

INDIAN  
INSTITUTE OF  
CHEMICAL  
TECHNOLOGY



50

**EVENTFUL YEARS**



BY  
BHARAT BHUSHAN





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**50**

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**INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY**  
(Council of Scientific & Industrial Research)  
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## FOREWORD

**F**ifty years is a long period in the life of any R&D institution, particularly if it had to traverse through different terrains. When established in August 1944 as Central Laboratories for Scientific and Industrial Research (CLSIR) through a Royal Decree by the Nizam of erstwhile Hyderabad State, the laboratory was mandated to scientifically explore and exploit the natural resources for industrial development of the State. CLSIR, right from its inception, was structured as a multi-disciplinary laboratory to fulfil its charter. After the merger of Hyderabad State with the Indian Union in 1948, the impact of some of the on-line projects at the CLSIR transcended the geographical boundaries of the State and acquired a national character. It was not surprising therefore that the CLSIR joined the main stream of national R&D and was taken over by the Council of Scientific and Industrial Research (CSIR) in 1956.

Prior to the take-over, two types of laboratories existed under the umbrella of CSIR, either these were discipline-oriented or commodity oriented. No multi-disciplinary R&D set-up, as obtained at the CLSIR, existed in the CSIR. After deliberation, CLSIR was renamed as the Regional Research Laboratory (RRL) specifically to retain its multi-disciplinary character. No boundaries were delineated for its R&D working. Though RRL, Hyderabad had become a full-fledged national laboratory like any other laboratory under CSIR, it had to work hard to shed off the stigma associated with the word "Regional" and finally it emerged as a front line and premier R&D institute with focus on chemical sciences and technology. On my presentation this fact was well-recognized by the Review Committee of the CSIR headed by Shri Abid Hussain and the Laboratory was appropriately re-named as the Indian Institute of Chemical Technology (IICT) in 1989.

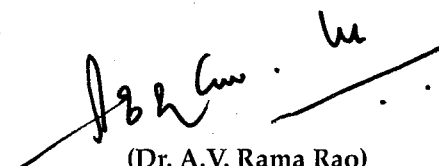
During this period, many events and personalities had profound influence on the evolution, development and present status and stature of the institute. It was considered desirable to record these developments in the form of a book and bring it out as part of the IICT Golden Jubilee activities.

Writing of such a book was a hard task, as it required not only a bent of mind for history and flair for narration but also an intimate knowledge of happenings at the institute during most of the period of its existence to put the events in correct perspective. Many names came to my mind for this assignment but finally, I requested Shri Bharat Bhushan, former Deputy Director of the Institute to write the book.

Shri Bharat Bhushan was among the first group of Scientists joining Dr. S.Husain Zaheer at CLSIR in 1950. During his service of almost three decades he was closely associated first with Dr. Zaheer and subsequently with Dr. G.S.Sidhu and had personal knowledge of all important events and functioning of the laboratory. Shri Bhushan is thus best suited to write a book of this type. In addition to his personal knowledge, he has put in commendable effort in collecting and collating information on the laboratory from various documents and records for writing of this book.

The book may be taken as a case study on evolution and establishment of a R&D laboratory in the modern India and I hope it will be found useful as a reference material.

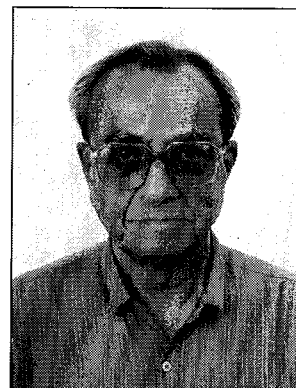
Hyderabad  
March 27, 1995



(Dr. A.V. Rama Rao)  
Director, ICT

## ABOUT THE AUTHOR

**S**hri Bharat Bhushan was among the first group of scientists who joined Dr. S.Husain Zaheer at the Central Laboratories for Scientific and Industrial Research (CLSIR) in 1950. Born in January 1921, he had his early education at Quetta and later at Lahore where he studied under Dr. S.S.Bhatnagar and Professor Carter Spears. On obtaining his M.Sc. degree in Applied Chemistry, he continued research work at the Forman Christian College, Lahore. After partition, he moved to Delhi and joined Dr. S. Siddiqui at the Chemical Laboratories of the Council of Scientific and Industrial Research then located at the Delhi University campus.



At the CLSIR, he continued his work on utilization of Indian turpentine and other essential oils. He was associated with the development of technologies for Citicide (a pesticide), Lounginin (a flavouring agent), benzyl chloride, terpineol and sodium azide.

In 1962, he was moved to head the Operational Research, Technical Information and Liaison Division (now Planning, Coordination and Liaison Division) where he continued till his voluntary retirement in 1979 to take up an assignment abroad. On his return from foreign assignment he was a consultant to the laboratory during 1982-83. Even after this period, he has kept himself abreast with the activities of IICT.

As Head of ORTIL Division, he refined Operational Research techniques, introduced and implemented management information service, project planning and evaluation. He was actively engaged in preparation of various plans and documents of the laboratory. As a member of committees appointed by the CSIR, he prepared basic documents on setting up of Regional Research Laboratory at Bhopal, evaluation of Extension Centres of CSIR and on Project Karimnagar - Philosophy & Action Plan. His report on Agricultural Residues and their Utilization in South and South East Asia prepared at the request of FAO was well accepted. Shri Bharat Bhushan is happily married to Mohini Bhushan and his son and both the daughters are also scientists and are settled in USA.

**Dr. U.T.Bhalerao**  
Director's Grade  
Scientist  
IICT, Hyderabad.

## AUTHOR'S NOTE

The Indian Institute of Chemical Technology (IICT) has completed fifty years of its fruitful existence. To mark the occasion, the Golden Jubilee Celebration Committee decided to bring out a history of the Institute. When I was requested to undertake the assignment, I was taken aback since I am neither a historian nor am I given to writing. On insistent persuasion, I undertook the assignment with great deal of diffidence and humility.

History brings about a conceptual integration of past events with a view to making an objective study. In doing so it follows strict rules of method of science for ascertaining available facts. The knowledge thus acquired is expressed as a narrative. An institution is a social phenomenon. Its focal point is its interaction with society, even if an individual may have played the role of a leader and a pathfinder.

The history of the IICT has thus involved the operation and interaction of various factors which have affected and influenced people in evolving research and development strategies and programmes. It also reveals in retrospect how the central issues get blurred and even bypassed due to differing perceptions and attitudes having bearing on factors other than those related to the advancement of science and technology.

Sources like contemporary records, public and confidential reports, records of the Andhra Pradesh State Archives, personal papers of Dr. S.Husain Zaheer, agenda papers and proceedings of various committees, personal discussions with knowledgeable individuals, CSIR News, Institute's Bulletins, newspapers and journals were among those used for extracting material. Many records and documents were in various stages of decay due to improper handling and poor storage. Important papers like the Nizam's Firman establishing the Central Laboratories for Scientific and Industrial Research (CLSIR) in 1944 or its transfer to the Council of Scientific and Industrial Research and its renaming as the Regional Research Laboratory (RRL) in 1956, were 'not in place' - a euphuism for lost or destroyed (weeded out). Some personal papers of Dr. Zaheer were acquired by the Nehru Memorial Museum and Library, New Delhi. The remaining were found stacked on an open shelf in the Institute's stores, exposed to sun, dust, insects and birds.

Several people read through the manuscript and made invaluable suggestions. Dr. G.S.Sidhu saw the draft covering the period upto 1962. Two meetings with Dr. G.Thyagarajan were useful. He also went through the manuscript covering period upto 1985. I had only a brief discussion with Dr. A.V.Rama Rao. He, however, read through the manuscript and gave his comments.

Thoughtful comments came from Professor A. Rahman who had the manuscript covering period upto 1985. The recasting of material to focus attention on aggressions committed by the conservative elements was suggested by him but was not done in order to retain the flow of narration. The draft given to my son Anil for a casual reading drew some welcome suggestions. Useful comments came from Professor D. Balasubramanian. Discussions with

Mr. M.M. Hasan and Mr. T. Krishna Reddy during the course of writing have been specially helpful. I am grateful to one and all.

