, dehydration procedures for improved varieties of bitter gourd and onion and shelf-life extension technique for edible mushroom have been worked out and information furnished.

The Institute has been collaborating with the University of Agricultural Sciences (UAS), Bangalore, in the development of crack resistant paddy. Three selections, i.e., FT-19, FT-12 (from *Vani* variety) and FT-1 (from *Pushpa* variety) developed and tested by CFTRI over four generations are characterized by crack resistance and reduced milling breakages. Seeds of such selections were produced at Naganahalli farm of the UAS and distributed to research farms for mini-kit trials. Three paddy crack detectors (developed by CFTRI) were supplied to the Tamilnadu Agricultural University and the Annamalai University for their research programmes. This simple gadget enables detection of cracks and insect infestation in paddy grains against transmitted light.

In collaboration with the Osmania Medical College, Hyderabad, sera from clinically diagnosed cases of amoebic infections were tested by CDRI for specific antibodies using standard amoeba antigen prepared from axenically grown *Entamoeba histolytica*. Sera from patients with amoebic liver abscess showed higher percentage of positive reaction than other types of hepatitis cases.

Methods have been developed by CDRI in collaboration with the K.G. Medical College, Lucknow to obtain homogeneous alpha-foetal protein and albumin. The former was found to be a good index of the age of the foetus and its level in amniotic fluid appears to be useful for diagnosis of neural tube defects.

A project on 'Mathematical modelling of water distribution system of Hyderabad city' is being carried out by NEERI in collaboration with the Administrative Staff College of India, Hyderabad.

CDRI is carrying out toxicological study for a new neuromuscular blocking agent, chandonium iodide, developed by the Department of Pharmaceutical Sciences, Punjab University, Chandigarh.

The Centre for the Study of Science, Technology & Development (CSSTD), New Delhi, has been recognised by the Birla Institute of Technology & Science (BITS), Pilani, for off-campus Ph.D. and M.E. (Collaborative) programmes in educational research and development systems.

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INTERNATIONAL COLLABORATION

UNDER the Commonwealth Science Council's Regional Metrology Programme for Asia & the Pacific Region, NPL has contributed in the compilation of the directory of calibration facilities and several other documents. NPL is also participating in the programme of intercomparison of standards of dc voltage, resistance, time & frequency, mass, length and photometry, and is the pilot laboratory for dc voltage standard. A training programme in legal and industrial metrology was organized during 27 June-6 July 1979 for participants of the Commonwealth countries of Asia and the Pacific Region.

At the request of the Department of Weights and Measures, Government of Sri Lanka, NPL has planned a complete set-up for a quality control section of their photometric laboratory. The photometric standard equipment duly calibrated at NPL will be supplied to Sri Lanka in due course.

NIO actively participated in the Monsoon Experiment of 1979 (MONEX-79) from May to August 1979 as part of the First Global Garp Experiment (FGGE) under the Global Atmospheric Research Programme (GARP). Under this programme, R.V. Gaveshani undertook six cruises, four in the Arabian Sea and two in the Bay of Bengal, collecting meteorological and oceanographic data from 534 stations on the origin of monsoon in the Indian Ocean.

In collaboration with the Australian Development Assistance Bureau, an apparatus for generating radial gratings has been designed and is under development at CSIO.

NCL is furnishing the process know-how for the manufacture of terpineol of perfumery grade from turpentine oil and will undertake designing, erecting and commissioning of the pilot plant at Rangoon. NCL will also arrange for training of the Burmese scientists/technicians. This technology is being offered by NCL to the Central Research Organisation, Rangoon, Burma as aid under the Indian Technical Economic Cooperation (ITEC) programme of the Government of India.

At the request of NRDC of India, RRL, Jorhat has taken up the work of setting up a demonstration unit (1 tonne/day) for the production of corrugated roofing sheets using waste paper at the Central Research Organisation (CRO), Rangoon, Burma. The Laboratory has already provided the technical know-how, designed and fabricated the special equipment and despatched them to the destination.

Under the United Nations University (UNU) programme, 15 UNU fellows from 11 developing countries have been trained in different areas of post-harvest technology of food relevant to their needs. Three senior Management Fellows from Brazil, Guatemala and Kenya spent 2-4 weeks studying the general management system in operation at CFTRI and also research areas of their own interest.

Two senior scientists of CFTRI are assisting Indonesia in setting up a post-harvest technology centre at Bogor under a World Bank assignment. This Centre houses a pilot plant as also storage and infestation control laboratories.

A workshop on management of R&D institutions of food science and technology sponsored by the United Nations University (UNU), was held at CFTRI during 17-31 July 1979. At the workshop, scientists shared their experience in management in developing countries through presentation of case studies. Twenty-eight participants and 11 observers, including heads of food R&D Institutions and experts in futurology, budgeting and costing, communication and information, and staff problems, from 16 countries or international agencies attended the workshop, which was followed by visits by the delegates to food processing units in Bangalore and Bombay.

A collaborative project on 'atmospheric corrosion of metals and alloys' with the National Research Institute of Metals (NRIM), Tokyo, Japan has been initiated at NML. The project to run initially for a period of three years, comprises exposure tests with different metals and protective coatings as well as laboratory studies on different aspects of atmospheric corrosion in both India and Japan, under identical climatic conditions. About 300 samples received from Japan have been exposed at NML for atmospheric corrosion.

An assignment on beneficiation of two low grade oolitic iron ores from Syria, with strict adherence to time schedules referred to NML through the Metallurgical and Engineering Consultants (MECON), Ranchi, was completed satisfactorily. The aim of the investigation was to establish an iron and steel complex in Syria based on their raw materials.

About 4 million tonnes of complex lead and zinc ore deposits are reported in the Romegangri-Canekga and Chakula areas of Bhutan as sulphides in partly oxidised and fully oxidised forms. Fully oxidised ore is reported to be of the order of about 3 million tonnes. Bench scale investigations on the oxidised ore of Chakula area, assaying about 25% zinc and 4.5% lead, were conducted by NML. This project was sponsored by the Geological Survey of India.

NEERI has been identified as the national focal point for coordination under the Global Environmental Monitoring Systems (GEMS) programme. Air quality is being monitored in Bombay, Calcutta and Delhi and data are being communicated to WHO.

Recognizing the expertise available at NEERI, the UNEP entrusted the Institute the task of organizing a GEMS Water Quality Monitoring Regional Training Course. The course, sponsored by WHO/UNEP, was organized at NEERI, Nagpur during 22 Oct.-2 Nov. 1979. Twenty participants from neighbouring countries like Indonesia, Nepal, Sri Lanka and Thailand attended the course, besides four from India.

A working programme of cooperation between CSIR (India) and the Scientific and Technical Research Council (TBTAK), Turkey, in science and

technology, for the years 1980-82 was finalized at the first meeting of the Joint Committee held in New Delhi in March 1980. Areas identified for cooperation include solar energy, polymer science, food technology, bio-gas, environmental engineering, earthquake engineering, remote sensing and micro-processor based systems.

Among the proposals submitted for UNDP assistance, six projects have been approved and included in the UNDP country programme for the years 1979-1983. They are in the areas of (a) coal gasification, (b) establishment of primary and transfer pressure standards, (c) vacuum standards, (d) bio-science and engineering, (e) development and testing of integrated exploration methods for precious minerals in Kimberlites, and (f) transfer of know-how through expatriate nationals (TOKTEN).

The Commonwealth Science Council has launched two regional projects for South East Asia/Pacific region. CSIR laboratories are participating in the following projects:

(i) Rural technology delivery systems (RRL, Jorhat).
(ii) Generation of technology packages to agro-based industries (RRL, Jorhat).
(iii) Management of water hyacinth (RRL, Jorhat).
(iv) Integrated utilization of paddy (CFTRI, Mysore).
(v) Co-operative study of inland fisheries (NIO, Goa).
(vi) Cultivation/processing of medicinal herbs and training of practitioners (CIMAP, Lucknow).
(vii) Small packages water treatment plant (NEERI, Nagpur).
(viii) Local manufacture of small prime mover (CMERI, Durgapur).

India is represented in the Steering Committee of the Regional Rural Technology Programme by Dr. G. Thyagarajan, Director, RRL, Jorhat.

The sixth meeting of the Association for Science Cooperation in Asia (ASCA) was held in Seoul, South Korea during 17-19 May 1979 and was attended by Dr. A.R. Verma, Director, NPL and Shri K.N. Johry, CSIR.

A programme on the Transfer of Know-how Through Expatriate Nationals (TOKTEN) has been initiated in association with UNDP. Under this programme, it is proposed to obtain the services of outstanding expatriate specialists of Indian origin who can make effective contribution in key sectors on a voluntary basis. Their travel and per diem costs for stay up to 3 months will be met by the project. Offers of assistance have been received from about 200 Indian specialists abroad.

During the year, 25 CSIR scientists provided consultancy/expert services under various technical assistance programmes of the Govt. of India and U.N. agencies like UNDP and World Bank and under bilateral arrangements to other developing countries.

ACTIVITIES OF EXTENSION CENTRES

A MICRO-PROCESSOR controlled automatic telephone exchange was designed and assembled in the CEERI Extension Centre, Delhi for inhouse applications. It provides 16 telephone lines and allows two simultaneous conversations. Other interesting features are: (i) 'Conferencing' as many lines as possible, (ii) "Call Hang on": in case a called party is already in conversation, the telephone will commence ringing the moment he puts his telephone down, and (iii) "Self-release"—the called party releases himself by pressing the cradle.

CSIO has set up a network of nine Service & Maintenance Centres in the country with a view to extending specialized facility for repair and maintenance service of sophisticated instruments worth crores of rupees in universities, industries, research laboratories, hospitals and government establishments. The S&M Centres are located in different regions of the country—one each at Bombay, Calcutta, Chandigarh, Cochin, Delhi, Hyderabad, Jaipur, Lucknow and Madras. During the year, these Centres repaired 2235 instruments valued at approximately Rs. 194.000 lakh and earned service charges around Rs. 9.03 lakh.

At the request of the Government of Rajasthan, CSIO has set up a new Service & Maintenance Centre in Jaipur. It started functioning with effect from 2 July 1979 at the SMS Medical College Campus, Jaipur. This Centre has repaired 92 instruments valued at about Rs. 5.35 lakh and earned nearly Rs. 35,000 as service charges.

RRL, Jorhat, has established sub-stations/extension centres at Upper Shillong (Meghalaya), Yaongyimsen village (Nagaland), Imphal (Manipur), Senua (Arunachal Pradesh) and Sepahijala (Tripura). In these R&D Centres, the need for the cultivation of some of the medicinal and essential oil bearing crops suited to the regional conditions for optimum growth was emphasized. The most prominent crops are *Java citronella, Eucalyptus citriodora* and Lemongrass in Yaongyimsen village, *Digitalis lanata,* Pyrethrum, Valreina in Upper Shillong and *Mentha piperita* and *Java citronella* is Sepahijala.

