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1977-78

COUNCIL OF SCIENTIFIC &

INDUSTRIAL RESEARCH

NEW DELHI

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

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INTRODUCTION

This is a brief report of the work done by and achievements of national laboratories/institutes during 1977-78. For the first time the report is presented in terms of major sectors to whom benefits have accrued directly out of the R & D programmes of the laboratories. Particularly, these relate to rural development, public and private sectors, collaborative efforts with other R & D agencies and Government departments/ministries.

Technologies transferred to the private sector have been further classified as large and medium scale, small scale and village industries. Highlights of programmes relating to public health, etc. have also been given separately. Lists of processes which have gone into production for the first time and released for the first time during 1977-78 together with the latest position with regard to patents have also been appended.

It is believed that the presentation of the report in this form would give a better picture of the efforts of CSIR, the relative emphasis being given to different areas of work and the general direction in which the activities of CSIR are channelled.

RESEARCH UTILIZATION AT A GLANCE

During the year, forty-eight processes went into production (Appendix I) and eighty-one 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 nearly 1110, out of which 450 processes were reported to be in production. Six processes were released to firms in foreign countries (Appendix III).

M/s Adhunik Ita Tiles (P) Ltd, Biratnagar (Nepal) have set up a "High draught kiln" based on CBRI know-how.

During the year, nearly 650 sponsored research schemes having a contract value of over Rs 780 lakhs, were in operation in the CSIR Laboratories. Work on 120 such schemes was completed.

The Laboratories had 228 consultancy assignments valued at more than Rs 26 lakhs. One hundred and three assignments were completed.

Patents

During the year, 118 patents were filed, 140 were accepted and 94 were sealed, in India. In foreign countries, six patents were filed, two accepted and four sealed (Appendix IV).

Royalties received/receivable through NRDC for the year 1977-78 are furnished below :

Premia	...	Rs 15.000 lakhs
Royalty	...	Rs 50.000 lakhs
Total	...	Rs 65.000 lakhs

CSIR AND RURAL DEVELOPMENT

The Harijan Evan Nirbal Varg Avas Nigam Limited, U. P. approached the Central Building Research Institute (CBRI), Roorkee, for the provision of designs and technical know-how for construction of houses for the landless labourers. The designs have been prepared for providing a one room accommodation (permanent skeleton only) costing about Rs 1060 and a room and a verandah (full house with mud floor) costing about Rs 3000. CBRI also undertook to prepare the scheme for constructing refugee houses at Hastinapur (Meerut) for the Ministry of Rehabilitation. The cost of this house has been estimated to be Rs 4100. The houses will be constructed by the Rural Engineering Services Department of U.P.

The Regional Research Laboratory (RRL), Bhubaneswar, has designed and fabricated a prototype unit of fish meal plant to process 120 kg 'C' class marine fish and fishery wastes per batch for cottage scale production of fish meal, having specification of good quality fish meal. The know-how has been supplied free of cost to a number of parties.

The Regional Centre of the Central Indian Medicinal Plants Organization (CIMPO) at Haldwani, has helped farmers to take up large scale cultivation of ergot for the first time in the tarai region of U. P. As a result of extension work and transfer of technology by the Regional Centre, about 10 tonnes of Peppermint oil, 10 tonnes of *Mentha citrata* oil and 200 kg of *Mentha arvensis* oil and one tonne of ergot worth Rs 230 lakhs were produced in the tarai area.

Due to the efforts of the Regional Centre of CIMPO, Bangalore, presently about 800 hectares are under Geranium, 40 hectares under Davana in Karnataka State, and 2000 hectares each under Citronella and *Catharanthus roseus*. These together will result in saving of considerable amount of foreign exchange.

The crop of *Salvia sclarea* (for oil of clary sage) was introduced for the first time in the Kashmir valley by CIMPO to meet the requirements of the perfumery industry.

Extension activities were continued by the Regional Research Laboratory (RRL), Jorhat, in Yaongyimsen village of Nagaland. A distillation still (600 kg/day) for Citronella oil and the Paper Slate unit (200 slates/day) offered by the Laboratory are in operation.

The National Geophysical Research Institute (NGRI), Hyderabad, has continued planned efforts under a collaborative project on 'Exploration and Management of Groundwater Resources'. The first phase of integrated geohydrological studies in the Lower Maner Basin has been completed. Sponsored surveys for groundwater prospecting were undertaken in several areas of the country.

Large scale field trials were undertaken by the National Chemical Laboratory (NCL), Pune, in collaboration with the Directorate of Irrigation Research & Development, Maharashtra in the reservoirs near Pune using the ethylene oxide condensate produced by a Bombay firm at the Labora-

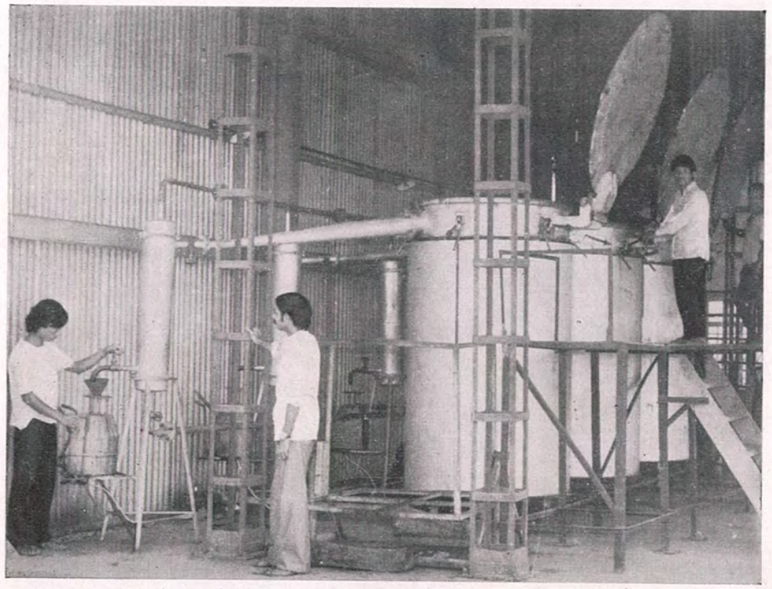
tory's instance. It has been observed that nearly 30 per cent evaporation loss can be saved by this technique. The saved water was allowed to be used by farmers in the command area of the reservoir and thus they were able to raise summer crops in their fields.

The National Environmental Engineering Research Institute (NEERI), Nagpur, carried out a massive programme of deworming in Avandi, a village 18 km from Nagpur on the Nagpur-Bhandara Road. This was the biggest single attempt of medication for deworming to be undertaken in Vidarbha and will ultimately improve the general health status of the people. The Institute has also completed the health survey of the eighth village Ajani near Nagpur.

NEERI has conducted a Rural Sanitation Programme in collaboration with the Zilla Parishad, Nagpur. Over 810 hand-flushed water-seal latrines have been put up in 10 villages.

The Structural Engineering Research Centre (SERC), Roorkee, evolved designs for 2 m^3 and 3 m^3 bio-gas plants. It has been shown that considerable savings in cost can be effected by using these designs. A few 3 m^3 bio-gas plants based on the SERC designs were commissioned on a trial basis to evaluate their long term performance.

Distillation still for Citronella oil in a Nagaland village supplied by RRL, Jorhat

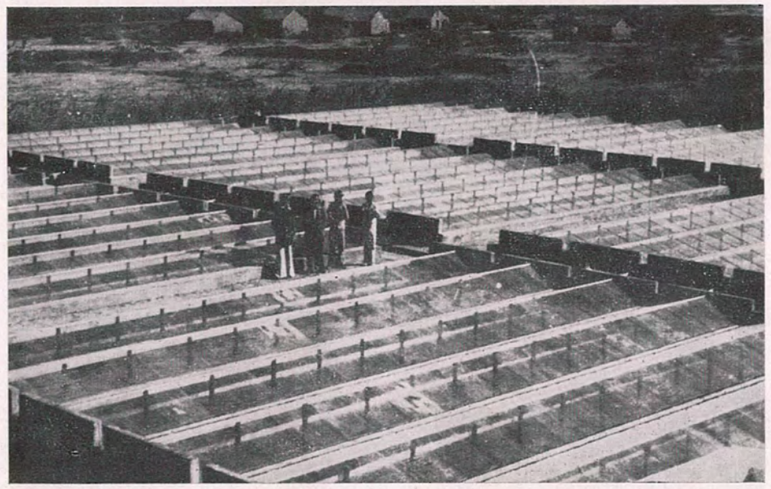


Under a project on 'Marine Aquaculture' the National Institute of Oceanography (NIO), Panaji, Goa, has perfected a technique for the culture of green mussel on ropes. This is in great demand in the poorer sections of coastal villages. The rope culture technique on floating raft has proved that it would fetch a profit of 180 per cent on investment. Efforts are on to popularize this technique among fishermen. The Institute has completed a study on beach erosion at Thumba in Kerala and suggested measures to protect rural coastal areas. A number of studies on 'protection of coastal waters from pollution' have been completed. These are of direct interest to fishermen and coastal population dependent on living resources of coastal waters.