Painstaking proof corrections by Mr. Ch.V. Suryanarayana, Mr. Pradeep Kumar and Mr. M.M. Hamza is highly appreciated. The assistance of Mr. V. Nagamuni, Mr. V. Mohan Rao, Mr. R.R. Yadhu Krishna, Mrs. V. Sujatha and Mrs. Sundari for typing, Mr. Sarfarz Khan for photocopying and of Mr. M. Sreedhar Kumar for preparing the press-ready copy is gratefully acknowledged.

I must thank the authorities of the A.P. State Archives for enrolling me as a Research Scholar for a period of two months to enable me to search the relevant documents.

I am indebted to my wife Mohini, for keeping my spirit high and encouraging me to continue when occasional irritants would urge me to throw the whole thing in.

Hyderabad  
March 27, 1995

**Bharat Bhushan**

# INTRODUCTION

The Indian Institute of Chemical Technology (IICT) which completes its fifty years, is the oldest of National Laboratories under the Council of Scientific & Industrial Research (CSIR). Started as the Central Laboratories for Scientific & Industrial Research (CLSIR) by the then princely State of Hyderabad in 1944, it was taken over by the CSIR in 1956 and was renamed the Regional Research Laboratory (RRL). The present name, the Indian Institute of Chemical Technology, is more appropriate to its areas of activity and is also a recognition of the contributions made by the IICT in the field of Chemical Technology.

The CSIR came into being in 1942 as an autonomous body registered under the Societies Act. Two years earlier, the Board of Scientific & Industrial Research (BSIR) was constituted.

At the suggestion of the Government of India, a BSIR was also established in Hyderabad in 1942 and two years later CLSIR was created to carry out similar functions in Hyderabad State as were assigned to CSIR in British India. The Government Industrial Laboratory, which had been functioning for over two decades, was merged with CLSIR. The Hyderabad BSIR also became its part.

The colonial power, for its own good, divided the country into British India, ruled directly by the British through a Viceroy, and the Princely India consisting of over five hundred states of various sizes, dispersed all over the country as pockets, which were ruled by the Indian Princes but owed allegiance to the British Crown.

Hyderabad State which occupied a central and strategic position on the Indian peninsula, was the largest and premier princely State. Originally built on the ruins of Qutabshahi Kingdom of Golconda, it was annexed by Aurangzeb in 1687. Asif Jah-I was appointed the Viceroy and given the title of Nizam-ul-Mulk Bahadur Fateh Shah which became hereditary. The title was abolished in 1970.

In 1857, the astute Nizam, on advice of his Dewan, Salar Jung-I, sided with the British in the vain hope of regaining control of Berar Province which had, under an agreement, been 'pledged' to the East India Company. With the collapse of the Mughal Empire, the Nizam declared independence but, along with other Princely States, accepted the paramouncy of the British Crown. Ninety years later, the last ruling Nizam, Mir Osman Ali Khan, made another bid to recover Berar through two Firmans (Royal Decree) issued on the eve of the Indian Independence in 1947. The first Firman declared the annulment of the agreement entered with the East India Company pledging Berar and the other announced the annexation of Berar area of the British India. By a third Firman, the Nizam declared Hyderabad as an independent State reportedly on the advice of Kasim Razvi, the Razakar Chief. There were protracted negotiations with the Government of India for a 'Standstill Agreement' while consultations with Mohamamed Ali Jinnah, Zaffarullah Khan and Ghulam Mohd in Karachi

were also continued. On their advice, Laik Ali was appointed Prime Minister of Hyderabad and an appeal to United Nations was also made. These events coupled with large scale peasant revolts in the Telangana area threatening to spill across the borders, eventually led to 'Police Action' by the Indian Government in September, 1948 and Hyderabad joined the Indian Union. Hyderabad was a multilingual State with substantial Telugu, Marathi, Kannada and Urdu speaking populations together with a sprinkling of people from the Arab and some African lands who had joined the Nizam's army and stayed behind. This lent a unique cosmopolitan character to its culture; and various institutions and organizations bore its imprint. In 1956, the States in India were reorganized on the linguistic basis. This led to the trifurcation of the Hyderabad State and the formation of Andhra Pradesh. Hyderabad State thus 'withered away' but its character is still reflected in its art and culture and other endeavours. As a matter of fact, it has been further enriched by the merger of other Telugu speaking areas.

Mir Osman Ali Khan appointed talented persons to advise him on matters of State and public welfare. One of the first acts after his accession in 1911 was to set up the Osmania University (OU) in 1917 to promote higher education in an Indian language. It was a bold experiment to conduct teaching at all levels in Urdu with English as a compulsory subject. For this purpose appropriate text-books and treatises were brought out under the guidance of Moulvi Abdul Haq.

Speaking on the occasion of the opening of the OU's Arts College building, the Nizam said that like Urdu, the architecture of the building represented a blend of styles which was reflected in the pillars, tracteries and carvings. OU should not only be the repository of Hyderabad's best traditions but it should also aim at broadmindedness and tolerance. In a message to the Indian Science Congress soon after, he said "It is my earnest desire that the OU should cooperate with other Indian Universities in preparing the way for scientific renaissance and prosperity of India, and at the same time, secure for her an honoured place in the ranks of the nations who lead in enlightenment and culture."

Rabindranath Tagore said on establishment of the OU "I have long been waiting for the day when, freed from the shackles of a foreign language, our education becomes naturally accessible to all our people. It is a problem for the solution of which we look to our Native States." After the Police Action, the medium of instruction of OU was changed to English.

In the area of industrial development, an ambitious scheme, prepared by a British consultant, was based on the abundant coal resources of Hyderabad. It was visualized to convert the Adilabad-Karimnagar-Khammam belt into the so-called 'Manchester of East' by setting up industries in the area. Some industries did come up in the belt.

India had a long tradition of science and technology which not only permeated through its art and culture but it also led it to interact with societies elsewhere. As a result, its socio-economic structure was based on a sound balance between agriculture and industry which brought wealth and prosperity. The advent of the colonial rule with all its economic aggression and political suppression, however, disrupted this balance and reduced India to the status of a mere raw material supplier to the British industry. Due to lack of appropriate technological inputs into agriculture, the farming techniques could not be improved. Post-harvest losses continued to be high neither could adequate attention be given to combination

farming. The rural industry virtually withered away weakening the rural economy still further. These factors, along with extensive exploitation by the vested interests, led to social unrest which was treated only as a law and order problem.

The setting up of industries and promotion of science and technology were permitted to the extent of serving the British or imperial interest. It was thus that the organizations which were concerned with the assessment of land and its wealth were first created. Some of these are: the Geological Survey of India (1851), the Survey of India (1878), the Botanical Survey of India (1880) and the Zoological Survey of India (1916). Tropical diseases affected everyone alike and thus received attention. A Bacteriological Laboratory was established at Agra in 1892, the Plague Research Laboratory (renamed Haffkine Institute) at Bombay in 1899, the Pasteur Institute at Kasauli in 1900, the King Institute at Guindy in 1903, the Pasteur Institute at Coonoor in 1907 and the School of Tropical Medicine at Calcutta in 1910. The National Institute of Nutrition was started as the Nutritional Research Laboratories at Coonoor in 1918 and later moved to Hyderabad in the 1950's. The Imperial Council of Agricultural Research was set up in 1929 with research laboratories at Pusa and Izatnagar. Forestry and sericulture were also covered but industrial research got a back seat despite the recommendation of the Holland Commission which was set up after World War-I.

The first step in the direction of applied research appears to have been taken by Hyderabad State when the Industrial Laboratory was set up by the then Government in 1920's which became the forerunner of CLSIR/RRL/IICT. Its work involved 'scientific help and advice, analytical services, and investigations and research on industrial problems'. The areas of investigation on laboratory scale in 1940, for example, included: synthesis of known drugs; organic acids from vegetable wastes; denaturants for alcohol used as motor spirit; graphite and mica purification; fire-proof paints; enamels and glass for bangles; and examination of fibres. Similar laboratories were later set up in some British provinces.