The programme of intensive study on seismicity, geodynamic problems and establishing an effective monitoring network was continued. RRL, Jorhat, in collaboration with NGRI, proposed to establish 12 seismic surveillance stations in this region with active support from the state governments of the region. In the first phase of the programme, 4 stations were established. These stations became operational during the last year. In the next phase, it is proposed to establish two more stations at Tezu and Along in Arunachal Pradesh. The establishment of a station at Tuensang, Nagaland is under process. The data now being generated are routinely analysed and tabulated. These are regularly despatched to various scientific and other organizations through mutual agreement.

Technical guidance was provided by CLRI to about 90 tanneries situated in Calcutta, Kanpur, Bombay, Jullundur, Bangalore, Madras and Vijayawada.

ACTIVITIES OF EXTENSION CENTRES

The technological problems solved and processes developed related to improvement of quality of various types of leathers such as soft bag leathers, goat uppers, blonde linings, watch-strap leathers, burnished uppers, cow and calf linings, aniline uppers, cow nappa leathers, sole leathers, sports goods and industrial leathers, mostly for export.

A total of 6275 technical enquiries covering different areas of post-harvest technology of foods were answered by CFTRI. In addition, analyses and testing of food materials, products, and packaging were carried out for 67 parties.

More than 10,000 samples of fruits and vegetables were analysed at the Bombay Experimental Station of CFTRI under the Food Products Order (FPO) of the Govt. of India.

NEERI has nine zonal laboratories which cater to the needs of their respective regions. These are located at Ahmedabad, Bombay, Calcutta, Cochin, Delhi, Hyderabad, Jaipur, Kanpur and Madras. Primary activities include participation in national projects (coordinated by NEERI headquarters) like air quality monitoring, assessment of performance of water treatment plants, technical assistance to state governments in the design and construction of slow sand filtration plants, integrated rural development and industrial effluents treatment and utilization. Liaison with State Pollution Control Boards, universities and engineering colleges is one of the other important activities. The Institute is studying a project on the utilization of effluents from the proposed Mathura Refinery of the Indian Oil Corporation and has assisted the Municipal Corporation of Greater Bombay to establish a cell for carrying out independent air quality monitoring in Bombay.

DISSEMINATION OF INFORMATION

A PROTOTYPE of Proximity Communications System in the area of Museum Electronics has been developed at the Delhi Centre of CEERI. The system enables the visitors to hear the commentary describing the significance of the exhibit with the help of guidophones when they come close to the exhibit. The National Museum of Natural History (Dept. of Science and Technology) has already paid Rs. 1 lakh for six prototypes.

CSIO participated in the India International Trade Fair (December 1979) and exhibited instruments developed along with the exhibits from other CSIR laboratories. Special mention could be made of Scanning Electron Microscope, Electronic Information Display System, Digital Multimeters, Data/Pulse Generator, Blood Cell Counter, Cardiac Pacemaker, Monitor DC Defibrillator, Electromagnetic Flowmeters, Stepper Motors, Optical Lenses and Components.

The National Information Centre for Food Science and Technology has provided specialized services by way of *Food Technology Abstracts* (monthly), *Food Digests* (quarterly), selective dissemination of information, preparation of bibliographies for different organizations, loan of publications and reprographic services. A new service, *Food Patents* (quarterly), covering worldwide abstracted information, was started during the year.

Two popular language publications, *Ahara Vignana* (Kannada) and *Khadya Vigyan* (Hindi) were continued. A bimonthly publication, *CFTRI Newsletter*, was launched to communicate with national policy makers and industry.

The National Information Centre for Drugs and Pharmaceuticals in CDRI and the National Information Centre for Leather and Allied Products (NICLAP) in CLRI set up under the NISSAT scheme of DST continued to bring out special publications, digests and bibliographies for a variety of users.

NML took part in the NRDC-CSIR get-together held on 3 and 4 November 1979 at Ahmedabad, where the state industries and government organizations and undertakings besides entrepreneurs participated. This get-together generated interest in NML processes on PVC coating on steel and aluminium, crucible production, etc.

PID continued to publish the following journals: *Indian Journal of Pure & Applied Physics, Indian Journal of Radio & Space Physics, Indian Journal of Chemistry*, Sections A and B, *Indian Journal of Experimental Biology, Indian Journal of Biochemistry & Biophysics, Indian Journal of Marine Sciences, Journal of Scientific & Industrial Research, Research and Industry, Indian Journal of Technology* and *Indian Journal of Textile Research.*

The other periodicals that were continued are: *CSIR News, Industrial News Digest and Medicinal & Aromatic Plants Abstracts.*

A monograph on 'Diosgenin and Other Steroid Drug Precursors' and 'A Dictionary of Generic and Specific Names of Plants and Animals Useful to Man with Their English and Latin Pronunciation in Devanagari' were also brought out.

DISSEMINATION OF INFORMATION

The Directorate continued to publish the popular science magazines in Hindi *(Vigyan Pragati)* and Urdu *(Science ki Duniya)*.

A continuing education programme in information handling, sponsored by Unesco, was conducted by Insdoc, New Delhi, during 10-22 September 1979. Eighteen persons working in middle-level positions in library and information systems from seven countries—Bangladesh, Burma, India, Iran, Nepal, Pakistan and Sri Lanka—participated in the programme. The objective of the course was to give a broad overview of the current developments in information field, indicating the future trends, with particular reference to the impact of technology. The course contents included topics in six areas, viz. Information flow and sources, Information systems and programmes, Information processing and organization, Information products and services, Information technology, and Management of Information centres/systems. The course faculty was drawn from expertise available at Insdoc, Publications & Information Directorate, New Delhi, Documentation Research and Training Centre, Bangalore, Delhi University's Department of Library Science, Department of Science and Technology and other organizations.

Two monographs entitled 'Science Policy Studies: A Survey of research in advanced countries on developing countries' and 'Manpower planning in scientific research institutes' were published. The Centre continued to publish "Current Literature on Science of Science (CLOSS)".

Bio-data of 30,000 specialists have been incorporated in the specialists Register as on 31.3.80. Considerable number of bio-data were updated during 1979-80. About 400 computerized job matchings were also done from this Register to assist leading organizations.

The Public Relations and Science Reporter unit continued its endeavour to project the image of CSIR through the press and other mass media and looked after the organizational aspects of the science pavilion of the India International Trade Fair (IITF) 1979.

Science Reporter, CSIR's popular science monthly in English, maintained its steady increase in circulation. The administrative control of the Science Reporter Unit was transferred to PID.

BASIC RESEARCH

Physical Sciences

BASIC and applied research was undertaken at NPL on both dc and ac Josephson effect, using various types of junctions, viz. thin film tunnel junctions, solder blop junctions and point contact junctions. A detailed study has been carried out to understand the interaction of microwave radiations with various types of junctions, and for establishment of Josephson volt standard. Investigations are also being made on non-equilibrium superconductivity and mixing of rf radiations in a Josephson junction.

NPL conducted the conduction electron spin resonance (CESR) and spin wave resonance study of A-15 superconducting thin films in the normal and superconducting states. These are the first observations of CESR and spin waves (Platzmann-Wolff type and antiferromagnetic type) in these materials, and they establish that exchange interactions play an important role in forming electron pairs in the conducting band, and in determining the critical temperature (Tc) of these materials below which they exhibit superconducting behaviour. The study of A-15 superconductors is being supported by the Science & Engineering Research Council of the Department of Science & Technology, as these materials hold potential for being utilized as industrially useful superconductors.

Investigations have been carried out by NPL on the kinetics of growth of Cu_2S films used in the fabrication of CdS-Cu_2S solar cells developed at the laboratory. These studies have shown for the first time that both the surface diffusion and the volume diffusion mechanisms are operative, their nature and the occurrence depending considerably upon the *p*H of the plating solution. The findings of this investigation have led to the evolution of a new growth model. The significance of this model, which is based on crystallite size considerations of the CdS film, is that it can predict the optimum conditions for efficient solar cell junction fabrication. The studies on the junction through X-ray photoelectron spectroscopy have revealed the nature of the hetero-junction. Studies have also shown that the Cd/S ratio can be changed on texturizing the CdS films in HCl. This has led to the findings that indeed Cd/S ratio is rather important for making efficient solar cells, and that the reproducibility of the cell fabrication can be traced back to non-optimization of this ratio. It has also been brought out for the first time that adsorption of oxygen is not the mechanism for photo-voltage generation as was hitherto believed to be occurring during the air heat-treatment of the junction. The results have led to a better understanding of the kinetics of copper diffusion across the junction which causes degradation of the solar cells, and in finding a solution to this degradation problem.

NPL conducted/participated in a number of programmes at the time of the total solar eclipse on 16 February 1980.

Instrumentation

Research on design and development of a variety of electron guns, ion guns, X-ray sources and energy analysers is being carried out by CSIO in the field of 'Electron and ion beam instrumentation for materials processing and analysis'. Besides optimizing single pass cylindrical mirror analyser for combined Auger-ESCA spectrometer, R&D work has been undertaken on the development of X, Y, Z rotation and flipping motion type sample holders for operation in the ultrahigh vacuum range of 5×10^{-11} torr. In the case of electron guns, main emphasis is basically on high brightness lanthanum hexaboride (LaB_6) system, to be used in the electron microscope, Auger Electron Spectroscope (AES) and Electron Spectroscope for Chemical Analysis (ESCA)—key instruments in the field of surface analytical instrumentation.

An electro-anaesthesia apparatus has been developed by CSIO in collaboration with the Department of Anaesthesiology, Postgraduate Institute of Medical Education & Research (PGI), Chandigarh for carrying out research on the suitability of electroanaesthesia in place of chemical anaesthetics.

Electroanaesthesia offers some definite advantages over chemical anaesthesia like rapid recovery following anaesthesia, least systemic toxicity, prompt change in anaesthetic level with current adjustments and least pollution of anaesthetics. Clinical trials were carried out in PGI, Chandigarh. Electroanaesthesia could be produced successfully in 230 trials on 81 dogs and 40 pigs. Anaesthesia produced in cases was good (57.4%), tolerable (37.8%) and poor (4.8%). Muscle relaxation was sufficient to undertake experimental surgery in 57.3% cases. Best results were obtained employing the combination of low frequency square waves and high frequency sine bursts in interference pattern.

In collaboration with the Cardiology Department of PGI, Chandigarh, a cardiac Research Stimulator has been designed to carry out stimulation studies in respect of refractory periods of various conduction systems of the heart and the effects of drugs on the same. These studies have been initiated with apparatus developed at CSIO.

Chemical Sciences

Mössbauer spectra of several tin (II) and organotin (IV) compounds were recorded at 77°K and from Mössbauer parameter probable structures for the compounds were inferred at NCL. Some theoretical calculations have been made on back illuminated MIS Schottky barrier solar cells and also in some novel configurations, using amorphous silicon. These offer interesting guidelines for optimization of parameters in solar cell design.