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has established a solar still of capacity of 5,000 litres per day in the village Avania, about 11 km from Bhavnagar. The plant supplies drinking water to the inhabitants of the village. The water is free from fluoride, a health hazard, otherwise present in the village.

The Central Food Technological Research Institute (CFTRI), Mysore, has developed a pedal operated machine which can produce about 2,000 rectangular leaf cups per day of 8 hours. This will be helpful in providing employment to village artisans.

Solar distillation plant installed by CSMCRI at Avania village, near Bhavnagar



The Mechanical Engineering Research and Development Organization (MERADO) at Madras has designed and developed pump head, India Mark II, for deep well hand pumps to be used in rural community water supply. Work has been done in collaboration with WHO/UNICEF. Based on this design, about 30,000 pump heads were reported to be in various stages of production during the year.

The Central Mechanical Engineering Research Institute (CMERI), Durgapur, designed a small experimental plant capable of producing about 250 litres of fuel gas from a fixed charge of water hyacinth. Further work is in progress in collaboration with the U. P. Government Gobar Gas Research Station, Ajitmal.

Deep well hand pump (India Mark II), designed and developed by MERADO, Madras and installed at a depth of about 30 m in Poonthandalam village, Chingleput District, Tamil Nadu.



BENEFITS TO THE PUBLIC SECTOR

The Structural Engineering (Regional) Research Centre (SERC), Madras, has developed an on-site pre-fabrication system on the basis of which, construction of 144 residential flats by the Tamil Nadu Housing Board at Madras was completed.

The Cement Research Institute of India (CRI), New Delhi, has developed designs for reinforced and prestressed concrete crossarms for 11 kV transmission line poles for the Rural Electrification Corporation Ltd, as an alternative to the steel and timber crossarms widely used at present. The designs are cheaper by about 50 per cent than steel crossarms.

The Central Food Technological Research Institute (CFTRI), Mysore, has evolved a flavour composition and supplied it to M/s Modern Bakeries for test marketing in Madras, Bombay and Delhi. In the initial stages, the flavour composition has been provided by the Institute to the Modern Bakeries for supply to bottlers. The soft drink is known as '77'.

On the basis of know-how developed at the Central Fuel Research Institute (CFRI), Jealgora, Dhanbad, a 2 tph pilot plant was commissioned in February, 1977 at Lodha Colliery at Bharat Coking Coal Ltd, to collect design data for scaling up of oil agglomeration process for demineralization of coal which holds good potentialities for the treatment of coking coal slurries, washery middlings and lower seam coals of the Jharia coalfield for metallurgical use.

A 70 kOe superconducting magnet of homogeneity of 0.01 per cent together with a 70 amp/8 V energizer and stainless steel cryostat were designed, developed and fabricated by the National Physical Laboratory, New Delhi, under sponsorship of M/s Bharat Heavy Electricals, Hyderabad. This is the first time that industry has come forward to sponsor development in the area of superconductivity and marks the beginning of further developments in magneto-hydrodynamics, superconducting motors and generators.

The Central Electronics Engineering Research Institute (CEERI), Pilani, has developed a versatile and relatively low cost synchronized slide projector system which has been taken up for production by M/s Central Electronics Ltd, Sahibabad, U. P.

The Central Scientific Instruments Organization (CSIO), Chandigarh, has provided specialized and critical assistance to many public sector organizations in the country. Among them are : optical components to the National Instruments Ltd, Calcutta, critical components and dials to the Hindustan Aircrafts Ltd, Lucknow, a core memory pattern generator for the Central Electronics Ltd, Sahibabad, and foam level controllers for the fermenters of the Indian Drugs & Pharmaceuticals Ltd, Rishikesh.

The National Institute of Oceanography (NIO), Panaji, Goa, has completed a number of surveys for the benefit of Oil & Natural Gas Commission. These include : the survey of oil pipeline routes from Bombay to Bombay High, Bombay floating light to Karanja island, and Bassein to Hajira and

Tarapur; sewage pipeline survey for the Bombay Municipal Corporation and surveys for Central Board for Prevention and Control of Water Pollution. The indigenous know-how has resulted in the saving of crores of rupees in foreign exchange.

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has given technical assistance and a project report to M/s Hindustan Salt Ltd, Kharaghoda, for the establishment of bromine plant. The plant has been established by M/s Hindustan Salt Ltd in collaboration with a consulting engineering firm and is expected to be commissioned this year. The Institute has completed a sponsored research scheme for M/s Indian Petrochemicals Corporation Ltd, Baroda, for the treatment of raw water to be used for cooling purposes by continuous counter-current ion exchange technique.

Another sponsored research scheme has been completed by CSMCRI for M/s Indian Petrochemicals Corporation Ltd, Baroda, for 'Solar evaporation and disposal of waste caustic stream'.

The Industrial Toxicology Research Centre (ITRC), Lucknow, helped the Hindustan Insecticides Ltd, in compiling toxicity reports for the registration of 'methoxy chlor', a product developed by HIL.

The construction work on the first phase of Mathura Oil Refinery Township has been completed according to the Master Plan prepared by CBRI.

CFRI completed a series of investigations on the problem of spontaneous combustion of coal vis-a-vis its carriage in ships for export by the nationalized coal industry. These were undertaken at the instance of the General Insurance Company, Bombay and as a result, the embargo exclusively on shipment of Indian coals to certain areas during particular periods, has been lifted for 10 years and extra (penalty) premium to be paid waived.

The Central Mechanical Engineering Research Institute, Durgapur, completed the design of a miniature electro-slag refining plant on behalf of the Alloy Steels Plant, Durgapur. Several other problems were also successfully solved by the Institute for the benefit of the Durgapur Steel Plant, the Rourkela Steel Plant and the Garden Reach Workshop, Calcutta.

R & D FOR INDUSTRY

LARGE AND MEDIUM SCALE INDUSTRIES

Messrs Blundell Eomite Paints Ltd, Bombay, have commenced production of an anti-corrosive paint based on the process developed by the Regional Research Laboratory (RRL), Hyderabad. The paint is suitable for use on ship bottoms and steel surfaces for protection against corrosion.

The National Metallurgical Laboratory (NML), Jamshedpur, has developed an import substituting product — electrical resistance alloy for heating elements — eliminating the usage of nickel in its composition. M/s Cable Works (I) Ltd, have started production of this alloy.

NML know-how on the production of electrolytic manganese dioxide (EMD) has since been translated into commercial production by M/s T. K. Chemicals Ltd, Bombay, in their 1000 tpa plant at Trivandrum. The plant is utilizing the waste liquor from the nearby M/s Travancore Titanium Products Ltd. The EMD produced by the firm has been well received by the dry cell battery industry. The technical know-how on production of copper-lead and leaded bronze bimetallic powders has been released to M/s Paras Metal Powders, Nasik, who have commenced trial production. The technology for the preparation of liquid gold has been transferred to M/s Andeep (India) Ltd, New Delhi.

On the basis of a process developed by RRL, Hyderabad, M/s Hyderabad Carbons and Chemicals Ltd, Hyderabad, have started trial production of active carbon from coconut shell. High-grade gas-absorbent active carbons which are now being imported will be produced.

On the basis of the work of RRL, Hyderabad, a new non-steroidal anti-inflammatory drug, RH_8, has now been cleared by the Drug Controller for manufacture and marketing. M/s Unichem Laboratories Ltd, Bombay, who had sponsored this work over the last many years and who are also the licensees of the process will undertake the manufacturing and marketing of the drug soon. This drug is covered by two Indian patents of CSIR.

Based on the know-how developed at the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, Kumardhubi Fireclay and Silica Works Ltd, Calcutta, have started commercial production of bloating type refractories, used extensively in the casting pits of steel plants. A technology for the production of high silica (96% SiO_2) glass has also been evolved. U-tubes for thermocouple cartridges made from this glass were found to be satisfactory on test at TISCO, Jamshedpur.

The new light-weight jute bagging for cotton developed by the Indian Jute Industries Research Association (IJIRA), Calcutta (reported last year), has been subjected to large-scale proving trials in the USA during 1977. Based on the successful performance, the National Cotton Council of America, has recommended the unrestricted use of this new bagging in the USA during the next cotton harvesting season. The jute cotton bagging has thus been able to regain its traditional market in the USA which was lost to the synthetic substitute.

The electrolytic process developed by the Bombay Textile Research Association (BTRA), Bombay for reducing the consumption of hydro-sulphite in vat dyeing has now been made available to non-members also. A demonstration unit was sent to RBA, West Germany. Negotiations are in progress for licensing this process to certain parties in the UK and USA.

The South India Textile Research Association (SITRA), Coimbatore, has investigated problems relating to both technological and economic aspects of optimum utilization of cotton. Among them may be specifically mentioned the 'System of Double Carding' which provides the advantages of the tendem carding with a simpler means of conversion.