Yet another pioneering effort to promote research and provide assistance to small industries was made by the Hyderabad Government through the creation of an Industrial Trust Fund. Many of the large pilot plants set up by the CLSIR were financed by the Fund.

A major advance in the direction of industrial research in India was made in 1935 when the Industrial Intelligence and Research Bureau (IIRB) was set up at Alipore for making a beginning and to lay the foundation on which a research organization suitable to the needs of the country could later be constituted.

In the meanwhile, the Indian National Congress which was leading the national liberation movement, set up in 1938 a National Planning Committee (NPC) with Pandit Jawaharlal Nehru as its Chairman and Professor K.T. Shah as the Secretary. Professor M.N.Saha and Professor P.C.Mahalanobis were its prominent scientist members. Nehru recognized 'science as a positive force for progress' and therefore wanted scientists to be closely associated with national planning. This put pressure on the Government to expedite industrialization of the country.

While the follow up action envisaged in the creation of IIRB, *viz.*, to constitute 'a research organisation suitable to the needs of the country', was being considered by the Government of India, came the World War-II.



The Americans, then deeply involved in the War, were concerned about the political situation in India which adversely affected the latter's participation in the War effort to the fullest extent. They sent a Technical Committee, called the Grady Mission, to India to assess India's potential as a War ally. The Mission held discussions with industrialists and scientists, but the recommendations of the Mission were lost in the red tape!

The pressure of the national independence movement and of Britain's War allies, together with the desperate need to keep the War supply-line well-oiled, persuaded the Government to create the infrastructure for the promotion of industrial research in India. Accordingly, the BSIR was set up in 1940 and the CSIR in 1942. Sir A.Ramaswamy Mudaliar, Commerce Member of Viceroy's Executive Council was Chairman and Dr. S.S.Bhatnagar, Director, Scientific and Industrial Research, CSIR and Mr. Ghulam Mohammed, Additional Secretary, Department of Supply, Government of India, were among the top-listed Members of the Society as well as the CSIR's Governing Body. Mr. Ghulam Mohammed, who later rose to the positions of Pakistan's Finance Minister and finally its Governor-General, played a leading role in the creation of the BSIR and CLSIR in Hyderabad. He visited Hyderabad during March 13-14, 1942 and held discussions with the Nizam and his Government in this regard. On May 24, 1942, he joined the Nizam's Executive Council as the Finance Member.

With the creation of CSIR in New Delhi, the Government of India requested the British Government for expert advice on the organization of scientific research in India. Accordingly, Professor A.V.Hill, Secretary of the Royal Society, London, visited India in 1943. During his 20-week stay, Professor Hill widely travelled over the country, visiting the centres involved in science and technology and the universities. He held discussions with the scientists, teachers, industrialists, government officials and several others. Among the places visited by him was Hyderabad and among the officials concerned with the organization of scientific research was Mr. Ghulam Mohammed.

About this time in 1943, a joint meeting of the CSIR and the Hyderabad BSIR was held at Hyderabad under the Chairmanship of Sir A.Ramaswamy Mudaliar. When the question of regional research laboratories in addition to the National Laboratories was discussed, it was felt that such laboratories would be useful in tackling urgent local problems. The institution of the National Research Laboratories had not materially altered the situation, as these could not, in the nature of things, be expected to find time to devote close attention to regional problems as "they will be busy with bigger problems of a national character."

Hyderabad being particularly rich in raw materials, especially vegetable oils, coal, various types of clays and a number of minerals, it was decided to create the CLSIR in Hyderabad State. Accordingly, a note embodying the proposal to set up the CLSIR was jointly prepared by the Departments of Commerce and Industry, Finance and Post-War Planning on February 18, 1944. It was vetted by the Nizam's Executive Council on March 20, 1944 and submitted to the Nizam for his approval and orders on May 10, 1944.

The note, justifying the need to create the CLSIR, dealt in detail with the efforts needed to set up new industries and to improve the existing ones. To raise the standard of living of the people, it was not only necessary to aid the industries but also to provide additional power, agricultural assistance, chemical fertilizers and modern agricultural implements. Agricultural and industrial progress was feasible only upon the appropriate utilization of natural resources

and that could be brought about only through scientific and industrial research conducted on a continuous basis. The note further emphasized that our own scientists must carry out these researches on the utilization of our own resources in our own laboratories.

Reviewing the existing infrastructure of Research and Development (R&D), the note recalled that with the onset of World War-II, the need for scientific and industrial research was felt in India too. Consequently, BSIR was set up in New Delhi. A similar organization was created in Hyderabad as well but its scope was limited and was confined only to the war effort. In addition, the Industrial Research Laboratory functioned under the Department of Commerce and Industry. But the scope of its researches was limited and not related to the basic industries. The staff members of the OU carried out researches on problems related to different chemical industries in their spare time. Lately, a Department of Applied Chemistry had also been established in order to facilitate investigations on oil and minerals. The Department of Agriculture had a small technical division which worked on specific problems and needed to be expanded suitably. The Department of Forests had no research infrastructure.

In view of the above, the note *inter alia* suggested that:

- i) The CLSIR be established on modern lines which will have separate research divisions concerned with
  - Industrial development
  - Agricultural chemicals
  - Forest products
  - Drugs
- ii) The proposed CLSIR have close collaboration with the OU. The latter will work on problems which have basic and educational bias while the proposed laboratory will have an application-oriented approach. The students would be able to avail of the facilities of the central laboratory and the scientists of the latter will have access to the OU laboratories on a mutual agreement. The arrangement had the approval of the OU Senate.
- iii) The newly established laboratories for research on oils and minerals be merged with the proposed central laboratory.
- iv) The affairs of the proposed CLSIR be managed by a Governing Body which will also oversee the work of BSIR and its Research Committees.

The note also sought approval of the Rules and Regulations and the Bye-laws of the CLSIR and of the composition of the Governing Body and the BSIR given as under:

**GOVERNING BODY (GB)**

President of the Executive Council	President
Member for Commerce & Industry	Vice-President
Member for Finance	Member
Member for Revenue	Member

Member for Public Health	Member
A Nominee of the OU Council	Member
A Joint Nominee of the Chamber of Commerce & Industry and the Mill Owners' Association	Member
Two Eminent Scientists from outside Hyderabad nominated by the Government	Members
A Scientist from Hyderabad nominated by the Government	Member
An Engineer from Hyderabad nominated by the Government	Member
Director, CLSIR	Member

### **BSIR**

Member for Commerce & Industry	President
Member for Finance	Vice-President
Managing Director, Nizam State Railway	Member
Secretary, Post-War Planning	Member
Secretary, Commerce & Industries	Member
Chief Engineer, PWD	Member
Director, CLSIR	Member
Director, Commerce & Industries	Member
Director, Mines & Geological Survey	Member
Inspector-General of Forests	Member
Director of Agriculture	Member
Director, Medical & Public Health	Member
Six Scientists nominated by the GB	Members
Three Industrialists	Members
Secretary, Governing Body (GB)	Secretary

The Firman by the Nizam, approving the above proposals was issued on August 5, 1944, when the Central Laboratories for Scientific and Industrial Research, Hyderabad came into being. That was fifty years ago.