A method was developed by NCL for the production of mosaic virus-free sugarcane (variety 00-740) by tissue culture. In field trials at different locations virus-free cane gave 15-40 per cent higher cane yield, depending on the degree

of reinfection. Planting in large areas reduced reinfection, except in the periphery. Trials on 15 acres are in progress to supply seed material for planting 100-150 acres. Inter-specific hybrids of *Carica papaya*, the cultivated virus susceptible variety, and *Carica cauliflora*, a wild virus-resistant variety which could not be obtained by conventional methods were raised successfully by embryo culture. Over 2000 plants of the F2 generation have now been obtained at the Agricultural College, Pune; 75% of these are virus-resistant. Further breeding work is in progress at the Agricultural College, Pune. Methods for clonal multiplication of turmeric, ginger and sugarcane have been developed.

An innovative single step process for the conversion of nitro compounds to isocyanates has been developed by NCL. A new zeolite catalyst has been developed which holds promise of making possible the synthesis of the much needed higher hydrocarbons (kerosene or diesel) from the more easily available lower alcohols and hydrocarbons. This catalyst has potentialities in a host of other useful organic syntheses.

It has been shown by NCL that a certain fraction of neem extract can completely prevent egg laying by some insects on treated surfaces. Technically this activity is known as 'oviposition (egg laying) deterrence'. It has been established that this activity is due to components which are neither antifeedant nor repellant as believed earlier. The application of either the crude fraction or the active components completely prevents egg laying on treated surfaces by the potato tuber moth for 7-9 days and by some species of mosquitoes for 2-3 days. Since some of these insects are serious pests of agricultural crops, prevention of egg laying by them on crops or stored commodities can provide almost total protection from insect damage.

Cellular and Molecular Biology

At CCMB, rat liver has been shown to contain a new type of transport-inhibitory protein which brings down, to the level obtained in resting liver cells, the enhanced rate of transport normally obtained in rapidly dividing liver derived cells (such as cells of an ascitic tumour of liver) or dispersed cells obtained from normal liver incubated *in vitro* at low cell concentrations. A further increase in the concentration of the inhibitory protein does not lead to any further lowering of the rate of transport in the systems mentioned above. This protein seems to satisfy the criteria laid down for the transport-inhibitory substance, *I*, postulated in the model of regulation of cell division and malignant transformation proposed by Bhargava (*J. Theoretical Biol.* 1977, **68**, 101-137). This model postulates that, in resting cells, only one set (sites A) of the two types of membrane sites proposed for transport of essential nutrients in cells of higher organisms, are open. The other set of sites, sites B, are the sites through which the major proportion of transport of essential nutrients occurs

in dividing cells. Sites B, it is proposed in the model, are blocked by a transport-inhibitory substance, *I* in resting cells. All triggers of cell division open up sites B. It is opening of sites B and the resultant influx of nutrients with consequent increase in their pool size in the cells, that is responsible for switching on the programme of the division cycle. All resting cells are proposed to be phenotypically I^+ and all dividing cells (including malignant cells), I^-. In malignant transformation, it is proposed the cells lose the ability to become I^+ even when the trigger for the cell division is no longer present in the system.

The I^- like substance—the first transport-inhibitory protein of its kind that appears to have been described so far—has been partially purified during this year and some of its properties studied. The demonstration of the existence of such a substance provides support to the model mentioned above. The protein also inhibits the synthesis of DNA in parenchymal cell suspensions obtained from the liver of partially hepatectonized rats, 24 hours after the surgery.

Several schemes of purification of this factor have been tried. It has been partially purified using molecular sieving ultrafiltration and Sephadex gel filtration chromatography. The factor is not yet homogeneous.

A protein factor from plasma membrane that stimulates reverse transcription: Following up earlier evidence suggesting that at least part of virus specific DNA synthesis could be taking place at the plasma membrane during the infection of host cells by several retroviruses, the role of plasma membrane bound factors on RNA-directed DNA synthesis has been examined. Experiments have been carried out with plasma membrane preparations from chicken embryos, using avian myeloblastosis virus (AMV) as the source of reverse transcriptase (RT).

When plasma membrane proteins were added to an endogenous RNA-directed DNA-synthesizing AMV system, a 3-5 fold stimulation in the rate of DNA synthesis was observed. Further, the DNA transcripts obtained from these reactions sedimented faster in comparison to the DNA products in control reactions lacking the membrane protein.

Nucleic acid hybridization experiments using the DNA transcripts suggested greater homology between the transcripts and the template. The membrane protein also stimulated DNA synthesis on synthetic template primers such as oligo (dG): Poly (rC), but not on synthetic homopolymers, containing only A&T. The mechanism of stimulation involves interaction of the protein with the template which interaction probably leads to the disruption of the secondary structure of the template.

Chemical Biology

It has been possible to transmit infection of *Brugia malayi*, a human filarial parasite, to mastomys through mosquitoes. A technique has been developed at CDRI to inoculate infective larvae of *Dipetalonema vitie*, the canine filarial

parasite, obtained from infected ticks, *Ornithodorous moubata*, subcutaneously in mastomys to achieve 100% microfilariaemia.

Primate test models have been established for the malarial infections *Plasmodium knowlesi, P. cynomolgi cynomolgi, P. cynomolgi bastinellisi* and *P. coatneyi*. A method has been standardized for culturing *P. berghei* in mastomys erythrocytes.

An experimental model of hypercholesterolemia and hyperglyceridemia has been developed in Charles Foster rats for screening of potential antilipaemic compounds.

The new local anesthetic (centbucridine), reported earlier, has now entered phase III trial. Data available so far in dental surgery cases indicate that it is effective in a majority of cases. Spinal anaesthesia with centbucridine was found to cause less neural damage in rabbit spinal cord than lignocaine.

Evidence has been obtained at IIEM suggesting that membrane bound lysosomal enzymes are phosphoglycoproteins with phosphate groups attached to the carbohydrate. Since phosphorylated oligosaccharide moiety of these enzymes can be sensed by cell surface receptors, it is possible that this type of attachment precedes the internalization of the lysosomal enzymes. These enzymes are implicated in the degradation of mucopolysaccharides, glycolipids and glycoproteins, and so obviously are of immense interest in cell catabolism.

A sialic-acid-binding lectin, carcinoscorpin, has been isolated from Indian horseshoe crab, purified to homogeneity and characterized. It has got potential use as a research biochemical for basic investigations of sialoglycoproteins of physiological or pathological importance.

Chemical structures of several natural products have been established and the total synthesis of two new flavones, araneol and araneosol, has been achieved.

Work on neuronal transmission has revealed the presence of muscarinic receptors on mammalian nerve terminals. There is further experimental evidence to support the postulate that circulating dopamine modulates acetylcholine release from motor nerve endings. These investigations of IIEM are expected to throw light on the mechanism of transmitter release process and the obscure field of neuronal transmission.

Botany

Studies at NBRI on the improvement and protection of ornamental plants and standardization of their agro-techniques led to the development/selection of a new foliage Amaranthus cultivar, 3 cultivars of amaryllis, 9 of chrysanthemum and 1 of rose. Investigations were also made to produce (i) larger number of bulbs per plant of amaryllis, (ii) hybrids between selected cultivars of bougainvillea, marigold and nymphaea. Propagation of selected

cultivars of bougainvillea, chrysanthemum, *Polargonium hortorum* Bailey, tuberose and several orchids was attempted, besides undertaking studies on the development of improved cultural practices for several other ornamental plants. For the first time in the case of any orchid, mericloning of *Vanda teres* was achieved employing root tips. Viral diseases of amaryllis, petunia and zinnia and fungal diseases of celosia, chrysanthemum, coleus, cosmos and gladiolus were studied and investigations made to identify the respective causal organisms and evolve control measures thereof.

GENERAL

THE 30th Conference of Directors of CSIR laboratories was held at NAL during 30-31 October 1979. The invitees to the conference included Directors of CSIR laboratories, Members of the Governing Body of CSIR, Directors of Research Associations and the General Manager of the National Research Development Corporation (NRDC).

Meetings of the Governing Body of CSIR were held on 3 April, 3 August and 20 December 1979.

The Planning Division continued its activities relating to the formulation of the annual plans of the national laboratories and their coordination both within and outside the CSIR system. By the year end, the Division finalized the draft annual plan 1980-81 after identifying the All India Coordinated Projects, Rural Development Projects and other major programmes of the laboratories. The recommendations for resource allocations of the Coordination Councils were based on the analysis and monitoring data provided by the Planning Division.

The Management Development Unit of the CSIR's Planning Division conducted a workshop on R&D Management at the National Environmental Engineering Research Institute (NEERI), Nagpur, during 18-25 September 1979. Thirty-one scientists participated in the programme.

A project development meeting on Alternative Strategies for Development was organized at CSIR Headquarters during 25-28 February 1980 by the Centre for the Study of Science, Technology and Development (CSSTD), CSIR, as the lead institute, in collaboration with the Association of Development, Research and Training Institutes of Asia and Pacific (ADIPA), Bangkok. The meeting highlighted the developing countries' problems such as basic minimum needs, employment, self-reliance, energy and environment and the role of science and technology in solving them. About 30 scholars from India, Bangladesh, Indonesia, Nepal and Thailand participated in the meeting.

Some of the distinguished scholars who visited the Centre and gave lectures in the area of science policy under its auspices were Dr. John Langrish (Dean, All Saints Polytechnic, Manchester, UK); Prof. John M. Ziman, FRS (Director, H.H. Wills Physics Laboratory, University of Bristol); Dr. Maurice Goldsmith (Director, Science Policy Foundation, London); Dr. Susantha Goonatilake (Director of Research, People's Bank, Colombo) and Prof. P.K. Rohatgi (Director, Regional Research Laboratory, Trivandrum).

Dr. Abdul Samin (Unesco fellow from Afghanistan); Prof. Stephen C. Hill (University of Wollongon, Australia); and Mr. R.J. Henry (Griffith University, Australia), worked at the Centre on short term assignments.

The Technology Utilisation Division continued to maintain close contacts with the Central Ministries of Agriculture, Industry, Health & Family Welfare, Department of Science and Technology, etc. It participated in appraisal of foreign collaboration proposals received by the government. During the period,

over 350 foreign collaboration applications were received from the government for scrutiny and comments.

The Division is represented on the Screening Committee of the Department of Science and Technology for recognition of R&D centres in industries. During the year nearly 80 new applications and 60 renewal applications for R&D recognition were received, examined and comments communicated to DST.

Four Polytechnology Transfer Centres were established at Lucknow, Bombay, Shillong and Calcutta. These were in addition to the six PTCs already functioning at Hyderabad, Trivandrum, Patna, Bhopal, Bangalore and Ahmedabad.

PTCs have been functioning as links of communication between the generators of technologies and their users through visits to industries by the officers-in-charge for identifying their technological, operational and engineering problems and arranging for their solution through CSIR laboratories and other technical institutions. During the year, 836 problems were identified, out of which 633 were solved. Thirty-five sponsored/consultancy projects were contracted at the instance of PTCs and sixty-five parties were identified for transfer of technologies developed in laboratories.

The Division continued to release its quarterly bulletin entitled "Technology Awareness Service" which has been well received both in the country and abroad.