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has fabricated a Reverse Osmosis plant of 10,000 litres per day for Ion Exchange of India Ltd. This was continuously operated for eight months in the presence of party's representatives.

The Central Mining Research Station (CMRS), Dhanbad, has designed and developed one close circuit and another open circuit hydraulic props for use as mine roof support. Both the designs are being commercially exploited by M/s Usha Telehoist Ltd, Calcutta. The closed circuit system is also being exploited by M/s Mashatro India Pvt. Ltd, Calcutta.

RRL, Hyderabad has prepared technical grade methyl 2-benzimidazole carbamate (MBC) and formulated MBC. These have been approved by the Central Insecticides Board. A commercial plant for which the Laboratory has provided the basic engineering design, is being set up by the Hindustan Mineral Products Ltd, Bombay.

The Laboratory has also completed work on process development for mono-crotophos. It is ready for demonstration to the licensees, M/s Sudarshan Chemical Industries Ltd. This process forms part of a complex coming up at Roha for manufacturing a group of pesticides and intermediates for which the Laboratory is supplying the technological know-how.

The Regional Research Laboratory (RRL), Jorhat, has prepared a know-how package on the pesticide Phosphamidon consisting of process know-how and basic design based on extensive pilot plant investigations. The developed technology is expected to have a distinct edge over the conventional process. The process know-how (Level II) of Phosphamidon is ready for release.

Large scale work on dephosphorization of manganese ores by dilute acid leaching and agglomeration of the dephosphorized product has been carried out by the Regional Research Laboratory (RRL), Bhubaneswar, for Manganese Ore (India) Ltd, Nagpur as a sponsored project.

The Cement Research Institute of India (CRI), New Delhi, has developed and produced on laboratory scale a new type of cement called 'PORSAL' combining the properties of ordinary portland cement, high-alumina cement and sulphate-resistant cement, and having a relatively low firing temperature, 1300°C.

The Central Mechanical Engineering Research Institute (CMERI), Durgapur, has developed a semi-automatic electro-chemical marking machine for marking brand names and monograms on a wide range of metallic products. The machine is very simple in construction and economic in working. Know-how has been licensed to industry. An electronic weigher for mine tubs has also been developed. It has been put under long term testing on aerial ropeway.

The Mechanical Engineering Research and Development Organization (MERADO), Madras, has designed and developed hydraulically operated wide leather shaving machine of 1250 mm width. M/s Shalimar Engineering Works (P) Ltd, Calcutta, has manufactured the machine as per MERADO design.

Pan sintering studies of iron ore fines on 15 kg scale with limestone as flux have been completed by RRL, Bhubaneswar. On the basis of the results achieved in laboratory trials, a pilot sintering plant of 1 tonne capacity is being set up at Kalinga Iron Works, Barbil, in order to use sinters in the low shaft furnaces.

RRL, Bhubaneswar has developed a process for the preparation of ammonium vanadate from vanadium sludge which is a byproduct of alumina industry and is an unconventional source of vanadium. Phosphate and fluoride byproducts present in the sludge can also be recovered. The process has been referred to NRDC for commercialization.

Low carbon sift magnetic iron required in signal and telecommunication fields in Railways has been developed at NML and commercial heats were undertaken in an industry for further evaluation. The soft iron is at present being imported. The process for the production of dense carbon aggregates has reached the stage of transfer and is ready for release to industries.

The Central Electrochemical Research Institute (CECRI), Karaikudi, has developed Titanium Substrate Insoluble Anodes as substitute for graphite in chlor-alkali industry. By using these anodes, a saving of 10 per cent in the electricity consumption can be effected. These anodes have been installed in one of the biggest mercury and diaphragm cells (150 kA at Gwalior Rayon, Nagda) and these cells are functioning satisfactorily.

RRL, Bhubaneswar has completed studies on 5 kg scale on the reduction roasting of laterite nickel ores using solid reductants/furnace oil followed by leaching with ammoniacal ammonium carbonate solution including ammonia recovery. About 90 per cent extraction of nickel and 90 per cent recovery of ammonia have been achieved on this scale. Studies on extraction of nickel from the overburden of chromite mines containing about 1 per cent nickel have been carried out in a similar way and it has been possible to recover more than 90 per cent of the metal-powder.

The National Chemical Laboratory (NCL), Pune, has standardized a process on a pilot plant scale of 10 kg/batch for Dimethoate (technical

grade) and necessary basic engineering design data collected. Based on the data collected, a complete process package has now been prepared. The technology is ready for release to industry.

A micro-film reader with 4 different magnifications and facilities to read 35 mm micro-films and film strips and micro-fiches has been developed by the Central Scientific Instruments Organization (CSIO), Chandigarh, under the sponsorship of the Department of Science and Technology for wide use in Indian libraries and documentation centres. The know-how has been released to the National Instruments Ltd, Calcutta, for commercial exploitation.

CSIO has developed an Echoencephaloscope, a sophisticated neuro-diagnostic instrument. The instrument has been clinically evaluated at the Post Graduate Institute of Medical Education and Research, Chandigarh. The know-how is ready for release to industry.

The Tocklai Experimental Station, Jorhat, of the Tea Research Association (TRA) has designed and developed a continuous tea roller, which makes tea rolling a continuous process of the present batch process. It reduces connected power load by 50 per cent in orthodox tea factories and electricity consumption by 35 per cent per kg of processed tea. The roller has been licensed for commercial production after a series of proving trials at Tocklai and in commercial tea estates.

SMALL SCALE AND VILLAGE INDUSTRIES

One of the unique features of the work of SITRA is the contribution it has been making to the improvement of the decentralized sectors comprising the Handlooms, Powerlooms and Knitting Industry. This has been achieved:

- By establishing powerloom service centres in order to improve their quality, efficiency and diversify their products for catering to indigenous as well as export markets.
- By undertaking research on ways and means of improving the handloom sector from the point of view of quality and economy and also assisting the sector in the production of sophisticated fabrics for catering to the changing consumer pattern.
- By transferring modern methods of technology to the knitting industry and assisting it to diversify their products from the manufacture of traditional undergarments to the production of outer garments for catering to both the indigenous and the export markets.

The work in these areas has also great relevance to the present day socio-economic conditions in providing wider job opportunities and rural development.

A mini rice mill had been developed by the Central Food Technological Research Institute (CFTRI), Mysore (incorporating all the features of a modern rice mill), for ultimately replacing the hullers in the country. Among the 15 entrepreneurs who have taken designs of the mini rice mill, three have begun fabrication.

On the basis of processes provided by RRL, Hyderabad, M/s Enpi Chemical Works, Bangalore, have started commercial production of glycerol monostearate and esterified wood rosin. These emulsifiers are widely used in food and confectionery industries.

The Indian Institute of Petroleum (IIP), Dehradun, has developed process for production of FIA grade silica gel used for estimation of aromatics, olefins and saturates in gasolines and kerosenes. Based on these, M/s National Chemical Industries have started production.

After successful laboratory investigations, a process for the production of para-tertiary butyl phenol has been licensed by IIP to M/s Percynic Chemicals Ltd, Bombay for further development and scale up work.

The National Physical Laboratory (NPL), New Delhi, has developed and released processes for Carbon Thrust Bearings and Electrographite Dynamo Brushes, both finding application in the automobile industry. At present these bearings are being imported and their annual demand is quite high. The process for the manufacture of electrographite carbon brushes, is an import substitution based on raw materials available within the country.

CGCRI has developed a low-cost technology for the production of glass fibres from 'C' type glass rods which are commercially available in the country. The fibres made by this process were found to be suitable for the manufacture of fibre reinforced plastics (FRP).

The Central Electrochemical Research Institute (CECRI), Karaikudi, has worked out a process for recovering gallium metal from sodium aluminate liquor obtained in the bauxite digestion units of aluminium plants. The laboratory scale trials have been successfully completed in a unit capable of producing 50 g of the metal/day. Setting up of a pilot plant capable of producing 200 g of gallium/day at the factory site of one of the aluminium plants in India is under active consideration.

A process has been worked out by CECRI for plating lead effectively on to aluminium plates up to a thickness of 20/μm. The know-how for this process has been released to a private firm in the Calcutta region. An electrolytic process has been worked out by the Institute for the production of glyoxalic acid from oxalic acid. It is possible to isolate the pure product easily by this process.

A simple process has been developed by the Institute for the recovery of zinc metal from galvanizers' ash by the electrolysis of a suspension of the ash in acidic solution. The licensees have commenced commercial production based on this know-how.

A high speed continuous process has been developed by CECRI for the forming of high grain etched aluminium foil. These formed foils are used in the production of low voltage electrolytic aluminium capacitors.

The Central Leather Research Institute (CLRI), Madras, has developed a new method of curing raw hides and skins with a mixture of organic compounds obtained from neem oil. This will dispense with the use of common salt, a major pollutant in tannery effluents. The use of compounds has been found to be satisfactory, as seen from the comparative tanning experiments using wet salted skins and the skins treated with the compounds.