نقل و حرکت  
۱۳۶۳ھ



## نقل و حرکت مبارک الخضریت قدر قدرت جنم پور لڈر بند گابغالی متفقہ ذیلاً

ملاحظہ - عرضداشت صیفہ تنظیم مابعد جنگ عروضا ۱۶ - جمادی الاول  
سنہ ۱۳۶۳ھ جو ملک کی معاشی - صنعتی و زری ترقی کیلئے مرکزی - صنعتی و  
سائنسیک ریسرچ کے تجربہ خانہ کے قیام مجلس نظامہ کی تشکیل وغیرہ کی نسبت ہے  
حکم - کونسل کی رائے کے مطابق ریسرچ کے تجربہ خانہ کے قیام مجلس  
نظامہ کے تشکیل کی منظوری دیجاتی ہے جس کے اخراجات مجوزہ گنجایش بحولہ سے  
ادا کئے جائیں گے اور مجوزہ تجربہ خانہ سے چاہے عثمانیہ کے ارتباط کے  
حدود و دیگر تفصیلات کا تعقیبہ ایک مشترکہ کمیٹی سے کرایا جائے جو مجلس اعلیٰ  
اور گورنمنٹ کے نمائندوں پر مشتمل ہوگی - اور گورنمنٹ کے نمائندہ کے انتخاب کا  
انتخاب رکن متعلقہ کو دیا جائے اور تجربہ خانہ کی نظامت پر چاہے عثمانیہ کے  
شعبہ کیمیا کے پروفیسر ڈاکٹر مظفرالدین قریشی کا تقرر کیا جائے مگر یہ تقرر  
استحاناً ذکر سال کے لئے تصور ہوگا جو حسب حال چاہے عثمانیہ کے پروفیسری  
کی خدمت میں انجام دینگے اور ان کے فرائض اور تجربہ خانہ کے دائرہ تحقیقات وہی  
ہونگے جس کی صراحت عرضداشت میں کی گئی ہے - (شرح دستخط مبارکہ )  
۱۵ - شعبان المدعوم سنہ ۱۳۶۳ھ

نقل و حرکت مبارک  
۱۳۶۳ھ

True copy of Firman dated August, 5, 1944 issued by the Nizam approving the establishment of the Central Laboratories for Scientific and Industrial Research and appointment of Professor Muzzafaruddin Qureshi as its Director.



**Central Laboratories for  
Scientific & Industrial Research**





# THE EARLY YEARS

## QUIET START

The creation of the Central Laboratories for Scientific & Industrial Research at Hyderabad by the Firman of August 5, 1944, went unnoticed. The importance of the event was, however, stressed by the Nawab of Chattari, President of the Nizam's Executive Council, a year later when he observed on the occasion of the establishment of the Hyderabad Engineering Laboratory, that India was a poor country and any conception, however beautiful and good it might be, was of no value if it was beyond the means of the people of the country. He therefore exhorted the scientists and engineers to make things cheaper and hoped that the research laboratories would be remembered as the blessings of the Osmania regime.

## BUDGET

An initial non-recurring grant of Rs. 15 lakhs (Rs. 7 lakhs for building and Rs. 8 lakhs for equipment) was sanctioned for the CLSIR. The grant was to be drawn from the Post-War Development Fund (Rs. 10 lakhs) and the Industrial Trust Fund (Rs. 5 lakhs). A recurring annual grant of Rs. 2 lakhs for the first five years was also sanctioned including an annual contribution of Rs. 50,000 by the Industrial Trust Fund. A further grant of Rs. 8 lakhs was made in 1947 for the buildings.

## FIRST DIRECTOR

By the Firman of August 5, 1944, directing the Government to set up the CLSIR at Hyderabad, the Nizam also approved the appointment of Dr. Muzzaffaruddin Qureshi, Professor and Head of Departments of Chemistry and Applied Chemistry, OU, as its first Director. To facilitate close collaboration between the two organizations and to the mutual advantage of both, Dr. Qureshi was asked to hold the posts at the OU and the CLSIR concurrently. The Nizam further directed that the proposed CLSIR be located at a site on the OU Campus. Dr. Qureshi was a Member of BSIR, New Delhi, and several other Committees of the Government of India. Dr. Qureshi took charge of the post on August 7, 1944.

## COLLABORATION WITH OU

The Government attached great importance to close interaction between the OU and the CLSIR. To this end, a Joint Committee was constituted to work out the details of arrangements which would not only be mutually gainful but would also avoid/resolve any conflicts between the two organizations. The Committee made its recommendations on September 5, 1944, which were approved by the OU Senate on December 20, 1944, and the Government on February 12, 1945. One of the decisions was that OU would allocate land with right of passage and related facilities to the CLSIR. The land site would be selected by the PWD and Commerce & Industries Minister, Nawab Zain Yar Jung. Other decisions related to the ownership and use of common equipment, pilot plants and so on.



## THE GB AND THE BSIR

The Firman of August 5, 1944, approved a GB of twelve members. Of these, six including the President and the Vice-President, were *ex officio* Members. The joint nominee of the Chamber of Commerce and the Mill Owners' Association was Mir Laik Ali, who later became the President of the Nizam's Executive Council and thus the President of the GB. He migrated to Pakistan after the Police Action. The two outside scientists, nominated on the GB, were Dr. J.C.Ghosh and Dr. R.M. Chowdhury. The latter also left for Pakistan. The OU was represented by its Vice-Chancellor.

In 1947, Secretary, Commerce and Industry and Secretary, P.W.D. (Planning & G.V.D) were nominated on the GB "to facilitate interaction between the Government and the CLSIR."

The 22-Member Board had 13 *ex officio* Members, including its President and Vice-President. Dr. J.C.Ghosh was a prominent Scientist-Member of the Board. In 1947, Head, Chemistry Department of the OU was nominated as a Member after Dr. Qureshi relinquished charge as the Head.

## PROGRESS REPORT

The CLSIR was provided a temporary location on the OU campus at the Department of Applied Chemistry. The Industrial Laboratory, located at Narayanaguda in the city, was amalgamated with the CLSIR on December 14, 1944 and its staff, headed by Dr. K.Habib Hasan, was transferred to the CLSIR. This is how the Central Laboratories got its initial work force which continued to operate at Narayanaguda Campus. Dr. Habib Hasan later left to join the industry. The assets of the Industrial Laboratory were valued at Rs.4 lakhs. The BSIR was brought under the GB on February 17, 1945. Its Secretary, Mr. M.C. Joshi, was appointed the Secretary of GB also and functioned as the Head of Administrative Staff of the CLSIR.

The first meeting of the GB was held on December 14, 1944, under the Chairmanship of the Nawab of Chattari which approved its constitution and bye-laws. It also set up an Appointments Committee to recommend the recruitment of the staff for the Laboratories.

In the meanwhile, Dr. Qureshi was chosen by the Government of India to be a Member of a Technical (Fertilizer) Mission which kept him away in the UK and the USA for about nine months, leaving the CLSIR rudderless at a crucial stage of its infancy. The work of the Laboratories practically stood still since no plan of work had been drawn nor was any staff recruited.

After his return, Dr. Qureshi obtained the sanction of the GB for the creation of new posts of Research Officers and Research Assistants. These posts were advertised both in Hyderabad and British India. Two Junior Research Officers and seven Research Assistants were selected by the Appointments Committee and approved by the GB.

While Dr. Qureshi was abroad, the plans for the Laboratories' new building also went awry. In his periodic report to the Secretary, Commerce & Industries, Nawab Mehdi Nawaz Jung, he stated "The site originally selected by Nawab Zain Yar Jung Bahadur for the Central Laboratories, has now been earmarked by the University for the Veterinary College. On my return from UK, the GB again discussed the question of the site for the Laboratories and

authorized a Sub-Committee consisting of Nawab Zain Yar Jung Bahadur, Nawab Ali Yavar Jung Bahadur (Vice-Chancellor) and myself to select an alternative site for the Laboratories. All three Members could not meet but a final decision has been arrived at through correspondence.”

The report made reference to long and short range problems in the areas of Fuels, Heavy Chemicals, Vegetable Oils and Forest Products utilization but gave no details. A mention was, however, made of the appointment of a botanist and an entomologist to assist the chemists in the utilization of forest products and in the development and testing of insecticides respectively. A systematic physico-chemical survey of Hyderabad coals had been initiated. Work had also been started on some projects sponsored by industry under the Industrial Research Fellowship plan incorporated in the Rules and Regulations of CLSIR.