Along with the 1981 Census Operations, a survey of degree holders and technical personnel is also being conducted by the Division for Scientific & Technical Personnel (DSTP) in collaboration with the Registrar General of Census. Unlike in 1971, when the coverage was sought to be global, the 1981 census will be restricted to a systematic sample of 25 per cent of the stock.

During this period, 8 issues of *Technical Manpower Bulletin* and 5 issues of Pool Supplements containing particulars of persons selected to the Scientists' Pool were brought out.

The Extra-Mural Research (EMR) Division processed 162 research schemes for sanction during the year. The total number of research schemes currently in progress is 554 (including new schemes). A total of 395 junior research fellowships, 267 senior research fellowships and 37 research associateships have been sanctioned for these schemes. The work in 96 research schemes was concluded during the year on completion of tenure.

About 1500 new research fellows, both senior and junior, accepted the fellowship offered by CSIR and joined during the year. The number of direct research fellows as on 1 March 1980 receiving assistance from CSIR was about 4000 (3,700 in academic and research institutions other than CSIR and 300 in CSIR laboratories/institutes). In addition, there were 22 research associates continuing work during the year.

Another activity of the EMR Division related to grants for dissemination of scientific information. Grants were given to 12 language periodicals—three in Hindi, three in Malayalam, two in Tamil and one each in Bengali, Gujarati, Kannada and Marathi, engaged in popularization of science. Grants were also recommended for three new journals, one each in Hindi, Assamese and Oriya. Grants were also given to learned societies for organization of symposia/seminars (about 30) during the year.

HONOURS/AWARDS

PROF. M.G.K. Menon, Director-General, Scientific & Industrial Research, and Secretary, Department of Science and Technology, has been elected General President of the sixty-ninth session of the Indian Science Congress Association (1981-82).

Prof. A.K. Sharma, Professor of Botany, Calcutta University, and member, Society and Governing Body of CSIR, is the General President of the sixty-eighth session of the Congress (1980-81).

Prof. Y. Nayudamma, Distinguished Scientist, Central Leather Research Institute (CLRI), Madras, and former Director-General, CSIR, has been appointed Chairman of the Committee on Science & Technology in Developing Countries (COSTED), one of the committees under the International Council of Scientific Unions (ICSU).

Shri H.N. Siddiquie of NIO was awarded the Shanti Swarup Bhatnagar Prize for the year 1978 in Earth Sciences.

Prof. A. Rahman, Chief (Planning), CSIR and Head, Centre for the Study of Science, Technology & Development, New Delhi, has been elected a Fellow of the Operational Research Society of India, Calcutta.

Dr. L.K. Doraiswamy, Director, NCL, was awarded the 'FICCI Award' in Science and Technology for the year 1979. Dr Doraiswamy shares this award with Dr. P.K. Patwardhan of BARC, Bombay.

Prof. P.K. Rohatgi, Director, RRL, Trivandrum has been elected a Fellow of the Indian Ceramic Society, Calcutta.

Dr. H.V.K. Udupa, Director, CECRI, Karaikudi, has been awarded the H.K. Sen Memorial Medal for the year 1979 by the Institution of Chemists (India).

Dr. Satya Vati Chandra of ITRC, Lucknow and Dr. (Mrs.) Minati Das of IIEM, Calcutta are among the 12 scientists selected for the National Medical Awards by the Indian Council of Medical Research (ICMR). Dr. Chandra is the recipient of Kshanika Oration Award for 1979. Dr. (Mrs.) Das has been awarded the 1978 Shakuntala Amir Chand prize.

Dr. J. Prasad of CSIO, Chandigarh rendered service as a UNESCO consultant in Optical Instruments & Technology to Lembaga Instrumentsi Nasional (LIN), Indonesia from 27 July to 2 November 1979.

Dr. B.M. Gupta of CDRI, Lucknow was elected a Fellow of the Indian National Science Academy; and Fellow of the Indian College of Allergy and Applied Immunology.

Dr. C.R. Krishna Murti, Director, ITRC, has been elected a Fellow of the Indian Academy of Medical Sciences.

Dr. J.G. Negi of NGRI, Hyderabad, has been elected a Fellow of the Royal Astronomical Society of London, U.K.

Dr. T.N. Khoshoo, Director, NBRI, was awarded the Rafi Ahmad Kidwai Memorial Prize and Medal, for the biennium 1976-77, by the Indian Council of Agricultural Research, New Delhi.

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HONOURS/AWARDS

Dr. R.P. Wadhwa of NPL was awarded the J.C. Bose memorial award for his paper entitled "Crossed-field microwave devices", at the IETE Annual function held in January 1980.

Six NCL scientists were awarded the NRDC Invention Promotion Board Award - 1979 for the development of the technology for the manufacture of nitrile rubber. The recipients of the award are Dr. S.L. Kapur, Sarvashri D.S. Gundiah, A.A. Gunari, M.B. Sabne, C.R. Rajan and R.A. Kulkarni.

CEERI, Pilani and NAL, Bangalore have won, institutionwise, the Federation of Indian Chambers of Commerce and Industry's 1979 Award for contributions in the field of research and technology.

CSIR TOTAL EXPENDITURE

(Rs. in lakhs)

Particulars	1977-78*			1978-79			1979-80		
	Non-Plan (1)	Plan (2)	Total (3)	Non-Plan (4)	Plan (5)	Total (6)	Non-Plan (7)	Plan (8)	Total (9)
1. Central Administration	334.388	32.643	367.031	388.060	27.810	415.870	414.110	32.060	446.170
(i) Pay and Allowances, Contingencies, maintenance	107.944	3.174	111.118	121.579	1.652	123.231	119.363	4.700	124.063
(ii) Headquarters Technical Activities	6.749	11.740	18.489	10.099	8.079	18.178	13.292	13.428	26.720
(iii) Misc. Pensions, Advances etc.	219.695	17.729	237.424	256.382	18.079	274.461	281.455	13.932	295.387
2. Laboratories	2558.617	1473.942	4032.559	2389.270	1480.640	3869.910	2521.220	1735.360	4256.580
3. Scientists' Pool	60.078	—	60.078	59.580	—	59.580	52.970	—	52.970
4. Research Schemes, Scholarships and Fellowships	169.070	136.880	305.950	167.840	122.960	290.800	—	312.650	312.650
5. Industrial Research Associations	100.000	75.818	175.818	43.500	11.970	55.470	53.240	14.630	67.870
6. Pilot Plants	—	138.054	138.054	—	136.600	136.600	124.510	—	124.510
7. Residential Buildings	174.314	—	174.314	40.450	133.700	174.150	39.780	97.610	137.390
Total	3396.467	1857.337	5253.804	3088.700	1913.680	5002.380	3205.830	2192.310	5398.140

*Includes transferred laboratories.

APPENDIX I

PROCESSES THAT HAVE GONE INTO PRODUCTION

Sl. No.	Process	Party	Nature of Licence
	Products of Food Industry, Including Beverages		
	CFTRI		
1	Amyloglucosidase enzyme	Kamala Sugar Mills, Amaravati Nagar	Technical aid
2	Energy food	Karnataka Agro-Corn Products Ltd., Bangalore	Non-exclusive
3	Cocoa mass	Sampangi Ramayya, Bangalore	Non-exclusive
	Chemicals		
	NCL		
4	Butenediol	Hindustan Organic Chemicals, Rasayani	Joint development work
5	Dimethoate	(1) Shaw Wallace & Co., Calcutta	Non-exclusive
		(2) Micro Farm Chemicals Ltd., Madras	Non-exclusive
6	Ethion	Shaw Wallace & Co., Calcutta	Non-exclusive
7	Silver paste for mica capacitor electrodes	Jyoti Refineries, Nagpur	Non-exclusive
	CSMCRI		
8	Potassium silicate from potassium chloride and sodium silicate	Mohanta Enterprises, Calcutta	Non-exclusive
	CECRI		
9	Sodium perchlorate	IDL Chemicals Ltd., Hyderabad	Non-exclusive
10	Glyoxalic acid	Bush Boake Allen India Ltd., Madras	Non-exclusive
11	Para-amino benzoic acid	Poompuhar Chemical Industries, Madras	Non-exclusive
	CLRI		
12	Acrylic resin emulsion	Amar Dye Chem., Bombay	Non-exclusive
13	Cenlesols	Indofil Chemicals Ltd., Bombay	Non-exclusive
14	Antifungal tablets	(1) Gojanan Chemicals, Madras	Non-exclusive
		(2) Antifungal & Allied Products, Kanpur	Non-exclusive
		(3) Pranav Enterprises, Bombay	Non-exclusive

APPENDIX I

PROCESSES THAT HAVE GONE INTO PRODUCTION

Sl. No.	Process	Party	Nature of Licence
		Electrochemicals	
CECRI			
15	Chromate treatment of zinc and die cast zinc alloy	Carburetor Ltd., Madras	Non-exclusive
		Metallurgy	
RRL, Bhubaneswar			
16	Iron ore sintering	Kalinga Iron Works, Barbil	Collaborative research
NML			
17	Reactive filter media for aluminium and its alloys	Bhaskar Stoneware Pipes Pvt. Ltd., New Delhi	Non-exclusive
		Materials	
SERC			
18	Ferro-cement cylindrical bins	(1) Ashoka Associates, Lucknow	Non-exclusive
		(2) Pedro Precast Units, Goa	Non-exclusive
		(3) Indian Concrete Products, Meerut	Non-exclusive
19	Prestressed concrete sleepers	Jay Prestressed Products Ltd., New Delhi	Non-exclusive
CBRI			
20	Lime slag based and lime sludge based masonry cement	Murti Mineral Industries, Vijayanagaram	Non-exclusive
IIP			
21	Improved wick stove	Ogale Glass Works, Pune	Technical aid
		Machinery	
CMRS			
22	Hydraulic props, 40 tonnes	Usha Telehoist Ltd., Calcutta	Sponsored research
CMERI			
23	Manual arc welding electrode holder	Flame Ring Industries, New Delhi	Non-exclusive
24	Paddy husk combustor and heat exchanger	Food Corporation of India, New Delhi	Sponsored research

APPENDIX I

PROCESSES THAT HAVE GONE INTO PRODUCTION

Sl. No.	Process	Party	Nature of Licence
25	Scan eyes holding structure	Scan International, Calcutta	Sponsored research
26	Pedal pump, design	(1) Dudas Engineering Co., Burdwan	Technical aid
		(2) Acme Scale and Engineering Co., Calcutta	Technical aid
		(3) Maharashtra Agro-industries Corporation Ltd., Bombay	Technical aid
		(4) Dube Engineering Corporation, Asansol	Technical aid
27	Pedal loom	A.S. Industries, Patna	Sponsored research
CFTRI			
28	Orange juice extractor	Mysore Precision Engineering, Mysore	Non-exclusive
		Electronics	
CEERI			
29	C B transreceiver	Punjab Wireless Systems Ltd., Chandigarh	Non-exclusive
30	1.2 kW induction heater	Pal Industries, Sangroor	Non-exclusive
		Instruments	
CSIO			
31	Digital optical density meter-electronic unit	Photo Electric Instruments, Jodhpur	Non-exclusive
32	Focimeter	Medico Instruments Manufacturing Co., Bombay	Non-exclusive
33	Altimeter	Durgapur Enterprises, New Delhi	Non-exclusive
NPL			
34	Cryoprobes for eye surgery	Industrial Cryogenics Corporation, Faridabad	Non-exclusive
35	Liquid crystal digital display devices	Punjab Display Devices Chandigarh	Non-exclusive
CEERI			
36	Audio-visual equipment	Central Electronics Ltd., Sahibabad	Sponsored research
NML			
37	Semi-automatic carbon analyser	KSM Laboratory Glass Works, Madras	Non-exclusive