The Institute has also formulated a solvent fatliquor blend completely from indigenous fatliquors and a commercially available solvent which is also economically priced. By this blend, a stable emulsion is obtained which is found to exhaust satisfactorily. One of the main advantages is that the tanners can easily prepare this blend in their own tanneries from indigenous fatliquors in use.

CSIO has given a lot of direct assistance to the small scale industry in matters of execution of their instrumentation production programmes. More than 400 such industries have been served during 1977.

RRL, Bhubaneswar has developed a new floatation column for the beneficiation of natural graphite to produce high purity graphite of 96 per cent pure carbon which is extensively used in dry cells, paints and pigments, pencils, crucibles, muffles, lubricants, etc. The know-how has been released to M/s Carbons India, Khammam, A.P. Know-how for hydro-distillation unit has been released to M/s Gupta Sons & Co., Calcutta and M/s B.N. Patnaik, Bhubaneswar. Know-how for ultrasonic therapy unit has been released to M/s G.K. Electromed, Bangalore and M/s Electrosonics, Bhubaneswar.

The Silk & Art Silk Mills' Research Association (SASMIRA), Bombay, has investigated problems relating to production techniques of man-made textiles and their blends thereby assisting in defect-free production. During the year, a total of 228 such technological problems were attended to.

COLLABORATION WITH MINISTRIES/GOVT DEPARTMENTS

Follow-up studies conducted by the Industrial Toxicology Research Centre (ITRC), Lucknow, among the workers at Ordnance Equipment Factory, Kanpur, who complained of breathlessness, cough and pain in chest while handling hemp fibres after a course of hyposensitization with hemp antigen revealed some improvement in their condition.

The National Aeronautical Laboratory (NAL), Bangalore, received jointly with the ISRO Satellite Centre the NRDC Independence Day Award for creative contribution in developing successfully a vertical dynamic balancing machine for balancing of the Aryabhatta.

The Laboratory has also successfully completed the design development, fabrication and commissioning of an electrohydraulically controlled large vertical filament winding machine for fabricating FRP (Fibre Reinforced Plastics) pressure shells up to 1.5 m dia. and 4.2 m length.

Based on the IIP process for the manufacture of microcrystalline waxes, ONGC has designed and set up a pilot plant to produce micro waxes (mp 90-93°C) from Ankleshwar crude tank sediments at Baroda. For the first time in the country, these were exported to the USA. These are also being exported to other countries such as the U.K. and Germany.

ONGC has commissioned a plant for re-refining of used lubricating oils based on IIP know-how. IIP has also helped in the commissioning of this plant. The Institute participated in the first test run on Bombay High Crude conducted recently at Bharat Refineries Ltd, Bombay. Specific studies were also carried out for refining of this crude in the Cochin Refinery. Studies were also taken up to examine the use of Basrah (Iraq) crude at the Haldia Refinery in place of Aghajari crude.

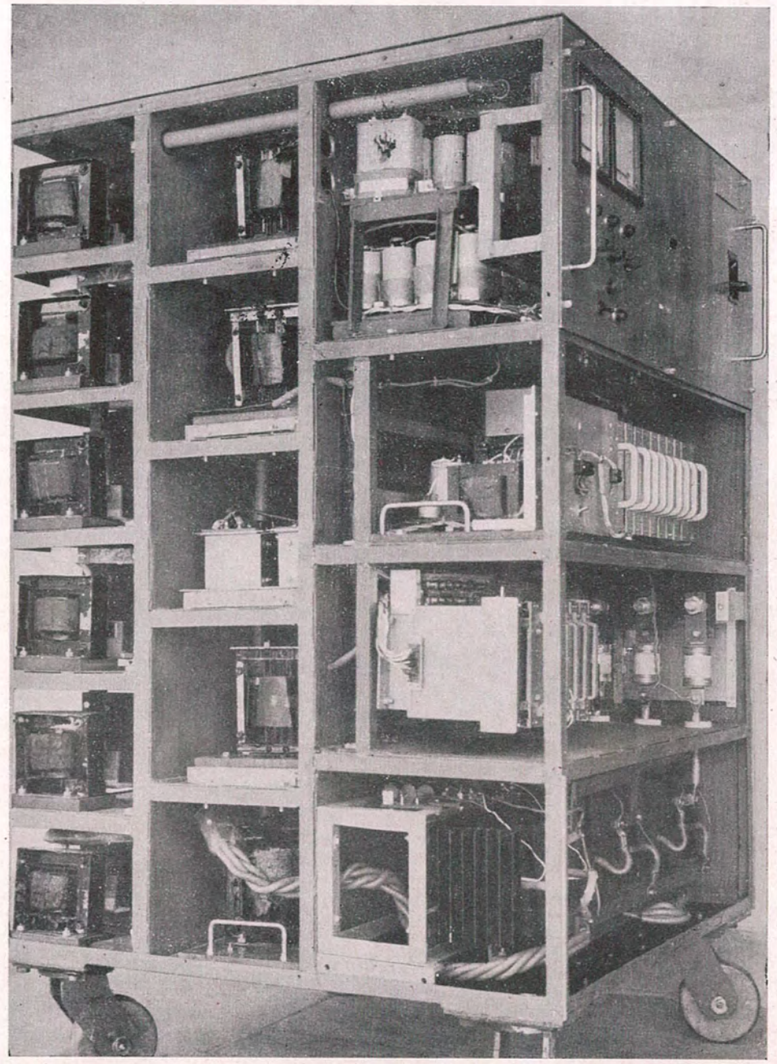
The National Geophysical Research Institute (NGRI), Hyderabad, has on the request of ONGC carried out Deep Seismic Sounding work in Gujarat along a 160 km long profile from Navibandar to Amreli and a 200 km long profile running between Mahmedabad and Navasari. Experimental resistivity surveys were carried out by NGRI to locate boundary of water-logged old and abandoned mines in Raniganj coalfields. Resistivity surveys were also carried out on Nhave Island off Bombay coast for determination of the thickness of top soil and depth to the bedrock.

RRL, Jorhat on a request by the Ministry of Petroleum studied the pipeline transportation problems of the waxy crudes of ONGC from eastern region and Bombay High. A report on 'Comparative evaluation of additive for transportation of waxy crude in India' was submitted to the Ministry.

CEERI has developed a 150 kVA Single Phase-to-Three Phase Thyristor Converter for Electric Locomotives, for the Indian Railways. This has gone into production at Electronics Corporation of India Ltd, Hyderabad.

NAL has designed, developed, fabricated and commissioned in the Laboratory a special purpose electrochemical machine for milling nozzle rings for Southern Railways. The machine and its accessories are all indigenous and have been designed for producing 75 nozzle rings per year.

150 kVA Single Phase-to-Three Phase Thyristor Converter developed by CEERI, Pilani for electric locomotives for the Indian Railways.



CFTRI analysed a total of 17,874 samples of fruit and vegetable products according to Food Products Order (FPO) and foreign buyer's specifications for ensuring quality control. Under a programme of revising FPO, 48 specifications have been redrafted and finalized for consideration by the Ministry of Agriculture and Irrigation.

The Government of Manipur approached the Central Building Research Institute (CBRI), Roorkee for providing them a suitable plan and speedy construction techniques for primary schools within limited cost. Keeping in view the special climatic conditions and likelihood of infestation of conventional wooden structures by white ants, this Institute in collaboration with concerned State Government agency developed a school design consisting of five rooms (7.32 × 6.1 m each), a Head Master's room and verandah and evolved new techniques for construction and management to achieve quicker execution within available resources. Construction of 80 primary school buildings consisting of 3 class rooms each was taken up in the first phase. Forty such structures have already been put up within two months' time and the rest are at various stages of construction.

RRL, Jorhat at the instance of Gujarat Mineral Development Corporation, Baroda, undertook in-plant experiments for beneficiation of Fluorspar using the dispersant developed at the Laboratory for preparation of metallurgical calcuim fluoride. The study indicated that 25-30% clay could be removed by this technique.

At the instance of Ministry of Petroleum, IIP has brought out reports on Demand projections for petroleum products 1976-77 to 1980-81 and 1981-83; Diesel fuel required for agricultural sector up to 1978-79; and Technoeconomic feasibility study for the production of naphthalene from lomex and other petroleum products.

Safety tests on special heavy rubber material developed by Defence Research Laboratory for construction of overhead tanks for storage of water in army camps were conducted by ITRC.