The GB meeting held on March 20, 1947, approved the closure of the Laboratories during the month of May each year in lieu of adjustment of public holidays and extra work hours. On CSIR's insistence, this practice of consolidation of holidays was discontinued in 1969, the Silver Jubilee Year of CLSIR/RRL. The system is however, being reintroduced in the Golden Jubilee Year of CLSIR/RRL/IICT. When Dr. Qureshi returned from abroad, World War-II had ended. There was an air of expectancy in India for a political settlement with the British Government. After the formation of the Interim Government, the events moved fast which were reflected in the political environment of Hyderabad State as well. The partition of the country seemed imminent. The Nizam's Firman of June 6, 1947 declaring that Hyderabad would revert to its independent sovereign status, created further uneasiness and uncertainty.

Dr. Qureshi went on home leave to Lahore but did not return.



# **Building an Institution**



## BUILDING AN INSTITUTION

### ENTER HUSAIN ZAHEER

The political uncertainties of Hyderabad continued till the Indian army carried out Police Action in September, 1948 when the State joined the Indian Union; General J.N. Choudhuri was appointed the Military Governor. One of the first things done by him as the President of the GB of CLSIR was to appoint a new Director of CLSIR, a post that had been lying vacant since Dr. Qureshi abandoned it a year ago.



It was fortuitous that Dr. S. Husain Zaheer was in Hyderabad as the Principal of the Government City College since 1946. He was appointed the Director of CLSIR on November 28, 1948. Dr. Zaheer came from a distinguished family of Lucknow and was educated at Lucknow, Oxford and Heidelberg. Before coming to Hyderabad, he taught at the Lucknow University. He represented the University constituency in the U.P. Assembly and was a Parliamentary Secretary for a while. He held socialist views and participated in anti-war movement and was imprisoned on that account. This brought him close to the top leadership of the liberation movement, especially Nehru. During his stay abroad as a student, he developed friendship with many leading scientists in the UK and Europe. These contacts gave him not only a wider outlook on life and matters, but he could also turn to them for advice, guidance and support.

Dr. Zaheer, like his predecessor, was concurrently appointed Professor and Head of the Department of Applied Chemistry, OU, which he later reorganized and expanded into Department of Chemical Technology.

On taking charge of the post, Dr. Zaheer reviewed the working and the assets of the Central Laboratories. The Laboratories had virtually no systematic programme of work but functioned on the basis of *ad hoc* problems. The small number of scientists, mostly of the ex-Industrial Laboratory, was not enthused enough to meet new challenges. A large number of vacancies existed but one had to scout for talent to fill them. Dr. Zaheer wanted young colleagues who would help build an institution and be leaders in their own right and thereby enthuse others to think and act. It was only after Independence that the people had come to regard Science as the main instrument for economic and social change. And, the younger scientists would realize the social functions of science, if they were provided with leadership, perspective, social sense and opportunity, Dr. Zaheer believed. He also advocated cultivation of scientific temper which he felt contributed substantially towards the growth of science. Scientific temper was a way of life which had to be inculcated by personal example of self-

discipline, objectivity, rationality and truthful presentation of scientific results, he would argue.

### **FUNCTIONS, ORGANIZATION AND AREAS OF WORK**

The GB Meeting held on March 8, 1949, approved the detailed scheme for the organization and development of the CLSIR, laying emphasis on developmental and pilot plant research, utilizing the raw materials available in the State. Stress was also laid on close collaboration with the CSIR Laboratories.

The functions of the Central Laboratories for Scientific & Industrial Research were:

- i) to help and encourage, through organized scientific and industrial research the industrial development of the Hyderabad State through
  - a) the exploration of the possibilities of the industrial utilization of the indigenous raw materials of the Hyderabad State, and
  - b) to devise methods for the expansion of existing industries and formulating plans for the beginning of new industries, by carrying out experimental work in the laboratory on pilot-plant scale.
- ii) to provide the facilities of a central and well-equipped scientific and industrial research laboratory to the existing and future industries of Hyderabad State.
- iii) to render, wherever possible, help and advice to the various Government departments and industries in matters of scientific interest.
- iv) to do routine analytical work for various departments of Government and industries.
- v) to inculcate amongst the industrialists and the public of Hyderabad, through precept and example, the value and advantages of scientific research for industries.
- vi) to provide a centre for the supply of personnel trained in up-to-date methods of industrial processes and applied scientific research necessary for the industrial progress of Hyderabad State.

**The areas of work were:**

- Oils and Fats
- Coal and Fuels
- Heavy Chemicals and Fertilizers
- Ceramics
- Organic Chemistry, Pharmaceuticals and Drugs
- Biochemistry
- Physical Chemistry
- Chemical Engineering
- Operational Research

The organization pattern was similar to that in the national laboratories.

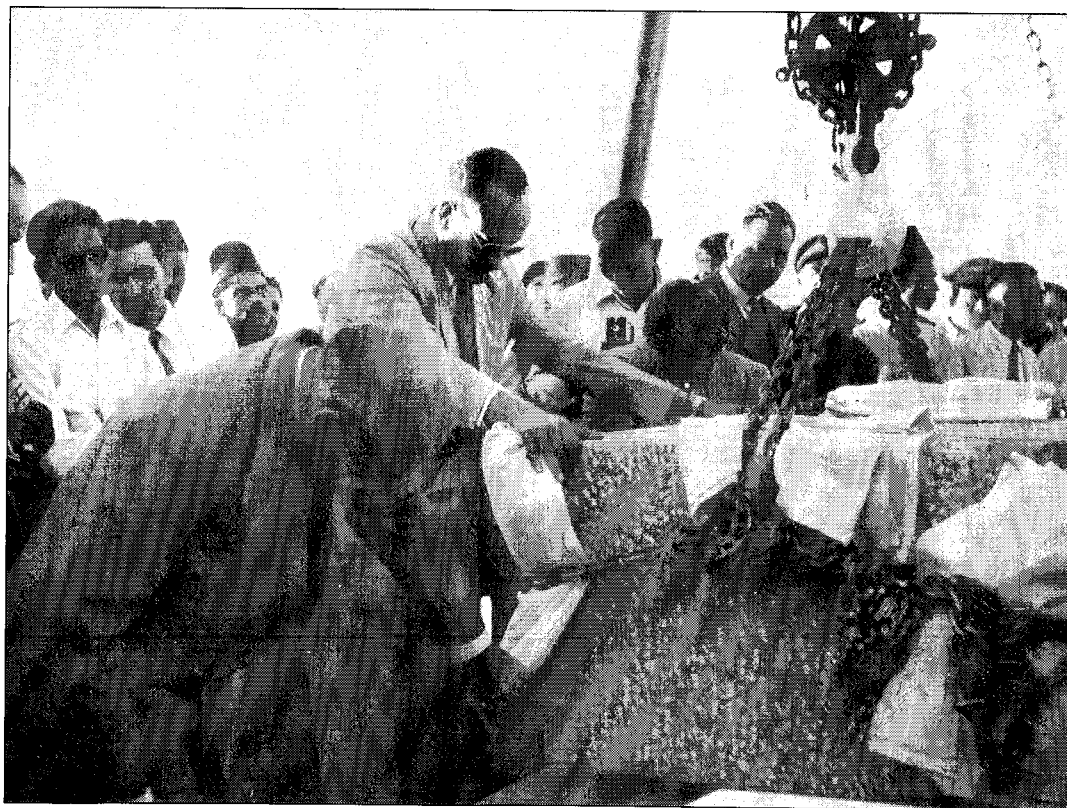
## THE GB, THE BSIR & THE RESEARCH COMMITTEES

With the backing of the CSIR, Dr. Zaheer requested the Government to induct more scientists into the GB and the BSIR. It was felt that the existing composition tended to be bureaucrat-dominated. While this was under consideration, Dr. Zaheer proceeded to fill the vacant positions. Dr. J.C.Ghosh continued to be a member of the GB and was joined by Professor M.S.Thacker. The BSIR had Professor S.Bhagavantam, Professor P.K.Bose, Dr. K.Habib Hasan, Dr. Syed Hussain and Professor M.Syed-ud-Din as its Members.

Later, Dr. S.S.Bhatnagar became an *ex officio* Member of the GB. The CSIR nominated Dr. J.W.McBain on the GB. Both were members of the BSIR also. Other Members of the Board were Dr. A.Lahiri and Dr. H.G.Kayser.