APPENDIX II

PROCESSES RELEASED TO INDUSTRY

Sl. No.	Process	Party
	Products of Food Industry, Including Beverages	
	CFTRI	
1	Sesame seed, dehulling of	V.V. Veniyappa Perumal and Sons, Virudunagar
2	Cocoa mass	Sampangi Ramayya, Bangalore
3	Vitamin-E concentrate from wheat germ (Sp.)	Ranbaxy Laboratories, New Delhi
4	Fish meal and oil	Karnataka Fisheries Development Corporation, Mangalore
5	Deep fat frying and salting of cashew kernel (Sp.)	Vijayalaxmi Cashew Co., Quilon
6	Development of emergency ration	(1) Sing Hindustan Marine Chemicals (P) Ltd., Calcutta (2) IMS Life Saving Appliances, Bombay
7	Cashew butter formulations	Kerala State Cashew Development Corporation Ltd., Quilon
	Chemicals	
	CECRI	
8	Perchloric acid (Sp.)	R.B. Engineering Pvt. Ltd., Bombay
9	Lacquer for corrosion prevention	Arvind Velayuthan Chemicals, Tiruchi (Tamil Nadu)
	RRL, Hyderabad	
10	Monocrotophos	National Organic Chemical Industries, Bombay
11	Dichlorodivinyl phosphate (DDVP)	Sudarshan Chemical Industries, Pune
	CSMCRI	
12	Precipitated silica (Tech. aid)	Smart Corpn., Ahmedabad
	RRL, Bhubaneswar	
13	Methyl and ethyl anthranilate from isatoic anhydride	(1) Simihas, Madras (2) Syncroma Chemicals, Dandeli, Karnataka
14	Extraction of tannins from plant barks (Sp.)	Industrial Promotion Investment Corpn., Orissa
	IIEM	
15	Process for isolation of galactose binding lectins (Sp.)	Hy-Gro Chemicals Pvt. Ltd., Calcutta

PROCESSES RELEASED TO INDUSTRY

Sl. No.	Process	Party
	RRL, Jorhat	
16	Beneficiation additive (Sp.)	Allied Resin and Chemicals Ltd, Calcutta
	Drugs and Pharmaceuticals	
	CDRI	
17	*l*-Ephedrine (Sp.)	The Indian Yeast Co. Ltd., Calcutta
18	New cervical dilator	Unichem Laboratories Ltd., Bombay
	RRL, Jammu	
19	Colchicine from glorioga (Sp.)	Kothari Phyto Chemicals, Madurai
	Metallurgy	
	NML	
20	Reactive filter for uminium and its alloys aluminium and its alloys	Bhasker Stoneware Pipes Pvt. Ltd., New Delhi
21	Aluminium based sacrificial anode for cathodic protection	Aluminium Mfg. Co., Calcutta
	RRL, Bhubaneswar	
22	Sintering of iron ore fines (Sp.)	Kalinga Iron Works, Barbil, Orissa
23	Iron oxide black and red pigment, synthetic	Laxmi Narayan, Aligarh
	Materials	
	CGCRI	
24	Process for production of glass ceramic tiles as a byproduct from a mineral wool manufacturing unit (Sp.)	J.R. Industries, Jamshedpur
25	Manufacture of red clay pottery (Tech. aid)	Department of Rural Reconstruction, Visva Bharati, P.O. Shantiniketan (W.B.)
	NPL	
26	Selenium photoconductive plate for electrostatic photocopying machine	Govind Prasad Garg, Kanpur
27	Liquid crystal digital display device	(1) Keltron, Trivandrum (2) Punjab Display Devices, Chandigarh (3) Krystronics Pvt. Ltd., Jaipur (4) Vijayanagar Textiles & Electronics Ltd., Madras

APPENDIX II

PROCESSES RELEASED TO INDUSTRY

Sl. No.	Process	Party
SERC		
28	Precast ferro-cement biogas holders for biogas plants (Sp.)	(Through) Department of Science and Technology, New Delhi
CMRS		
29	Dust respirator (Sp.)	Industrial Components, Calcutta
30	Quick setting clamp for cross-bar support (Sp.)	(1) Friends Industrial Enterprise, Jharia (2) Kanpur Steel & Tubular Works, Jharia (3) Shri Durga Timber & Mining Stores, Asansol (4) Union Carbons, Jharia (5) Hind Industrial Corporation, Kirkend, Dhanbad (6) Sharan Industries, Mohuda, Dhanbad
31	Convergence indicator and surface strain measuring device (Sp.)	Progressive Machine Tools, Jaunpur
32	Quick setting screw props (Sp.)	(1) Nanda Millar Co., Calcutta (2) Kapur Mining Equipment Pvt. Ltd., Asansol
33	Central despatcher system for mines (Sp.)	(1) Westinghouse Saxby Farmer Ltd., Calcutta (2) Bihar State Electronics Development Corpn., Patna
NPL		
34	Multipurpose solvent extractor	Continental Instruments, Ambala Cantt
NAL		
35	Spark erosion machine, package extension of know-how (Sp.)	Toolcraft, Bangalore
CFTRI		
36	Leaf-cup making machine	33 parties
CSMCRI		
37	Mechanical salt harvester (Tech. aid)	Tata Chemicals, Mithapur
CMERI		
38	Spinning attachment for making milk cans (Sp.)	Bose and Co. Pvt. Ltd., Howrah
39	Hydraulic jack with pump, design (Sp.)	Mikron Manufacturing Industry, Calcutta

APPENDIX II

PROCESSES RELEASED TO INDUSTRY

Sl. No.	Process	Party
40	Mechanical load brakes for auxiliary hoist motion (Sp.)	Hindustan Motors, Hind Motor, Hubli
41	Steam jet ejector (Sp.)	Engineers India Ltd., New Delhi
42	Pedal pump, design	12 parties
MERADO, Pune		
43	Tractor implements for harvesting sugarcane (Sp.)	Phaltan Sugar Works, Phaltan, Satara
44	Stone crusher, design and development	Universal Engineering Co., Pune
MERADO, Ludhiana		
45	Drill head for radial drilling machine	Royal Foundry, Batala
46	Jigs and fixtures for 7.5 BHP electric motors	Speri Electrical Co., Ludhiana
	Instruments	
CSIO		
47	Cine projection lens	Govt. Instruments Workshop, Trivandrum
48	Digital grain moisture meter	Associated Instruments Manufacturer India Ltd., New Delhi
CEERI		
49	Audio visual system (Sp.)	Central Electronics Ltd., Sahibabad
NGRI		
50	Proton precision magnetometer	CEO Instruments, Hyderabad
51	Shallow electromagnetic prospecting unit	CEO Instruments, Hyderabad
NPL		
52	Platinum resistance thermometer	Continental Instruments (India), Ambala Cantt
53	Thin film thickness rate monitor	Vacuum Instruments Co., New Delhi
NIO		
54	Tide and wave telemeter	Electronics, Cochin
NAL		
55	High current potentiometer	Century Systems, Bangalore

APPENDIX II

PROCESSES RELEASED TO INDUSTRY

Sl. No.	Process	Party
56	Bonded wire strain gauge column type load cell	EFGE Load Cells, Bangalore
57	Instrumentation system for dynamic balancing machine for APPLE (Sp.)	Indian Space Research Organisation, Bangalore
	NML	
58	Semi-automatic carbon analyser	K.S.M. Laboratory Glass Works, Madras
	CBRI	
59	Water proofing system for exposed brick masonry and lime concrete surface	(1) Gujarat Water Proofers, Ahmedabad (2) Malka Sons Chemicals, New Delhi

Sp., Sponsored research

APPENDIX III

CSIR PATENTS FILED, ACCEPTED AND SEALED IN INDIA AND ABROAD DURING THE PERIOD 1.4.1979 TO 31.3.1980

Name of the Laboratory*	INDIA			ABROAD		
	Filed	Accepted	Sealed	Filed	Accepted	Sealed
CECRI, Karaikudi	16	7	29	—	—	—
NCL, Pune	14	3	4	2	—	—
RRL, Hyderabad	8	—	4	—	—	—
CMERI, Durgapur	8	5	13	—	—	—
CMRS, Dhanbad	7	1	4	—	—	—
CEERI, Pilani	6	2	4	—	—	—
CSIR Schemes	5	—	5	—	—	—
CDRI, Lucknow	5	3	8	—	1	1
NML, Jamshedpur	4	1	5	—	—	—
RRL, Bhubaneswar	4	3	10	—	—	—
IIP, Dehradun	4	1	2	—	—	—
CSMCRI, Bhavnagar	3	—	1	—	—	—
CLRI, Madras	3	1	2	—	—	—
NGRI, Hyderabad	2	—	—	—	—	—
NPL, New Delhi	2	1	5	—	—	—
CGCRI, Calcutta	2	—	1	—	—	—
CBRI, Roorkee	1	—	1	—	—	—
IIEM, Calcutta	1	—	—	—	—	—
NAL, Bangalore	1	3	1	1	—	—
MERADO, Ludhiana	1	—	—	—	—	—
MERADO, Madras	1	—	—	—	—	—
SERC	2	—	—	—	—	—
CFTRI, Mysore	1	1	1	—	—	—
CSIO, Chandigarh	1	—	1	—	—	—
RRL, Jorhat	2	1	7	—	—	—
CRRI, New Delhi	—	4	—	—	—	—
CFRI, Dhanbad	—	2	4	—	—	—
IPIRA, Bangalore	—	—	1	—	—	—
IRMRA, Bombay	—	—	1	—	—	—
NBRI, Lucknow	—	—	1	—	—	—
NEERI, Nagpur	—	—	3	—	—	—
NIO, Goa	—	—	2	—	—	—
MERADO, Pune	—	1	—	—	—	—
SITRA, Coimbatore	—	1	1	—	—	—
TOTAL	104	41	121	3	1	1