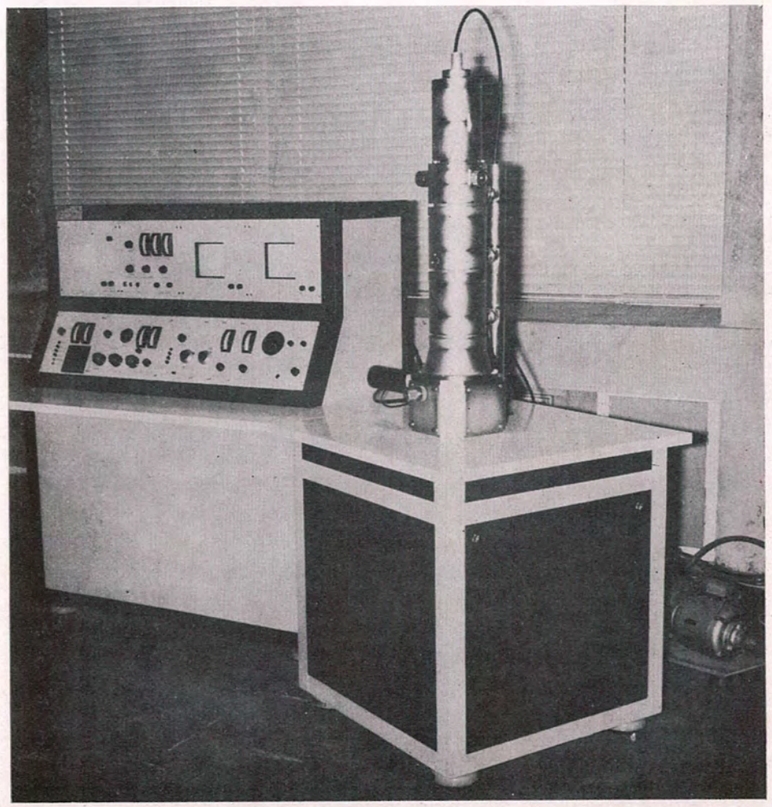
At the request of Metallurgical and Engineering Consultants (MECON), a subsidiary of SAIL, laboratory characterization of the coals and box coking tests on coal samples from Australia have been completed by CFRI.

INSTRUMENTATION

The Central Scientific Instruments Organization (CSIO), Chandigarh, has developed technical know-how for digital multimeter (AC/DC), digital panel meter, breath alcohol analyser, altimeter, and thermo-silico tester. These have been released to industries for commercial exploitation.

Design and development of scanning electron microscope was undertaken as a joint programme of CEERI, CSIO and NPL, under the sponsorship of the Department of Science & Technology. For laying down specifications, user representatives from the Bhabha Atomic Research Centre, Banaras Hindu University, and Indian Institute of Technology, Delhi have been consulted. The Central Electronics Ltd, the manufacturing organization, has been involved in the project throughout the development period.

Scanning Electron Microscope : CSIO, Chandigarh



A laboratory prototype has already been developed by CSIO and scanned pictures taken. A fully engineered first prototype will also be fabricated at CSIO shortly.

NGRI has fabricated a device (reflection calorimeter) to quantitatively estimate the reflectance of iron ore dust samples. This device will be very useful for the friability estimation of iron ores.

The Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad, has developed the following instruments for testing and process control : Fibre Bundle Strength Tester; Nip Load Meter; Roller Eccentricity Tester; Suction Pressure Gauge; Starch Refractometer; and Fabric Abrasion Tester. These have also been released for commercial use.

With the help of Appleton Laboratory, Slough, England, a Rapid Response Electronic Rain Gauge and Rate Meter has been designed and fabricated by NPL and this has been used successfully during the last monsoon season to record rainfall and rain rate variations with 10 seconds time resolution for the number of rain storms. The advantage of this equipment over the conventional ones used by India Meteorological Department with a much larger time constant, is that short term bursts of rain can be recognized and the maximum rate estimated more correctly.

Instruments developed by IIP are : Techocorder, Viscosity Controller, Vacuum Guard and Metallic Contact Indicator. Quite a few enquiries have been received from national laboratories placing order for supply of *p*H controller designed and fabricated by IIP. Steps are in progress to commercialize Rotational Slurry Viscometer.

BASIC RESEARCH

Some significant oriented basic research work was done by NPL in electrostatics and electro-photography, thin films, single crystals (study of properties and perfection), dielectric constant of gadolinium gallium garnet and alpha alumina (αAl_2O_3) - single crystals and infrared materials, detectors and systems. Extensive investigations on the structure, imperfections, ordering and other physical properties of liquid crystals were undertaken.

With the availability of liquid helium facility and the international effort at establishment of Josephson Voltage Standard based on superconducting tunnelling phenomena, the Laboratory has taken up oriented basic research in superconductivity to supplement its efforts on development of superconducting materials and systems. The studies undertaken during 1977-78 include in particular :

(i) Time dependent superconductivity, and
(ii) Hysteresis in Clarke Solder Blob junctions

Some basic studies on copper ferrites and Mn-Zn ferrites have also been undertaken. These include :

(i) Thermogravimetric study of the oxidation of $CuFeO_2$,
(ii) Study of oxidation kinetics of $CuFeO_2$ in the Cu-Fe-O system, and
(iii) Effect of doping a Mn-Zn ferrite with GeO_2 and SnO_2

Studies undertaken in the area of radio science are :

(i) Electron density and electron temperature models of the ionosphere
(ii) Ionospheric scintillations in UHF range,
(iii) Stratospheric problems, and
(iv) SODAR

Basic research at CEERI was mainly on the following themes :

(i) Study of contact phenomena in Gunn-Devices,
(ii) Transient behaviour of Electron Drift Velocity and impact ionization in semi-conductors, and
(iii) Development of Hetero Junction IMPATT Diodes

The studies in connection with three items have led to a clearer understanding of the behaviour of electrons in semi-conductors and at semi-conductor interfaces. They also make a contribution towards developing the fabrication technology for special semi-conductor devices like Gunn Diodes, IMPATT Diodes and BARITT Diodes, etc.

Studies have been made on electron optical properties of Synklysmotron lenses (CSIO). These new types of lenses incorporate microwave techniques in the field of electron optics, and provide a practical system design to correct spherical aberration of conventional electron lenses without introducing any chromatic aberration. Therefore, these can be used to improve the performance of scanning, transmission and high voltage electron microscopes.

Furthermore, a new type of lens system which makes use of time-varying fields is being investigated for low voltage scanning electron microscope which has several distinct advantages over high voltage scanning electron microscopes available in the market.

In order to understand the movement of the Indian plate and various tectonic phases of the Himalayan orogeny, palaeomagnetic studies were carried out (NGRI) on a large number of Himalayan rocks collected from different formations. A number of oriented rock samples collected from precambrian dolerite dykes near Bangarpet, Hansur, Holenursipur, Tiptni and Chitaldurg were also studied.

Fault plane solution, direction of rupture propagation and source parameters have been determined for two earthquakes of Burma-India border region using P, S and surface waves. A southward movement of the Burmese block near the syntaxial bend is inferred.

Upper mantle velocity structure in the Hindukush region was determined to a depth of 310 km from the analyses of P and S wave travel times of 51 deep earthquakes using analytical method. Similar studies have been also carried out for the Japan region. Using a new analytical method, the upper mantle shear-wave velocity structure in Japan region has been determined from S-wave travel time. This research suggests that there is no direct indication of the existence of a low-velocity channel for S-waves in upper mantle beneath the Japan region.

Toxicity of heavy metal to the green mussel, *Mytilus viridis* was evaluated by short-term bioassays at NIO. The sequence of descending toxicity for 8 metals tested was as follows:

$$Hg > Cu > Zn > Cd > Ni > Co > As > Pb$$

The rate of accumulation of the metals in the mussel was also determined.

Studies on the living resources of the Arabian Sea and Bay of Bengal based on the research vessel *Gaveshani* samples, again confirmed that the Arabian Sea is richer in exploitable living resources. *Trichodesmium* blooms off Goa were found to be associated with high concentrations of nutrients. The extracellular products in the sea seem to be largely contributed by nanoplankton organisms (NIO).

NCL has standardized a method for the rapid multiplication of teak seedlings by tissue culture. By this method 25-50 seedlings can be obtained from one seedling in a year. NCL has also developed a method by which two new varieties of turmeric can be multiplied rapidly by tissue culture to yield 100,000-200,000 seedlings per year from one rhizome compared to only 5-10 seedlings by conventional methods.

Investigations at NBG on the simplification of the synthetic medium devised earlier for the mass propagation of *Dioscorea floribunda* have resulted in the formation of a much simpler and, therefore, cheaper medium consisting of only four ingredients, excluding even agar agar. This cuts

down the cost of the medium, and consequently, of the *in vitro* raised plants, considerably. Culture media have been developed for the mass multiplication of *D. composita* and *D. deltoidea* by tissue culture technique.

NBG has isolated some interesting lines by cross-breeding of large number of temperate varieties of Opium Poppy (*Papaver somniferum* Linn.). A number of pure lines have also been developed. A hybrid variety developed by crossing pure lines of Dhaturia and Kali Dandi varieties, has shown considerable hybrid vigour and yields 52 kg/ha opium on dry weight basis as compared to 37 to 39 kg/ha by the present varieties.

CIMPO has developed a process for isolation of Colchicine, one of the important alkaloids mainly used for treatment of gout. Initial experiments with the widely growing *Gloriosa superba* have shown that an yield of 0.018-0.024 per cent of Colchicine can be obtained from roots on air-dry weight basis. Pilot scale studies are under way.