Eight Research Committees functioned under the Board which had scientists as their members who were drawn from the industry, the University and other local research institutes. These Committees were:

- Vegetable Oils Utilization Committee
- Pharmaceuticals & Drugs Committee
- Fibre Research Committee
- Heavy Chemicals Committee



Major-General J.N. Chaudhuri laying the foundation stone of the new buildings of the Laboratories on November 6, 1949

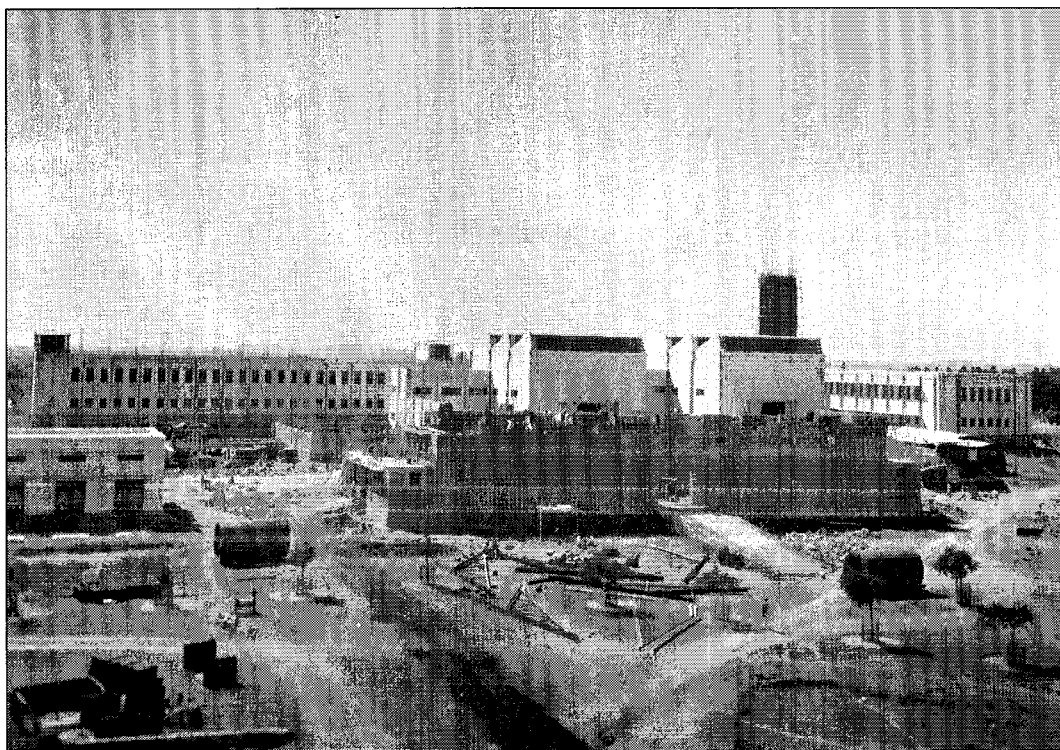


Ceramics Research Committee  
Fuels Research Committee  
Forest Products Utilization Committee  
Industrial Fermentation Committee

### NEW RECRUITS

Dr. Zaheer felt that in order to use the CLSIR as an agency to bring about socio-economic development through the utilization of science and technology, the scientists should be imbued with a social and moral purpose and a belief in the social functions of science with a mission and dedication. Science should not be a mere intellectual pursuit and a means of earning one's livelihood. The scientists themselves were part of the society and would react to its objectives and needs. He therefore endeavoured to gather bright young scientists who would help him create an environment of dedication and build research groups of committed scientists in different areas of interest to the CLSIR.

With this end in view, Dr. Zaheer searched for talent in the Universities in India and abroad, met young scientists at symposia and seminars and interviewed some on the annual meetings of the Indian Science Congress Association. The major recruitment was done during 1949-50. Among those appointed were: S.A.Saletore, G.S.Sidhu, K.T.Achaya, M.S.Iyengar,



Building under construction

N.Shanmukha Rao, M.G.Krishna, G.S.Chowdhury, A.Rahman, Baldev Singh, P.M.Bhargava, R.Vaidyeswaran, Bharat Bhushan, E.R.Saxena, I.K.Kacker, S.Z.Ali, Z.Osmani and G.S.Rao. Those already on the staff of the Laboratories included: D.S.Datar, B.S.R.Sastry, M.A.Hai, L.M.Srivastava, N.B.Naidu, M.A.Sivasamban and M.B. Naidu. Later, K.S.Chari (on transfer from the OU), C.C.Reddy, K.G.Rangrez and S.Raghavendar Rao also joined.

Recalled Dr. Zaheer later with some pride, "I did not start the Hyderabad Laboratory with a "bang." Twentyone years ago, I began with only about 5 or 6 scientists and it took nearly fifteen years for RRL, Hyderabad, to grow to its present stature. Today, nearly 90 percent of the senior positions are occupied by young scientists who joined 20 or 15 years ago — that is, they have grown with and round the institute and the Director —even though all appointments are through advertisements and selection committees. This is almost the only way to build a scientific research institute." Many of those listed above later occupied positions of high responsibility in other laboratories or organizations.

Many eyebrows were raised in the conservative Hyderabad when Dr. Zaheer appointed women as scientists and as workers in the Central Laboratories. Several of his appointees had proven political record like himself, including one who had been dismissed from CSIR service on political grounds. And when the Centre directed the Hyderabad Government to terminate the services of this scientist, he mobilized the country's entire scientific community including the leading scientists like Bhatnagar, Bhabha, Mahalanobis, M.N. Saha, K.S.Krishnan, Bhagavantam, B.C.Guha and others and sought Nehru's personal intervention. The scientist was reinstated.

## **DEVELOPMENT OF A RESEARCH MANAGEMENT SYSTEM**

Even though the various links of the innovation chain were not clearly perceptible at that point of time, there was an instinctive feeling of the enormous effort that would be required to develop new processes and transfer those successfully to the industry. It was also realized that information was an integral part of the innovation process. Attempt was therefore made to develop an information-based management system at the CLSIR in order to speed up the existing R&D programmes and to identify new development programmes. The system recognized that the scientists were the greatest asset of the Laboratories who should be fed with information in order to produce new information through experiments which must be evaluated periodically.

A feature of the CLSIR in those formative years was openness and free discussion which was permitted even when the viewpoint was contrary to the known thinking of the management. In fact, it was encouraged since new ideas thus emerged and a few times, it led to good decisions also. Any forum was considered suitable for being used as a sounding board to test new thinking. This mode of functioning eventually developed into a participative type of management system where crucial decisions were taken in a collective, though informal, manner. This also led to informal delegation of authority for execution of important assignments, though under the Rules, the responsibility remained that of the Director.

The leadership of Dr. Zaheer was what gave the 'line and direction' to those activities though he recognized the contributions of his colleagues. He was so deeply involved in the CLSIR that the imprint of his personality is still seen in the conduct of research, entrance hall,

furniture or the garden. He strongly believed in personal contacts and sharing of knowledge. Every morning, he would read the leading journals for at least two hours at his house, note down interesting references and pass them on to his colleagues with the noting "Please read and discuss." Many new research ideas would thus emerge. After inspecting the garden, he used to go round the laboratories and discuss the progress of work with each and every worker. This practice helped *inter alia* to remove any bottlenecks, encourage the scientist, establish personal rapport and promote trust. He firmly believed that good relations could not be imposed but were cultivated. Most looked for good leadership and few needed discipline. A result of these discussions and new thinking was the identification of the priority areas of work. It also helped in pin-pointing the gaps in knowledge and the need for taking steps to fill these gaps. Among these were: the need for pilot plant research, especially where the demonstration to industry was a must, market research and product promotion. It also became possible to foresee a shortfall in funds, lack of a specialized expertise or the absence of a vital equipment, and therefore, take necessary steps to overcome these. The need for helping the industry in the problems at site was considered an important function of the Laboratories. Since science and technology go hand in hand, technology development was contingent upon growth of science. Adequate attention was therefore given to the basic research.