*Includes transferred laboratories

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES (AS ON 1.8.1979)*

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
		Physical & Earth Sciences Group		
CEERI				
1	CEERI Extension Centre, New Delhi. (1967)	Extension, demonstration, consultancy, design & engineering, research, prototype fabrication. R&D activities in audio-visual systems, electronics for museums and speech	CEERI Extension Centre, CSIR Complex, NPL Campus, Hillside Road, New Delhi-110012	CEERICENT, New Delhi 583172 & 581467
2	CEERI Extension Centre, Madras. (1974)	As above and R&D in process control instruments and electronics control systems, particularly for plastics, textiles and paper industries	CEERI Extension Centre, CSIR Complex, Adyar, Madras-600020	CONSEARCH, Madras 412430/412122 041-363
CSIO				
3	Service & Maintenance Centre, (CSIO), New Delhi. (1961)	Repair and maintenance of instruments in the region. Design & development, consultancy, 'on-job' training, etc.	CSIO Service & Maintenance Centre, CSIR Complex, (2nd Floor), Hillside Road, New Delhi-110012	CENINSTS, New Delhi 586794/585663
4	Service & Maintenance Centre, (CSIO), Madras (1964)	Servicing & maintenance of instruments in the Southern region. R&D in process control instrumentation and electrochemical devices	Service & Maintenance Centre (CSIO) CSIR Complex, Adyar, Madras-600020	CONSEARCH, Madras 412061 MS 363 Code: RESEARCH
5	Service & Maintenance Centre (CSIO) (Hq.) Chandigarh. (1965)	Repair and maintenance of instruments in the Region. Design & development, consultancy, 'on-job' training, etc.	Service & Maintenance Centre (Hq.) (CSIO), Sector 30, Chandigarh-160020	CENINSTS, Chandigarh 24614
6	Service & Maintenance Centre, (CSIO), Calcutta. (1969)	As above and R&D in electric, electronic and electrochemical instrumentation	Service & Maintenance Centre (CSIO) IIEM Campus, 4, Raja S. Mullick Road, Jadavpur, Calcutta-700032	CENINSTS, Calcutta 42-5412

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
7	Service & Maintenance Centre (CSIO), Bombay. (1971)	Repair and maintenance of instruments in the nearby region. 'on-job' training and development of scientific instruments	Service & Maintenance Centre (CSIO), Sahkar Bhavan Kurla Industrial Estate Narayan Nagar Ghatkopar (W) Bombay-400086	CENINSTS, Bombay. 551994
8	Service & Maintenance Centre (CSIO), Lucknow. (1975)	As above	Service & Maintenance Centre (CSIO), Lucknow Polytechnic Campus, Kanpur Road Lucknow-226005	CENINSTS, Lucknow. 51302
9	Service & Maintenance Centre (CSIO), Hyderabad. (1976)	As above	Service & Maintenance Centre (CSIO), Osmania University Campus Hyderabad-500007	CENINSTS, Hyderabad. 71761
10	Service & Maintenance Centre (CSIO), Cochin. (1976)	Servicing & maintenance of instruments	Service & Maintenance Centre (CSIO), CSIR Cochin Complex, South Kalamassery, Cochin-683104	CONSEARCH, Cochin. 5908
11	Service & Maintenance Centre (CSIO), Jaipur. (1979)	As above and also train servicing personnel	Service & Maintenance Centre (CSIO), Gymnasium Building SMS Medical College, Campus, Jaipur	CENINSTS, Jaipur.
NIO				
12	Regional Centre of NIO Bombay (1963)	Research in oceanography in the Bombay region, with special reference to marine pollution control	NIO Regional Centre, Seven Bungalows, Versova, Bombay-400061	OCEANOLOGY. 573773 Bombay 574807 532620
13	Regional Centre of NIO Cochin (1966)	Research in oceanography in the region, with particular reference to problems of applied value	NIO Regional Centre, Pulleapady Cross Road, PB No. 1913, Cochin-682018	OCEANOLOGY, Ernakulam. 33306 31814

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
14	Regional Centre of NIO, Waltair. (1976)	As above with emphasis on marine geology and geophysics	NIO Regional Centre, Waltair, Andhra University Campus, Visakhapatnam-530003	OSTECHLAB, Waltair.
	Chemical Sciences Group			
CECRI				
15	CECRI Corrosion Testing Station. (1957)	Tropical corrosion testing	CECRI Corrosion Testing Station Mandapam Camp Tamil Nadu-623519	62
16	Madras Unit (1962)	Demonstration and extension. Trouble-shooting in the areas of electroplating and metal finishing corrosion studies. lead acid battery performance evaluation	CECRI Madras Unit, Adyar, Madras-600020	CONSEARCH, Madras. 412068/413856 41363 CSIR IN
CSMCRI				
17	Marine Algae Research Station, Mandapam (Ramnad Distt.) Tamil Nadu (1966)	Basic studies on culture and cultivation of marine algae	CSMCRI Marine Algae Research Station, Mandapam Ramnad Distt. Tamil Nadu-623518	MARS/ Mandapam 22
18	Experimental Field Unit of Sea Water Irriculture Berhampur (Orissa) (1975)	Sea water irriculture	Experimental Field Unit of Sea Water Irriculture House No. 20-93 Gopabandhunagar Berhampur-5 Orissa	
	Biological Sciences Group			
NBRI				
19	Banthra Research Station Banthra, Lucknow. (1955)	Agro-botanical investigations requiring field scale experimentation. Also used as a centre for rural development projects	Banthra Research Station (NBRI) P.O. Banthra Lucknow	Tel.-50072

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
20	Experiment Station Bangalore (1979)	Introduction and assessment of non-agricultural economic plants relevant to R&D work of NBRI	NBRI Experiment Station NAL Belur (WTC) Campus Bangalore-560037	
CIMAP				
21	Regional Centre Bangalore (1960)	Development of agro-technologies and processing technologies of medicinal and aromatic plants (extension, demonstration, analysis, research, consultancy and training programmes)	CIMAP Regional Centre NAL (WTC) Belur, Bangalore-560037	MEDPLANTS, Bangalore 52113, 279 (Care NAL)
22	Regional Centre Pantnagar (1963)	As above	CIMAP Regional Centre P.O. Dairy Farm Nagia-263149 Pantnagar Distt. Nainital (UP)	
23	Regional Centre Jammu (1968)	As above (extension, demonstration, surveys and applied research)	CIMAP Regional Centre (J&K) Drug Research Laboratory, Canal Road Jammu-Tawi-180001	DRUGLAB, Jammu 6488
24	CIMAP Regional Centre Kodaikanal (1977)	Development of agro-technologies and processing technologies of medicinal and aromatic plants (extension, demonstration and applied research)	CIMAP Regional Centre, Westbrook Convent Road Kodaikanal-624101 Tamil Nadu	Tel. 378
25	CIMAP Regional Centre Darjeeling (1978)	As above	CIMAP Regional Centre, Anselgunj, P.O. Tung Distt. Darjeeling (W.B.)	
	(Drugs Farms and Factories Jammu (1964)	(The units belong to J&K Govt. and were taken over on lease for 20 years for being run on proper commercial basis)	(Drug Farms and Factories, J&K Canal Road Jammu-Tawi)	(DRUGLAB, Jammu) (6488/5280)

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
CFTRI				
26	CFTRI Fish Technology Experiment Station Mangalore (1960)	Marine fish handling, processing and preservation (extension, techno-economic surveys, technical assistance, analysis, consultancy, training and research)	CFTRI Fish Technology Experiment Station Hoige Bazar Mangalore-575001 Karnataka	FOODSEARCH, Mangalore 24304/26218
27	CFTRI Experiment Station Nagpur (1960)	Fruit and vegetable preservation techniques (demonstration, analysis, dissemination, surveys, consultancy and applied research)	CFTRI Experiment Station Gole Bungalow Chhindwara Road Nagpur-440013 Maharashtra	FOODSEARCH, Nagpur 33850/53984
28	CFTRI Experiment Station Bombay (1961)	Fruit and vegetable preservation techniques (extension, demonstration analysis, consultancy, training and research)	CFTRI Experiment Station Bhavan's College Campus Andheri West Bombay-400058	FOODSEARCH, Bombay 571599/662231
29	CFTRI Experiment Station Lucknow (1962)	Fruit and vegetable preservation techniques (extension, demonstration, analysis, surveys, training programmes, research)	CFTRI Experiment Station PP Bldg. of CDRI Opp. High Court Lucknow-226001	FOODSEARCH, Lucknow 44941
30	CFTRI Experiment Station Hyderabad (1963)	As above	CFTRI Experiment Station C-25 Industrial Estate, Sanatnagar Hyderabad-500018 (A P)	FOODSEARCH, Hyderabad 269301/53561
31	CFTRI Experiment Station Ludhiana (1968) (Started in Simla in 1963)	As above	CFTRI Experiment Station Gill Road Ludhiana-141006	FOODSEARCH, Ludhiana 24568/22058
CLRI				
32	Regional Extension	Show-how of know-how of CLRI deve-	Regional Extension Centre (CLRI)	Tel: 266796 246046

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
	Centre (CLRI) Calcutta (1962)	loped processes, technical assistance, research, extension, demonstration, testing, analysis, consultancy, research, etc. (Chrome-tanning and leather goods)	7/1D, DP Row Calcutta-700014 (Tannery at 129 South Tangra Road Calcutta-700046)	
33	Regional Extension Centre (CLRI) Kanpur (1963)	As above with special reference to heavy industrial and upper leathers and leather goods	Regional Extension Centre (CLRI) 11/208 Souterganj Kanpur-208001	Tel: 40879 41433
34	Regional Extension Centre (CLRI) Bombay (1964)	As above (EI skins)	Regional Extension Centre (CLRI) 220 Dharavi Road Bombay-400017	Tel: 474575 523120
35	Regional Extension Centre (CLRI) Jullundur (1964)	As above with special reference to sports goods leather	Regional Extension Centre (CLRI) Nakodar Road Jullundur-144003	Tel: 74711
36	Regional Extension Centre (CLRI) Rajkot	As above with special reference to rural and small scale leather industry	Regional Extension Centre (CLRI) Opp. City Station Rajkot-360003 (Gujarat)	Tel: 7138
		Engineering Sciences Group		
NML				
37	Field Station Madras (1964) Now known as: NML Unit, Madras.	Provide metallurgical and technical assistance and services and take up R&D in collaboration with industries, (extension, testing, analysis, consultancy, research)	NML Unit CSIR Complex Adyar Madras-600020	CONSEARCH, Madras 412077-363
38	NML Field Station, Batala (1964)	Technical assistance to small scale foundries (Demonstration, testing, analysis, training, consultancy, design and engineering)	NML Field Station Industrial Estate Batala-143505 Punjab	