A sponsored project for the development of a process for clonidine, an anti-hypertensive drug, was completed and the process has been demonstrated to the sponsor by CDRI.

Laboratory scale methods have been standardized by CDRI for the new anti-malarial, daraprim and primaquine; the anti-leprosy drug, lamprene, and the anti-fertility agent ethacridine lactate and these are now being scaled up.

A sponsored project for the development of a process for Diloxanide furoate, an anti-amoebic drug, was completed by CDRI and the know-how handed over to the sponsor.

DISSEMINATION OF INFORMATION

The work on three more volumes of 'Indian Coals', an encyclopaedic document of the quality of all the coals, has since been completed by CFRI. These are in addition to three other volumes completed earlier.

The Publications and Information Directorate (PID), New Delhi, has started an Industrial Information Service. A bimonthly bulletin, *Industrial News Digest,* is being brought out under this project. The Bulletin of Indian Raw Materials and their Utilization is being brought out with effect from 1977 in two series: (A) dealing with current literature on medicinal and aromatic plants and (B) dealing with current literature on the economic plants, other than medicinal and aromatic. Series A of the Bulletin is being brought out under the Medicinal and Aromatic Plants Information Service (MAPIS).

The Indian National Scientific Documentation Centre (Insdoc), New Delhi has been carrying out an experimental project, viz. Selective Dissemination of Information (SDI) with the collaboration of the Indian Institute of Technology, Madras. A fully computerized system, SDI uses Chemical Abstracts Condensates (CAC) and INSPEC magnetic tapes. Requests were received from 225 scientists for CAC and 175 scientists for INSPEC, out of which 125 and 50 respectively were serviced during this year. In the West, South, Central and South-East Asia, India is the first country to have successfully run such a service.

The Birla Industrial & Technological Museum (BITM), Calcutta, has organized thirteen District Science Fairs in collaboration with the Dept of Youth Services, Government of West Bengal. The fairs were held in Bankura, Burdwan, Birhum, 24-Parganas (South), 24-Parganas (North), Midnapore, Howrah, Hooghly, Murshidabad, Nadia, Purulia, Malda and Jalpaiguri Districts.

The Visvesvaraya Industrial & Technological Museum (VITM), Bangalore, has organized a State level Science Fair in collaboration with the Education Department of Government of Karnataka. Sixty-three schools from 18 districts of Karnataka and 16 Bangalore schools participated in this fair with 235 exhibits and 158 participants. About 25,000 people visited this Science Fair. Two Divisional level Science Fairs, one in the Belgaum Division at Bagalkot and the other in the Gulbarga Division at Bellary were organized during the period under review. Ninety-three schools with 270 exhibits participated in the Belgaum Division Science Fair. Sixty-three schools with 185 models participated in the Gulbarga Division Science Fair. The fairs were visited by about 13,000 people.

The Management Development Unit of the Planning Division of the CSIR Headquarters continued to organize in-service training programmes in different aspects of R & D management. In addition, for the first time, the unit organized an orientation programme on 'Science and Society' for the benefit of the Principals of Kendriya Vidyalayas in response to the request from the Ministry of Education and Social Welfare. The primary

objective of this programme was to instil in the participants an appreciation of the role of science in society and through them disseminate the values of scientific enquiry to the school children.

CSIO, Chandigarh, published the second enlarged edition of the Directory of Scientific Instruments and Components manufactured in India, containing useful information about and serving as a data bank to the instruments industry.

INTERNATIONAL COLLABORATION

The first phase of the research-cum-demonstration projects on 'Slow Sand Filtration for Small Communities' has been completed and the final report has been submitted to the World Health Organization, International Reference Centre (WHO-IRC) for Community Water Supply, the Hague, the Netherlands. India is represented by NEERI and is among the six participating countries in this international programme which is coordinated by the WHO-IRC. Data have been collected for design, construction and operation of slow sand filters suitable for rural and small communities. An experimental filter plant has been erected in the Institute's premises.

CFTRI is an associated institution of the United Nations University (UNU) under the World Hunger Programme. Ten UNU fellows have joined the centre and commenced their programmes in various areas of post harvest technology of food materials. Eight senior UNU fellows have visited the centre for varying periods and held discussions for building new R & D institutions in post harvest technology of food in Thailand, Indonesia, Sudan, Tanzania and Mexico.

CBRI has designed compaction under-reamed pile foundations for transmission line towers in Dubai. Fifteen designs were prepared to cover several cases of different types of transmission line towers. In all 600 piles for several tower locations were constructed under the supervision of scientists of the Institute.

Consultancy services were imparted by CSMCRI to two parties including a foreign firm, M/s Saudi Automatic Salt Refinery, Jeddah, Saudi Arabia. Technical know-how has been given to Government of Somalia for the establishment of solar stills of 5000 litre per day capacity at Khuda, Somalia.

Under UNIDO assignments consultancy services were provided by a team of experts from CSIO, Chandigarh in preparing a comprehensive report for production of medical appliances in Arab countries. Technical consultancy was also rendered by an expert from CSIO to the National Institute of Instrumentation, Bandung, Indonesia in optical instruments design and development under a UNESCO assignment.

The first phase of the project 'Marine Environmental Monitoring and Marine Living Resources Assessment Programme for the Indian Ocean' sponsored by the United Nations Environment Programme was completed by NIO and the report published. The second phase of this project and IGOSS project, Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) were continued.

The expertise of NIO was made available to the Council of Scientific and Industrial Research Organisation, Sydney, Australia for sorting and identification of zooplankton.

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HEADQUARTERS ACTIVITIES

The Planning Division continued its activities relating to the Annual Plans of the national laboratories, monitoring and evaluation and coordination of their R & D programmes. By the year end, the Division finalized the draft Medium Term Plan of the organization for the years 1978-83 incorporating the new perspective based on the socio-economic objectives of the national plan. The Annual Plan 1978-79 was also finalized for presentation to the Planning Commission. The Centre for the Study of Science, Technology & Development continued its researches on problems of Science and Society interface, Science planning and brought out a number of publications and continued to publish the Current Literature on Science of Science (CLOSS). A number of lectures and seminars by eminent scientists were organized. The Management Development Unit of the Planning Division organized a R & D management workshop for the benefit of scientists and technologists of the Tea Research Association. For the first time, they organized a programme sponsored by the Ministry of Education & Social Welfare (*see* under Section *Dissemination of Information*).

The Technology Utilization Division maintained a close link and communication with the National Research Development Corporation of India and the CSIR laboratories in the matter of utilization of CSIR technologies. Further, the Division represented CSIR in the Technical Evaluation Committee constituted by the Ministry of Industry. The Division coordinated the visits of delegations under the India-UNIDO agreement on transfer of technology, from Turkey and Sri Lanka. The Project Officers of the Polytechnology Transfer Centres, visited nearly 534 industrial units and handled more than 250 problems with the cooperation of the national laboratories and other R & D institutions. Under the scheme for grant of leave for CSIR scientists for setting up of industries, 6 scientists/technologists were sanctioned special leave during the year.

The Extra Mural Research Division administered 200 new research schemes for financial assistance during the year. Six Emeritus Scientists were selected for grants. More than 2000 award letters for research fellowships were issued by the Division during this period of which about 1500 joined. The number of junior, senior and post-doctoral fellows working as on 1st November, 1977 was 1958, 467 and 278 respectively. Grants were given for holding symposia/seminars on topics of relevance to CSIR. Grants were given to ten language periodicals for popularization of science in Indian languages.

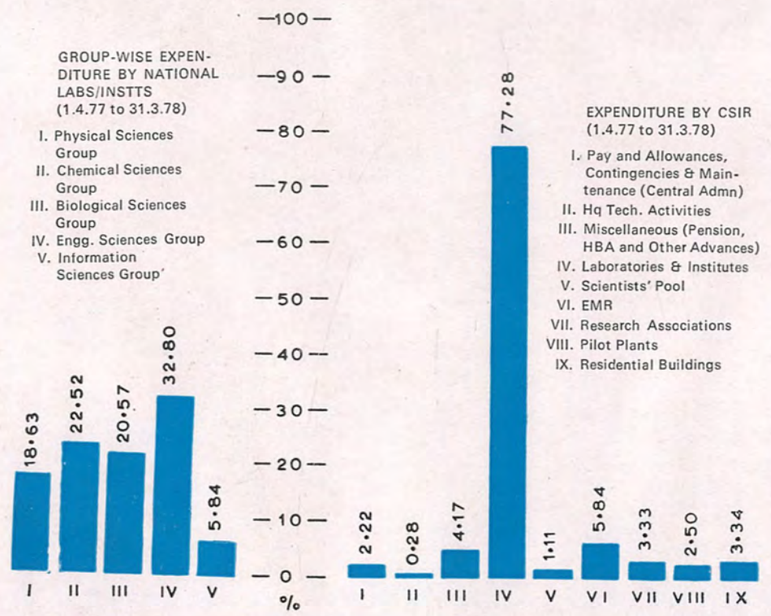
The Division for Scientific and Technical Personnel has prepared a Specialists' Register, containing computerized information on over 20,000 persons, with academic specializations or professional experience, to assist in locating suitable personnel for various purposes.