## OPERATIONAL RESEARCH

An important outcome of these exercises was the introduction and development of 'Operational Research' (OR) as a tool for the management of scientific and industrial research. The basic concept, based on wartime application of OR, emanated from Rahman and was supported by the Director and others. It has since been refined over the years and has been adopted and used elsewhere. OR, essentially an interdisciplinary approach, carried the seeds of 'Project Orientation of Work' by multidisciplinary teams adopted by the CSIR some years later. OR exposed a problem in all its facets and thereby facilitated taking a rational decision which by itself was a valuable contribution. It also recognized that good scientific work stimulated industrial growth, directly or indirectly, and sooner or later. The Annual Report of the year 1950 illustrates the working of the OR Section thus:

"The Section of Operational Research is a very young section of the Laboratory and it consists at the moment of one research worker. The purpose of starting this new section in the Laboratory was two-fold:

- a) Promotion of laboratory research to pilot-plant research, prior to the handing over of the process to industry, and
- b) Internal integration and co-ordination of research. "The important aspect of observing and collecting scientific and statistical data on the workings of any process in industrial manufacture was not tackled, simply because the laboratory has not so far handed over any process to industry. "An information chart was compiled regarding the number of problems at hand and the stage of their development with a view to have proper co-ordination and integration of research in the laboratory. Information regarding the development of science has been collected from all over India. This information consists of all finances, research programmes, personnel, etc., of almost all the research establishments in India. Work on the tendencies of research in India by study of this material is under progress.

"The progress of research in the Central Laboratories has been closely followed through discussion with the research workers and through fortnightly and quarterly reports. A printed form on which to enter fortnightly progress is distributed to each research worker which aims to eliciting information regarding papers sent to journals and especially technical and other difficulties hampering progress, their solution, etc., and invites suggestions from research workers for new problems arising out of their work.

"For the purpose of promoting laboratory research to a pilot-plant stage a small unit has been formed with Dr. S.Husain Zaheer, Dr. M.G.Krishna and Mr. A.Rahman as Members. This unit discusses in detail with the research workers the completed problems, from the chemical engineering point of view and from that of economic feasibility.

"In the present stage of its development the Operational Research Section aims at co-ordinating the researches that are under investigation in the laboratory and at checking the progress of research. This is being done with a view to keep close to the industrial aspects of any problem and to check shooting off from the main problem under investigation. It also carries out, in collaboration with the researchers, investigations on the economic and sociological side to help and facilitate and transfer of laboratory research to pilot-plant level and finally to industry.

"The following problems have now been advanced to the pilot plant stage:

Manufacture of fructose, and

Manufacture of dehydrated castor oil.

"Eleven problems have been discussed in detail and technical and non-technical notes prepared on them with a view to informing industrialists regarding the possibilities of the exploitation of the process.

"With regard to the work on the utilization of cottonseed, a preliminary investigation has been carried out by Mr. A.Rahman on the factors limiting such utilization; statistical data have been compiled with regard to the types of seeds in Hyderabad State, their respective acreage, etc., with a view to working out the linter and oil content of the various varieties. Apart from liaison with the Agriculture Department, the Indian Central Cotton Committee and the Indian Central Oilseeds Committee were also contacted in order to obtain the necessary information regarding the cottonseed crushing industry. Unfortunately, no information is available, as cottonseed is not regarded as an oilseed. It is believed that the Indian Oil Mill at Navasari is crushing cottonseed but so far no information could be obtained from them regarding the oil percentage of various varieties of cottonseeds, or the machinery used especially for the purpose of delinting."

In course of time the OR Section expanded and added new tools like PERT and CPM for forecasting and monitoring of major project work. It also carried out field market surveys on the availability of raw materials and market potential of the proposed or the existing products. Though design and engineering was also identified as a major gap in the development and transfer of technology, it took more than a decade of persuasion to convince the authorities that it was a legitimate and essential activity of an R&D institution.

## **PRIORITY COMMITTEE**

A Committee was appointed by the Governing Body: (a) to draw up a plan of non-recurring expenditure for the next three years and submit a priority list for purchase of equipment from non-recurring grants required for the next three years, and (b) scrutinize the research programme of the laboratory keeping in view, especially, the items of vital importance immediately required for the State and its industries.

The Committee consisted of: Dr. J.C.Ghosh, Director, Indian Institute of Technology, Kharagpur; Maj.Gen. S.L.Bhatia, Inspector-General, Medical and Public Health Department, Hyderabad-Deccan; Prof. M.S.Thacker, Director, Indian Institute of Science, Bangalore; Dr. A.Lahiri, Assistant Director, Central Fuel Research Institute, Dhanbad; Dr. S.P.Raju, Director, Engineering Research Laboratories, Hyderabad-Deccan; and Dr. S.Husain Zaheer, Director, Central Laboratories for Scientific & Industrial Research, Hyderabad-Deccan.

The Committee met on March 27, 1951, and considered the papers submitted by the Director, CLSIR, relating to the following:

- i) List of existing equipment,
- ii) A priority list of equipment proposed to be purchased,
- iii) The research programmes of the laboratory under different sections,
- iv) The expansion programme of the staff,
- v) The estimates of capital expenditure of the laboratory, and
- vi) The estimates of expenditure for the new buildings of the laboratory and its fittings.

The Committee endorsed the existing research programme of the laboratory and recommended that, as a general principle, no project should be taken in hand which did not have a reasonable chance of being completed within a period of 3 to 5 years, and that each project be reviewed every six months. It further recommended that research effort should mainly be concentrated on the following problems of far-reaching importance for the Hyderabad industries and for national development:

## **FUELS**

1. Recovery of by-products of low temperature carbonization and allied work,
2. Distillation of tar and studies on low temperature tar,
3. Briquetting of coal and coke, and
4. Related problems (coal washability, coal survey, etc.)

## **OILS**

1. Solvent extraction of oilseed cakes,
2. Processing of cottonseeds in all aspects, and
3. Studies on the utilization of vegetable oilseeds grown in Hyderabad State, in particular castor, mohwa, groundnut, safflower and cottonseeds in all their aspects.

## MISCELLANEOUS

1. Investigation on the utilization of local forest woods for the production of newsprint,
2. Utilization of cotton dust for the preparation of cellulose, paints and varnishes,
3. Utilization of molasses for various biochemical processes, and
4. Intensive work on sulphur-bearing minerals to utilize all available sulphur.

## EQUIPMENT

For equipment the Committee recommended as a general rule that the following conditions be fulfilled for purchase:

1. Its utilization is essential for a research programme already undertaken or under immediate contemplation, and
2. There is an adequate staff for its upkeep and utilization.

After examining the priority schemes submitted by the Director, CLSIR, the following recommendations were made for capital expenditure during the next 3 to 5 years:-

1. General and Capital equipment	Rs.
Priority A	10,50,200
Priority B	6,84,600
2. Special schemes under different sections	
Priority A	11,11,700
Priority B	4,58,000
3. Buildings — new Laboratory	18,00,000
4. Fittings for the new Laboratory — Gas, Water, Electricity, Drainage and Furniture	12,00,000
Land acquisition	2,50,000
Residential cottages	2,00,000

## SOME ASPECTS OF EARLY WORK

Reporting to the Government on March 19, 1952, the Director said that since very little work could be done without suitable equipment and proper buildings, and main attention was paid to planning, acquiring and building up these essentials. After making a thorough study of other similar laboratories, a detailed plan was prepared for an "up-to-date laboratory building" and its construction taken up. Equipment worth Rs. 8 lakhs was ordered. Senior staff was partly deployed for looking after these jobs.

The work of the Laboratories was determined by the directions given by the BSIR and its Research Committees and the Governing Body, bearing in mind the general principles laid down by the Priority Committee. There were some interesting investigations which were carried out in or around 1950. These included work on insecticidal properties of custard apple seed oil —with the availability of modern techniques, interest in the work has now

been revived at the IICT, ICRISAT, IRRI and elsewhere. Work on castor oil, cottonseed oil, bleaching earths, active carbons, coal carbonization, survey of coals and clays of Hyderabad and some synthetic drugs was initiated. It may be worth mentioning that the work on the first synthetic drug developed by any research laboratory in India, *viz.*, methyl methaquinazolone, was also started in this period.