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
39	Marine Corrosion Research Station Digah (1964)	Research on corrosion of metal in sea water and marine atmosphere	Marine Corrosion Research Station (NML) P.O. Digah Via CONTAI Dist. Midnapore (W B)	MCORR DIGAH Midnapore Tel Digah-40
40	NML Field Station Howrah (1965)	Service to small scale industries situated in Calcutta and Howrah (testing, analysis, consultancy, technical enquiries)	NML Field Station Industrial Estate P.O. Baltikuri Howrah-711402	
41	NML Field Station Ahmedabad (1968)	To serve the foundry industry (testing, analysis, training, consultancy)	NML Field Station P.O. Naroda Ahmedabad-832300	
42	NML Regional Liaison Centre Calcutta (1974)	Organize in-plant industrial trials of NML processes and establish close and personal contact with representatives of the industry	NML Regional Centre 4, India Exchange Place, 7th Floor Calcutta-700001	CA METALIASO 22-3054 CA-7432
CGCRI				
43	Naroda Centre Ahmedabad (1977)	Evaluation of local raw materials; technical assistance to industry (extension, testing, analysis, dissemination, training, consultancy, research)	CGCRI Naroda Centre Naroda Industrial Estate Ahmedabad-382330	GLASCERCH Naroda 82-576
CMERI				
44	Mechanical Engineering Research & Development Organization (MERADO) Ludhiana (1965)	Design, development and standardization, Industrial consultancy, testing & evaluation (training, surveys, consultancy, prototype fabrication, research)	Mechanical Engineering Research & Development Organization Gill Road Ludhiana-141006	MERADO, Ludhiana 24572/29616
45	Mechanical Engineering Research & Development Organization (MERADO) Pune (1965)	As above	Mechanical Engineering Research & Development Organization NCL Campus Pune-411008	MERADO, Pune 58224/50743

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	'Grams, Telephones, Telex
46	Mechanical Engineering Research & Development Organization (MERADO) Madras (1966)	As above	Mechanical Engineering Research & Development Organization CSIR Complex Adyar, Madras-600020.	CONSEARCH, Madras 412175/412122
47	Mechanical Engineering Research & Development Organization (MERADO) Durgapur (1968)	R&D in the field of welding (design & development, training, technical advice)	Mechanical Engineering Research & Development Organization CMERI Campus Mahatma Gandhi Avenue Durgapur-713209	MECHSEARCH, Durgapur Tel: DGP 3301 Telex: DGP 213
48	Liaison Office Calcutta (1974)	Liaison and collection of technical problems of small scale sector	Liaison Office of CMERI Fifth Floor 23 R.N. Mukherjee Road, Calcutta-700001	Tel: 220745
49	Mechanical Engineering Research & Development Organization (MERADO) Cochin (1976)	Design and development of new machinery and improvements, testing and inspection, consultancy	Mechanical Engineering Research & Development Organization CSIR Cochin Complex Kalamassery-683104 Kerala	CONSEARCH, Ernakulam 5861
NEERI				
50	NEERI Zonal Laboratory Bombay (1959)	Study problems of environmental engineering and provide technical assistance to local bodies (research, testing, analysis, extension, demonstration, etc.,	NEERI Zonal Laboratory 89/B, Dr Annie Besant Road, Worli Bombay-400018	NEERI, Bombay 18 376635 -3462-
51	NEERI Zonal Laboratory Delhi (1959)	As above	NEERI Zonal Laboratory, Inside Chandrawal Water Works No. II Alipore Road Delhi-110054	DELPHERI, Delhi 221757

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
52	NEERI Zonal Laboratory Ahmedabad (1961)	As above	NEERI Zonal Laboratory Sewage Farm Road Ahmedabad-380022	NEERI, Ahmedabad 50420
53	NEERI Zonal Laboratory Jaipur (1961)	As above	NEERI Zonal Laboratory B-25 Rajendra Marg Bapunagar Jaipur-302004	NEERI, Jaipur 74872
54	NEERI Zonal Laboratory Kanpur (1961)	As above R&D work on industrial effluent treatment and other environment problems	NEERI Zonal Laboratory 6/33, Civil Lines Kanpur-208002	NEERI, Kanpur 40127
55	NEERI Zonal Laboratory Calcutta (1962)	As above Environmental problems of eastern India, air-pollution, air-quality surveys	NEERI Zonal Laboratory, IIEM Campus 4, Raja S.C. Mullick Road Calcutta-700032	NEERI, Calcutta 32 23-8792
56	NEERI Zonal Laboratory Hyderabad (1969)	As above	NEERI Zonal Laboratory RRL (H) Campus Hyderabad-500009	NEERI, Hyderabad 703349 Telex 155-261 RRL(H)
57	NEERI Zonal Laboratory Madras (1969)	Pollution problems of Karnataka and Tamilnadu (refresher course, consultancy, design & engineering, research)	NEERI Zonal Laboratory CSIR Complex Adyar Madras-600020	CONSEARCH, Madras 413964 -41 363 CSIR
58	NEERI Zonal Laboratory Cochin (1976)	Pollution and public health engineering problems of Kerala (extension, testing, analysis, training, surveys, consultancy, research)	NEERI Zonal Laboratory CSIR Complex Kalamassery South-683104 (Kerala)	CONSEARCH, Ernakulam 5998
		Information Sciences Group		
INSDOC				
59	Insdoc Regional Centre Bangalore (1964)	Documents supply, information service, reprographic services, consultancy	Insdoc Regional Centre, IISc Campus Bangalore-560012	INSDOC Care SCIENCE, Bangalore 31461

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
60	Insdoc Regional Centre Calcutta (1978)	As above	Insdoc Regional Centre, IIEM Campus 4 Raja S.C. Mullick Road Calcutta-700032	INSDOC Care Living Cell, Calcutta 424883
61	Insdoc Regional Centre Madras (1978)	As above	Insdoc Regional Centre, C/o CSIR Complex, Adyar Madras-600020	INSDOC Care CONSEARCH, Madras 411453
	Polytechnology Transfer Centres (PTCs)			
62	PTC, Hyderabad (1975)	The object of the PTC is to bridge the communication gap between the technology generator and the technology user. PTC will carry out "needs" surveys and transmit problems to concerned laboratories, and also follow-up	CSIR-Polytechnology Transfer Centre, F-3, Satellite Industrial Estate, Balanagar Hyderabad-500037	POLYCLINIC, Hyderabad 269508
63	PTC Bangalore (1976)	This PTC is a 'diagnostic' information and direction centre for groups of industries in a particular area or region	CSIR Polytechnology Transfer Centre 2nd Floor Rastrothama Parishat Bhavan 14/3, Nrupathunga Road, Bangalore-560002	CONSEARCH, Bangalore 27464
64	PTC, Patna (1976)		CSIR Polytechnology Transfer Centre 2nd Floor, Udyog Bhavan East Gandhi Maidan Patna-800004	POLTECH, Patna 50134
65	PTC, Trivandrum (1976)	As above	CSIR Polytechnology Transfer Centre Medical College Road, Pattom Trivandrum-695004	Tel: 62214

APPENDIX IV

REGIONAL CENTRES/FIELD STATIONS, ETC. OF NATIONAL LABORATORIES/INSTITUTES

Sl. No.	Name of the Centre/Station, etc. (when established)	Major activities	Full address	Grams, Telephones, Telex
66	PTC, Ahmedabad (1975)	As above	CSIR Polytechnology Transfer Centre Gujarat University Complex (Room No. 15-16) Navrangpura Ahmedabad-380009	TECHCLINIC, Ahmedabad 443664
67	PTC, Bhopal (1977)	As above	CSIR Polytechnology Transfer Centre Block-A (West) Guru Tegh Bahadur Complex Roshanpura (Bhopal)	
68	PTC, Bombay (1979)	As above	CSIR Polytechnology Transfer Centre Industrial Chemical Laboratory Building Near Chuna Bhatti Railway Station Sion, Bombay-400022	POLYTECH, Kurla 521717
69	PTC, Lucknow (1979)	As above	CSIR Polytechnology Transfer Centre 113, Jawahar Bhawan 18, Ashok Marg Lucknow-226001	TECHTRANS, Lucknow 31955-0535-286 CDRI-IN
70	PTC, Calcutta (1979)	As above	CSIR Polytechnology Transfer Centre 4, India Exchange Place, 7th Floor Calcutta-700001	
71	PTC, Shillong (1979)	As above	CSIR Polytechnology Transfer Centre North Eastern Council Secretariat Shillong-793001	

*On the basis of a survey conducted by the Planning Division, CSIR Hqs.

NON-PLAN—SUB-HEADWISE BREAKUP OF ACTUALS FOR THE YEAR 1979-80

(Rs. in lakhs)

Laboratory/ Institute	RECURRING							CAPITAL					
	P1-Pay of Officers	P2-Pay of Estt	P3-Allowances	P4-Contingencies	P6-Maintenance	P7-Chem. App & Equipt	Total Rec	P5(3) App & Equip	P5(4) (i) Furn	P5(4) (ii) Lib Books	P5(4) (iii) Vehicles	Total Capital	Grand Total Cols 8+13
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Physical Sciences Group													
NPL	27.430	32.900	47.440	17.186	2.574	15.680	143.210	13.053	—	6.509	—	19.562	162.772
TEC	1.007	1.654	1.711	1.284	—	0.810	6.466	—	—	—	—	—	6.466
CEERI	11.740	19.300	17.600	7.676	1.724	8.870	66.910	5.497	—	3.000	1.640	10.137	77.047
CSIO	10.890	22.870	24.820	11.000	1.495	20.500	91.575	—	—	1.649	0.320	1.969	93.544
NGRI	12.810	19.100	26.800	11.950	1.042	16.540	88.242	17.000	—	2.176	0.049	19.225	107.467
NIO	6.856	10.270	12.443	6.720	1.233	5.830	45.070	—	—	2.283	0.365	2.648	47.718
Boat Opn.	—	—	—	—	—	1.718		—	—	—	—	—	
Total	70.733	106.094	130.814	55.816	8.068	69.948	441.473	35.550	—	15.617	2.374	53.541	495.014
Chemical Sciences Group													
NCL	33.023	31.048	41.990	15.700	1.853	16.540	140.154	49.844	—	8.796	—	58.640	198.794
CECRI	14.170	22.316	23.210	10.225	0.735	15.578	86.234	1.998	—	1.811	—	3.809	90.043
CSMCRI	11.280	11.390	13.400	4.000	0.170	6.300	46.540	—	—	1.801	—	1.801	48.341
RRL, Hyd.	24.490	31.720	44.060	17.000	1.500	16.540	135.310	25.000	—	3.010	—	28.010	163.320
RRL, Jorhat	9.310	13.470	14.340	5.230	1.000	6.040	49.390	—	—	4.168	0.392	4.560	53.950
Total	92.273	109.944	137.000	52.155	5.258	60.998	457.628	76.812	—	19.586	0.392	96.820	554.448
Biological Sciences Group													
CFTRI	23.390	30.730	35.490	11.200	2.999	17.040	120.849	10.080	1.912	4.500	(−)0.380	16.112	136.961
IIOR	22.230	25.000	35.160	15.080	1.400	19.950	118.820	15.000	—	5.000	—	20.000	138.820
CLRI	13.700	15.710	24.424	7.800	0.893	10.770	73.297	0.992	—	1.630	—	2.622	75.919
CRI	8.140	19.175	22.090	5.690	0.830	8.140	64.065	—	—	2.090	—	2.090	66.155	
	5.700	9.400	13.680	3.200	0.481	3.920	36.381	—	—	4.000	—	4.000	40.381	
, Jammu	11.570	15.900	18.910	7.480	1.000	18.000	72.860	1.998	—	2.751	—	4.749	77.609	
CIMAP	3.170	5.460	7.360	6.614	0.115	5.480	28.199	0.600	0.180	1.538	—	2.318	30.517	
ITRC	5.680	4.640	8.190	3.980	0.517	5.780	28.787	—	—	1.998	—	1.998	30.785	
CCMB (RRL, Hyd.)	1.030	0.790	1.540	—	—	2.100	5.460	—	—	0.950	—	0.950	6.410	
Total	94.9160	126.805	166.844	61.044	8.235	91.180	548.718	28.670	2.092	24.457	(−)0.380	54.839	603.557	
Engineering Sciences Group													
NML	23.700	29.880	36.590	15.546	1.505	12.338	119.559	5.671	—	2.844	—	8.515	128.074
CGCRI	13.100	20.392	25.990	6.617	0.800	6.347	73.246	3.973	0.100	1.800	—	5.873	79.119
CMRS	19.090	14.658	21.470	6.351	1.469	2.006	65.044	—	—	1.577	—	1.577	66.621
CMERI	26.448	34.638	41.408	12.242	2.695	9.836	127.267	—	—	3.091	1.257	4.348	131.615
NEERI	10.870	17.610	22.650	6.560	1.189	5.500	64.379	—	—	1.606	(−)0.216	1.390	65.769
NAL	29.670	39.040	54.850	18.828	1.604	*35.810	179.802	7.411	—	8.360	0.505	16.276	196.078
RRL, Bhub.	6.534	7.122	8.179	4.585	1.001	5.890	33.311	—	—	2.710	(−)0.012	2.698	36.009	
SERC (R)	4.309	4.379	6.492	2.100	0.396	3.383	21.059	—	—	0.730	—	0.730	21.789	
SERC (M)	4.010	3.020	5.700	2.250	—	5.941	20.921	—	—	0.702	—	0.702	21.623	
CSIR Madras Complex	0.670	3.100	3.510	3.088	0.697	—	11.065	—	—	—	0.185	0.185	11.250	
Total	138.401	173.839	226.839	78.167	11.356	87.051	715.653	17.055	0.100	23.420	1.719	42.294	757.947	
	*includes Rs. 9.350 lakhs for W.T.												
Information Sciences Group													
INSDOC	8.880	11.120	14.380	8.751	1.286	5.809	50.226	0.750	—	5.250	—	6.000	56.226
PID	7.980	8.010	11.530	8.410	0.650	16.350	52.950	—	—	1.100	—	1.100	54.030
Total	16.860	19.130	25.910	17.161	1.936	22.159	103.156	0.750	—	6.350	—	7.100	110.256
GRAND TOTAL	412.877	535.812	687.407	264.343	34.853	331.336	2266.628	158.867	2.192	89.430	4.105	254.594	2521.222