TOTAL EXPENDITURE 1977-78

(Rupees in lakhs)

PARTICULARS	NON-PLAN	PLAN	TOTAL
1. CENTRAL ADMINISTRATION			
i) Pay & Allowances, Contingencies, Maintenance	108.757	8.565	117.322
ii) Headquarters Technical Activities	12.964	6.025	18.989
iii) Miscellaneous (Pension, Advances, etc.)	212.932	17.437	230.369
2. LABORATORIES/INSTITUTES	2562.192	1468.472	4030.664
3. SCIENTISTS' POOL	59.359	—	59.359
4. RESEARCH SCHEMES, SCHOLARSHIPS & FELLOWSHIPS	169.650	134.874	304.524
5. INDUSTRIAL RESEARCH ASSOCIATIONS	100.000	75.818	175.818
6. PILOT PLANTS	—	138.026	138.026
7. RESIDENTIAL BUILDINGS	174.017	—	174.017
Grand Total	3399.871	1849.217	5249.088

Note : Figures given are tentative.



APPENDIX I

PROCESSES WHICH HAVE GONE INTO PRODUCTION FOR THE FIRST TIME IN 1977-78

	Process	Party	Nature of Licence
CECRI			
1.	Iron powder from mill scale	(i) The Metal Powder Products, Ambattur	Non-exclusive
		(ii) Malwa Metal Products, Ratlam	do
2.	Self regulating high speed chrome salt formulation	Navarathna Chemicals, Bangalore	do
3.	Zinc from galvanizers ash	(i) G. P. P. Micro Metals, Pune	do
		(ii) Sethia Metals & Alloys P. Ltd, Bikaner	do
CEERI			
4.	Electret condenser microphone	Microsonics, Pilani	do
5.	Semi-conductor processing equipment	J. C. Gupta, New Delhi	do
6.	Transistorized excitation control system for DE locomotives	Heavy Engineering (I) Ltd/ECIL	Sponsored work
CFTRI			
7.	Dehydrated green pepper and buff coloured white pepper	(i) Pepper India Corpn, Kottayam	Non-exclusive
		(ii) Spicex Chemicals Pvt. Ltd, Mysore	do
		(iii) Kalpaka Processing Co. Kottayam	do
		(iv) Kirthika Agencies, Trivandrum	do
8.	Instant rasam and sambhar	Western India Bakers (P) Ltd, Bombay	do
CGCRI			
9.	Casting pit refractories	Kumardubi Fireclay Silica Works, Calcutta	do
CMERI			
10.	Electronic belt weighing machine	M/s Associated Cement Cos. Ltd, Bombay	Sponsored
11.	High speed paper lapping machine	M/s Guest Keen Williams Ltd, Calcutta & M/s Noakhali Machine Tools Ltd, Calcutta	do
12.	Rotillor (MERADO, Poona)	M/s Satpuda Engg. Industries, Bombay & M/s Greenfield Tractors & Implements (P) Ltd, Ghaziabad, U.P.	Non-exclusive through NRDC

APPENDIX I — Contd

	Process	Party	Nature of Licence
13.	Pump Head (India) Mark II, suitable for deep well hand pump to be used in rural community water supply (MERADO, Madras)	WHO/UNICEF	As per UNICEF orders M/s Richardson & Cruddas (1972) a Govt. of India Undertaking is manufacturing pump heads based on the MERADO design
CMRS			
14.	Catalyst filament for methanometer	K. S. Associates Pvt. Ltd, Calcutta	Non-exclusive
CSIO			
15.	Digital *p*H meter	Digital Instrument Corpn, Baroda	do
16.	Thermo-silicon tester	Toshniwal Instruments, Delhi	do
17.	Foetus Stethoscope	(i) Erma, Chandigarh	do
		(ii) Transtronix, Baptala	do
18.	Cardiac Monitor	Electro Medical & Allied Instruments, Calcutta	do
19.	Patient Monitoring System (TV display)	Instrument & Chemical Co., Ambala City	do
20.	Digital Multimeter	(i) Digital Instrument Corpn, Baroda	do
		(ii) Naina Electronics Pvt. Ltd, Chandigarh	do
		(iii) Vaishika Electron Devices, Ambala Cantt.	do
21.	Digital display for flame photometer	Photoelectric Industries, Jodhpur	do
22.	Digital clock/timer	Digital Instrument Corpn, Baroda	do
23.	Electrostatic photocopying machine objective, 180 mm, f/4.5	Precision Optics & Machineries Pvt. Ltd, Calcutta	do
24.	Breath alcohol analyser	National Instruments Ltd, Calcutta	Exclusive
25.	Scanning objective for electro-fax type of copying machine	Universal Optics, Roorkee	Non-exclusive
26.	Bubble chamber scanner	Andhra Scientific Co., Machillipatnam	do
NAL			
27.	Fibre glass epoxy based etched copper terminals by manual process	Fralis, Bangalore	do
28.	Spark erosion machine	Tool Craft, Bangalore	Sponsored work
NCL			
29.	Carbazole dioxazine violet pigments	Square Chemicals, Bombay	Non-exclusive
30.	Dimethyl aniline	Sahyadri Dyestuff & Chemicals Ltd, Poona	Sponsored work

	Process	Party	Nature of Licence
31.	*p*-Menthane hydroperoxide	Camphor & Allied Products Ltd, Clutterbuck Gunj, Bareilly	Exclusive
32.	Phenyl acetic acid	Superanil Chemical Industries, Poona	Non-exclusive
33.	Terpeneol	Dujodwala Industries, Bombay	do
NEERI			
34.	Chloroscope	Gudimani Enterprises, New Delhi	do
35.	Membrane filter	Elic Corporation, Bombay	do
NGRI			
36.	D. C. earth resistivity meter	Elico Pvt. Ltd, Hyderabad	do
NML			
37.	Bimetallic powders	Paras Metal Powders, Nasik	do
38.	Electrolytic manganese dioxide	T. K. Chemicals Ltd, Trivandrum	do
39.	Vanadium pentoxide from aluminium sludge	S. G. Enterprises, Ranchi	Sponsored work
NPL			
40.	Fabrication/reconditioning of cathode ray/TV picture tubes	Video Tronics, New Delhi	Non-exclusive
41.	Liquid crystal thermal devices	Dimple International, New Delhi	do
42.	Natphyl vacuameter—Industrial McLeod gauge	Vacuum Enterprises, New Delhi	do
RRL, Hyderabad			
43.	Glycerol monostearate and esterified wood rosin	Enpi Chemical Works, Bangalore	Sponsored work
44.	Speciality paper	Fompac Pulp & Paper Industries, Hyderabad	Non-exclusive
RRL, Jorhat			
45.	Multi-speed cycle hubs	Multi-speed Hubs Ltd, Mysore	do
IIP			
46.	FIA grade silica gel	National Chemical Industries, Ghaziabad	do
47.	Microcrystalline wax	ONGC, Ankleshwar	Sponsored work
TRA			
48.	Continuous tea roller	Steelsworth, Tinsukhia	Non-exclusive
		Trade & Industry, Tezpur	do

APPENDIX II

PROCESSES RELEASED TO INDUSTRY FOR THE FIRST TIME IN 1977-78

	Process	Party
CBRI		
1.	Boards for use in building and other construction work	Benguet Electric Corpn, Manila, Philippines
CDRI		
2.	Protein hydrolysate	Aristo Pharmaceuticals Pvt. Ltd, Bombay
3.	Sulphamethoxazole	Dolphin Laboratories Pvt. Ltd, Calcutta
4.	Clonidine	Sarabhai Research Centre, Baroda
5.	Diloxanide furoate	Themis-Orgasyn Chemicals, Bombay
6.	Cyproheptadine	Kembiotic Collaborators, Bombay
CECRI		
7.	Corrosion prevention in reinforced concrete and brick construction	Manar Chemicals & Anti-corrosive Industries, Nasik Road
8.	Para-amino benzoic acid from para-nitro benzoic acid	Poompuhar Chemical Industries, Madras
9.	Si-Mg Alloy	Spheroidal Castings Ltd, Madras
10.	Acid inhibitor in solid form	Chief Engineer, Pamban Bridge Project, Madras
11.	Portland cement coating on steel	Chief Engineer, Pamban Bridge Project, Madras
12.	Rust prevention composition	do
13.	Glyoxalic acid	Bush Boake Allen India Ltd, Madras
CEERI		
14.	Citizen band transreceiver 100 MW and 30 MW	Punjab wireless systems Ltd, Chandigarh
15.	Piezoelectric vibration pickup	Rouzan Electronics, Muzaffarpur
16.	R.F. induction furnace 1.2 kW	Pal Industries, Sangrur
17.	T.V. service wobbulator and sweep generator	Bhalla Electronics Sales Corpn, Ambala Cantt.
CFRI		
18.	Flyash bricks	West Bengal Housing Board, Calcutta