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ANNUAL REPORT 1979-80

PLAN—SUB-HEADWISE BREAKUP OF ACTUAL EXPENDITURE FOR 1979-80

(Rs. in lakhs)

Laboratory/ Institute	RECURRING							Wages	P5(3) App & Equipt	CAPITAL							
	P1-Pay of Officers	P2-Pay of Estt	P3-Allow-ances	P4-Contin-gencies	P6-Main-tenance	P7-Chemi-cals. App & Equipt	Total Rec			P5(4) (i) Furniture	P5(4) (ii) Lib Books	P5(4) (iii) Vehicles	P5(4) (iv) W/shop stores	P5(4) (v) Models & Exhi	P5(4) (vi) Misc	Total Capital	Grand Total Rec + Capital
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Physical Sciences Group																	
NPL	4.976	3.312	2.486	0.850	—	6.218	17.842	8.9[illegible]716	40.114	0.538	—	0.119	—	—	—	56.391	74.223
CEERI	5.885	0.691	3.760	—	—	5.897	16.233	4.8[illegible]994	32.010	0.460	—	—	—	—	—	41.314	57.547
CSIO	6.902	3.557	3.941	1.929	—	4.430	20.759	4.8[illegible]264	34.943	1.007	—	(–) 0.103	—	—	—	41.980	62.739
NGRI	3.695	4.346	4.030	1.492	—	11.955	25.518	11.8[illegible]559	45.409	1.292	—	0.748	—	—	—	60.006	85.524
NIO	4.409	4.819	4.856	2.837	—	2.224	74.644	4.0[illegible]385	43.680	0.750	—	0.066	—	—	—	48.883	123.527
Boat operation						55.499											
Total: I:	25.867	16.725	19.073	7.108	—	86.223	154.996	34.[illegible]018	196.156	4.047	—	0.830	—	—	—	248.574	403.570
Chemical Sciences Group																	
NCL	5.338	1.320	3.283	3.749	—	10.000	23.690	15.[illegible]000	30.563	1.500	—	—	—	—	2.500	54.989	78.679
CECRI	2.815	—	0.520	—	—	—	3.335	7.0[illegible]012	18.650	0.435	—	—	—	—	—	28.162	31.497
CSMCRI	1.728	0.723	1.670	1.342	—	3.099	8.562	3.5[illegible]118	11.201	0.494	—	—	—	—	—	16.411	24.973
RRL, Hyd.	4.150	3.449	2.670	0.500	—	14.470	25.239	12.[illegible]73	25.725	1.180	—	—	—	—	—	42.178	67.417
RRL, Jorhat	5.349	3.055	5.366	1.901	—	7.535	23.206	12.[illegible]0	14.383	0.315	—	—	—	—	—	28.972	52.178
Total: II:	19.380	8.547	13.509	7.492	—	35.104	84.032	50.[illegible]63	100.522	3.924	—	—	—	—	2.500	170.712	254.744
Biological Sciences Group																	
CFTRI	8.560	—	1.140	2.000	—	7.120	18.820	21.[illegible]00	32.061	0.498	—	—	—	—	—	57.559	76.379
CDRI	3.856	1.295	3.640	3.900	—	9.350	22.041	[illegible]3	33.000	0.899	—	—	—	—	—	49.085	71.126
CLRI	3.949	4.098	2.319	4.200	—	1.716	16.282	[illegible]9	19.126	1.498	—	—	—	0.001	—	31.263	47.545
NBRI	3.634	—	1.400	1.729	—	5.510	12.273	8.0[illegible]30	12.499	0.593	0.510	—	—	—	—	21.649	33.922
IIEM	1.611	0.579	0.265	1.341	—	2.684	6.480	1.[illegible]14	37.985	0.295	—	—	—	—	—	43.181	49.661
Centre for Biochemicals	0.639	1.861	2.260	3.642	0.291	1.949	10.642	0.[illegible]58	5.627	0.152	0.057	—	0.221	—	—	6.467	17.109
RRL, Jammu	2.292	0.080	1.470	1.320	—	8.338	13.500	10.71.965	40.845	1.000	—	2.145	0.124	—	—	55.789	69.289
CIMAP	1.816	1.995	2.084	0.987	—	4.458	11.340	2[illegible]61.851	16.472	1.370	—	1.300	—	0.074	—	46.678	58.018
ITRC	1.328	2.827	3.994	1.658	—	7.601	17.408	[illegible]3	15.963	0.797	—	—	—	—	—	20.719	38.127
CCMB (RRL, Hyd.)	0.240	0.824	1.950	2.000	—	2.000	7.014	[illegible]	27.005	0.920	—	1.650	—	—	—	39.720	46.734
Total: III:	27.925	13.559	20.522	22.777	0.291	50.726	135.800	[illegible]	240.583	8.022	0.567	5.095	0.345	0.075	—	372.110	507.910
Engineering Sciences Group																	
NML	8.879	2.301	6.104	—	—	—	17.284	1.[illegible]95	26.934	0.447	—	—	—	—	—	30.260	47.544
CGCRI	1.406	—	0.471	—	—	1.277	3.154	4.7[illegible]219	22.230	0.188	—	—	—	—	—	27.385	30.539
Naroda Centre	0.187	0.676	0.679	0.790	0.249	0.430	3.011	—	0.223	0.050	0.099	—	—	—	—	0.372	3.383
CMRS	2.119	—	2.327	—	—	—	4.446	1.[illegible]85	4.298	0.599	—	—	—	0.026	—	6.415	10.861
CMERI	1.000	0.750	—	—	—	—	1.750	4.[illegible]27	13.596	0.884	—	—	0.037	0.041	—	20.183	21.933
NEERI	3.271	0.841	0.756	1.983	—	2.477	9.328	3.[illegible]55	5.959	0.600	—	—	—	—	—	15.139	24.467
NAL	6.800	3.431	2.956	—	—	6.421	19.608	11.[illegible]1	111.471	1.997	—	4.308	—	—	—	134.289	153.897
RRL, Bhubaneswar	3.611	—	1.688	—	—	2.210	7.509	1.[illegible]	35.493	0.400	—	—	—	—	—	51.051	58.560
SERC, Roorkee	—	—	—	—	—	0.400	0.400	[illegible]	4.252	0.095	—	—	—	—	—	4.347	4.747
SE(R)RC, Madras	2.413	0.288	2.138	0.386	—	—	5.225	[illegible]	8.769	0.477	—	—	—	0.028	—	9.274	14.499
CSIR Madras Complex	0.216	0.783	0.770	—	—	—	1.769	5.[illegible]00	—	0.407	—	—	—	—	—	7.403	9.172
RRL, Trivandrum	3.765	3.950	5.800	2.799	0.136	2.808	19.258	[illegible]	40.256	0.800	2.503	0.915	—	—	—	55.716	74.974
CSIR Cochin Complex	1.053	0.808	1.216	0.711	0.014	0.334	4.136	[illegible]	3.760	0.164	0.295	—	—	—	—	4.219	8.355
Total: IV:	34.720	13.828	24.905	6.669	0.399	16.357	96.878	[illegible]	277.241	7.108	2.897	5.223	0.037	0.095	—	366.053	462.931
Information Sciences Group																	
INSDOC	1.700	0.020	1.330	—	—	7.537	10.587	[illegible]	8.000	0.460	6.500	0.069	—	—	—	30.178	40.765
PID	2.780	0.050	1.540	—	—	1.297	5.667	[illegible]	8.951	0.460	0.198	—	—	—	0.534	10.292	15.959
Total: V:	4.480	0.070	2.870	—	—	8.834	16.254	15.[illegible]49	16.951	0.920	6.698	0.069	—	—	0.534	40.470	56.724
Total: I-IV:	112.372	52.729	80.879	44.046	0.690	197.244	487.960	245.[illegible]29	831.453	24.021	10.162	11.217	0.382	0.170	3.034	1197.919	1685.879
Equipment under TCA/ Colombo Plan	—	—	—	—	—	—	—	—	49.480	—	—	—	—	—	—	49.480	49.480
GRAND TOTAL:	112.372	52.729	80.879	44.046	0.690	197.244	487.960	245.[illegible]29	880.933	24.021	10.162	11.217	0.382	0.170	3.034	1247.399	1735.359