	Process	Party
CFTRI		
19.	Citrus fruit extractor	Mysore Precision Engg, Mysore
20.	Methyl bromide	Mysodet Pvt. Ltd, Bangalore
21.	Cashew kernel drier, design drawings	Premier Engg Co., Cochin
22.	Mini maize mill, design drawings	8 parties
23.	Mini rice mill, design drawings	18 parties
24.	Improved process for manufacture of garlic powder	Garlic Corporation, Jaora
CLRI		
25.	Censesols 12, 30, 74, 360	Akbar Mumtaz, Madras
26.	Cationic fat liquor cencatacol-O	do
27.	Syntan, PKR	Pilar River Plate Corpn, New Jersey, USA
28.	Urethane varnish based on castor oil as top coat	Chhalaria Eurochem, Bombay
CMRS		
29.	40-Tonne hydraulic prop (open circuit system)	Usha Telehoist Ltd, Calcutta
30.	20-40 Tonne hydraulic prop (closed circuit system)	Mashtro (India) Pvt. Ltd, Calcutta
CSIO		
31.	Altimeter	Durga Enterprises, New Delhi
32.	Breath alcohol analyser	National Instruments Ltd, Calcutta
33.	Thermo silico Tester	M/s Toshniwal Engg Co., New Delhi
34.	Microfilm reader	M/s National Instruments Ltd, Calcutta
CSMCRI		
35.	Filter aid	White Chemicals, Bhavnagar
36.	Potassium nitrate by ion exchange method	Widfield Chemicals, New Delhi
37.	Solar salt works	Jeddah Automatic Laundries, Jeddah (Saudi Arabia)
IIEM		
38.	Gelatin optical filter	Prakash Chemical Laboratory, Poona
NAL		
39.	Electronic load weighing system for static weigh bridge	Narne Tulman Mfg. (P) Ltd, Hyderabad
40.	Vibration endurance test system	International Instruments Pvt. Ltd, Bangalore
NCL		
41.	Trichlorobenzene	Mycol International Agents, Madras

APPENDIX II—Contd

Process	Party
NEERI	
42. Chloroscope	Gudimani Enterprises, New Delhi
NML	
43. Clay-graphite stopper heads	Patna Estate Graphite Mining Co., Titagarh, Orissa
44. Liquid gold	Andeep (India), New Delhi
45. Vanadium pentoxide	Rase Metals and Chemicals, Ranchi
46. Magnesium inoculant briquettes for production of nodular cast iron	Dawani Traders, Calcutta
NPL	
47. Electrostatic air filters	Amar Plastics, Bombay
48. Natphyl vacuameter—Industrial McLeod gauge	Vacuum Enterprises, New Delhi
49. Cryoprobe for eye surgery	Indo-Burma Petroleum Co., Bombay
RRL, Bhubaneswar	
50. Beneficiation of natural graphite	M/s Carbons India, Andhra Pradesh
51. Steam distillation unit	M/s Gupta Sons & Co., Jhargram, West Bengal
52. Ultrasonic therapy unit	M/s Electromed, Bangalore
RRL, Hyderabad	
53. α-(3-Pentadecyl phenoxy) propionic acid and α-(3-pentadecyl phenoxy) isobutyrate	Unichem Laboratories, Bombay
54. Edible protein flour from cotton seed	Karnataka Agro-proteins Ltd, Bangalore
55. Monochloro acetic acid	MCA Chemicals Ltd, Hyderabad
56. Esterified wood rosin	Enpi Chemical Works, Bangalore
57. Glyceryl monostearate	Enpi Chemical Works, Bangalore
58. Sulphur suspension wettable	IA & IC Pvt. Ltd, Bombay
59. UDMH, manufacture of	Defence Research & Development Laboratory, Hyderabad
RRL, Jorhat	
60. No-carbon-required paper	Titagarh Paper Mills Co. Ltd, Calcutta
61. Theophylline from caffeine	Assam Drugs & Pharmaceuticals Ltd, Jorhat
62. Paper roofing sheet	M/s P. K. Enterprises C/o Rai Bahadur Chuni Lal & Sons, Jorhat, Assam
RRL, Jammu	
63. Cedar wood oil rectification	Sangam Essential oil, Samba
64. Citric acid from sugar by fermentation	Andhra Citrates Pvt. Ltd, Hyderabad
65. Colchine from *Gloriosa superba* tubers	Kothari Physiochemicals, Madurai

Process	Party
SERC	
66. Prestressed cement concrete sleepers	Jay Prestressed Products Ltd, New Delhi
CMERI	
67. Domestic oven	M/s Nusearch Enterprises, Calcutta
68. Electrochemical marking machine	M/s Vanaz Engineering (P) Ltd, Poona
69. Electronic belt weigher 200 tph	M/s Associated Cement Cos. Ltd, Bombay
70. Miniature electroslag refining plant (Design)	M/s Alloy Steels Plant, Durgapur
71. Power Tiller	M/s Garden Reach Shipbuilders & Engineers Ltd, Calcutta
72. Design & development of a continuous agitating processing cooker for canned fruits (MERADO, Madras)	The Malabar Coast Products, Kottayam, Kerala
73. Design & development of hydraulically operated wide leather shaving machine-1250 mm (MERADO, Madras)	NRDC/Shalimar Engineering Works, Calcutta
74. Magnetic load cell (MERADO, Madras)	Electromag Methods, Bombay
75. Nipple forming (by cold squeezing process) powered machine (MERADO, Ludhiana)	M/s Teg Forgings & Stampings, Ludhiana
76. Formulation of draft specifications for testing small tools and hand tools (MERADO, Ludhiana)	Hand Tools Manufacturers Association, Jullundur
77. Design and setting up of a test laboratory for pest control equipment (MERADO, Ludhiana)	M/s Sigma Steel Industries, Ludhiana
78. Quality investigation of sugar machinery components (MERADO, Poona)	M/s Backau Wolf New India Engg Works Ltd, Poona
79. Development & modernization of special purpose turning machine (Ring lathe) (MERADO, Poona)	M/s Bombay Ring Travellers Co. Ltd, Thana
80. Modified design for orbital surface finishing and deburring machine (MERADO, Poona)	do
TRA	
81. New specifications for chasing—CTC roller	C. M. Ho & Co., Dibrugarh Trade & Industry, Tezpur

APPENDIX III

PROCESSES RELEASED TO FIRMS IN FOREIGN COUNTRIES

1.	Board for use in buildings (CBRI and RRL, Jorhat)	Philippines
2.	Spice oleoresins (CFTRI)	Malaysia
3.	Syntan PKR (CLRI)	USA
4.	Solar water still (CSMCRI)	Saudi Arabia
		Somalia
5.	Electrolytic manganese dioxide (NML)	Burma
	Potassium schoenite (CSMCRI)	do
	Menthol (RRL, Jammu)	do
	Orange juice concentrate (CFTRI)	do
	Miltone (CFTRI)	do
	Sodium alginate (CSMCRI)	do
6.	Optical designs of microscope objectives and eyepieces (CSIO)	Philippines

APPENDIX IV

PATENT APPLICATIONS FILED, ACCEPTED AND SEALED IN INDIA AND ABROAD DURING 1977-78

Labs.	In India			In Foreign Countries		
	Filed	Accepted	Sealed	Filed	Accepted	Sealed
CECRI	16	26	18	5	2	—
RRL (Bhub)	14	6	4	—	—	—
RRL (Jorhat)	10	15	10	1	—	—
CDRI	6	11	9	—	—	2
NPL	5	12	11	—	—	1
RRL (Hyd)	6	1	2	—	—	—
CMRS	5	2	2	—	—	—
CMERI	5	—	5	—	—	—
NCL	3	2	1	—	—	—
CEERI	3	18	4	—	—	—
NIO	4	1	1	—	—	—
CLRI	3	—	—	—	—	—
NML	2	12	5	—	—	—
CFRI	2	14	3	—	—	—
CBRI	1	1	1	—	—	—
CSIO	1	—	—	—	—	—
CGCRI	1	—	1	—	—	—
CFTRI	1	—	1	—	—	—
CRRI	1	—	—	—	—	—
IHD (CSIR)	1	—	—	—	—	—
SERC	1	2	—	—	—	—
NEERI	1	—	—	—	—	—
NAL	1	—	1	—	—	—
CSMCRI	1	2	2	—	—	—
MERADO	—	1	2	—	—	—
CIMPO	—	—	3	—	—	—
RRL (Jammu)	—	1	1	—	—	—
SRIFIR	—	1	3	—	—	—
SITRA	4	1	2	—	—	—
IRMRA	1	1	—	—	—	—
IPIRI	1	—	—	—	—	—
ATIRA	1	1	—	—	—	—
Schemes	5	4	2	—	—	—
IIP	4	4	—	—	—	—
BTRA	—	—	—	—	—	1
IJIRA	8	1	—	—	—	—
Total	118	140*	94	6	2	4

*Includes patents accepted this year but filed earlier.

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