The work output as determined by the papers published or sent for publications, or patents taken or applied for was high considering the meagre facilities of staff and equipment. During 1950, 1951 and 1952, in the respective years, the published papers were 13, 14 and 13 and those communicated were 3, 11 and 21 totalling 40 and 35 respectively. During the same period, the patents granted were 7, 4 and 6 respectively totalling 17 in all. Four patents were pending.

The report of March 19, 1952 stated: '8 processes had been completed on a laboratory scale and awaited commercial exploitation'. None was, however, released to industry during this period.

This lack of interest by industry in the work of the CLSIR had several reasons. The country had become independent only a few years ago. It had no tradition of industrial research and the avenues of entrepreneurship were also limited. The scale of operation in the laboratory in the absence of appropriate pilot plant work, also did not breed confidence in the investor, especially when plant and equipment together with know-how guarantees could be freely imported.

It was also realized that the researchers themselves considered their job over when laboratory-scale experiments had been completed and sufficient data were available for a publication/patent. That researchers had a role in further developments like upscaling, evaluation and preparation of project reports, and even in the marketing of technology, was unknown to them at that point of time. In the absence of the pilot plant equipment, the upscaling work could not be undertaken. The erection of 25-tpd low temperature coal carbonization (LTC) plant had been started and steps had been initiated to procure pilot plant for processing of cottonseed and other equipments.

To give the much-needed exposure of industrial work to the research scientists, the programme of assistance to industry was energized. An unused 1-tpd ether plant at the Government Distillery at Kamareddy was dismantled, re-erected and commissioned at the site of the Hyderabad Chemicals and Pharmaceutical Works Ltd., Azamabad, Hyderabad, under the technical advice and on-site supervision of the staff of CLSIR on a token fee of Rs. 1,000. The problems of hand-made paper manufacture were taken up with the Khadi and Village Industries Commission (KVIC). Free demonstration of improved methods of raw material selection, pulp making and paper lifting were given to the entrepreneurs. The design of the newly developed vat for paper-making was also released free to the KVIC. Likewise, advice was given to cottage-scale distillers of palmarosa oil. In later years, the problem was studied in greater detail, both from chemistry and technology angles.

Technical assistance was provided to the Hyderabad Chemicals and Fertilizers Ltd., Bellampalli with regard to their expansion and diversification and to the Nizam Sugar Factory, Bodhan for the utilization of their byproducts.

It was during these early years of the CLSIR that the concept of project teams consisting of scientists, engineers and economists was first tested. For this purpose the OR section was expanded. Market data on items of interest to the CLSIR was collected on regular basis and fed to the project teams. The chemical engineers got associated with a project from its very initiation and continued till the final designs on transfer of technology stages. As days went by, these concepts not only got refined but also were accepted and adopted elsewhere.

Since the Industrial Trust Fund (ITF) could not continue financial support of some schemes, agencies like CSIR, AEC and the Indian Central Oilseeds Committee were approached for funding. In an unusual step, the work of the CLSIR was reviewed in the Hyderabad Government Gazette of February 24, 1955.

### **PILOT PLANTS**

A distinctive feature of the CLSIR was its pilot plants which had been set up to upscale the laboratory experiments to an appropriate level. The pilot plant experiment could have one or more of the following objectives:

- To study the effect of upscaling on reaction behaviour, product quality and yield,
- to optimize the process,
- to carry out any equipment modifications in the light of the above,
- to work out the economics of the process,
- to collect data for the design of a commercial scale plant,
- to have large samples for consumer acceptability trials,
- to carry out semi-commercial production and sale of a new product to create market,
- to produce to meet specific critical needs of an industry, and
- to demonstrate the process to the entrepreneurs and train their personnel in the production and related procedures.

The upscaling work at the CLSIR was carried out in two types of pilot plants. One category comprised sets of equipments of various sizes, made of different materials of construction, located close to each other such that the experiments could be performed in a sequence to produce the final product(s). Thus an array of reactors, fitted with condensers, heating and cooling systems, gas absorption towers, vacuum and gas inlet arrangements, various mixers, driers, autoclaves, size reduction equipments and high temperature furnaces, could be used as sort of improvised pilot plants where different unit operations/processes could be carried out.

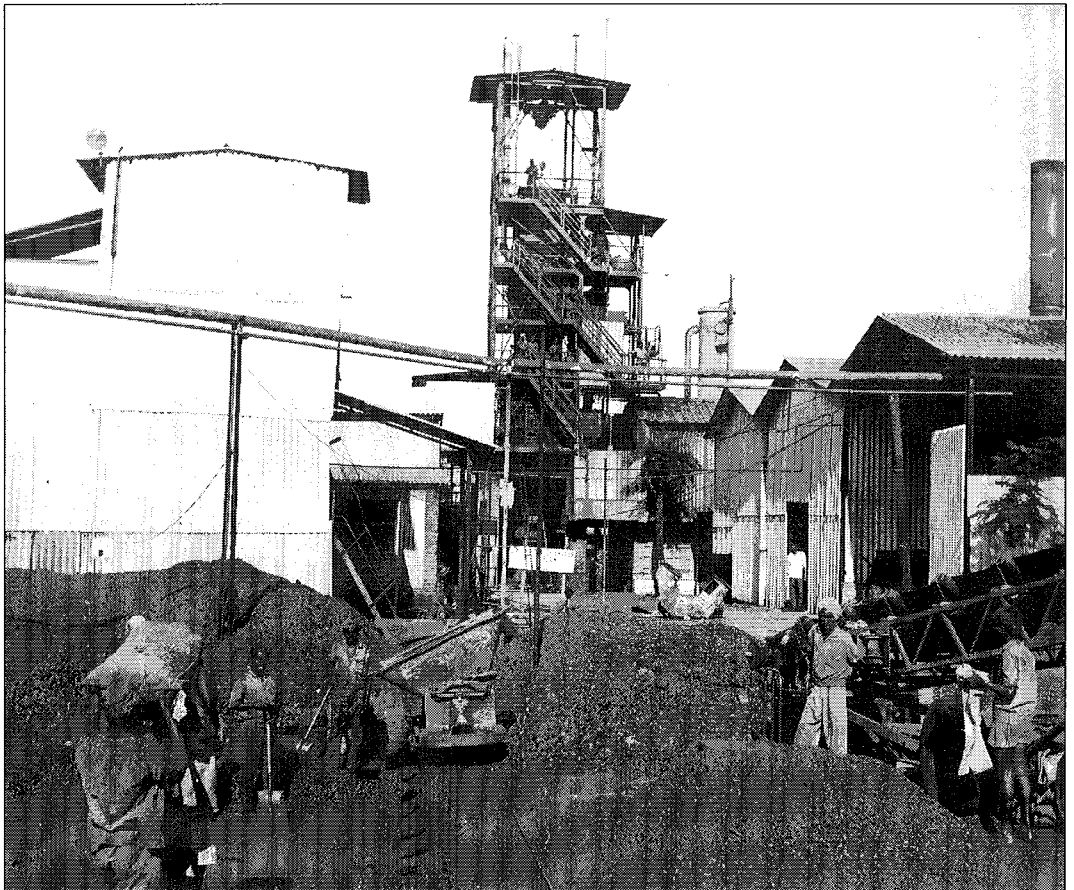
Glass was perceived as a material of construction for industry especially for its ability to withstand acidic corrosion and its transparency. With the availability of different components and the reactors of various capacities, it was possible to design and erect all-glass pilot plants at the Laboratories and later commercial plants at the factory site.

The second category of pilot plants produced the designated product(s) through multi-operational processing in specially designed plants. In 1953, two such plants were erected. These were: low temperature carbonization (LTC) of coal (cap. 25 tpd) and cottonseed processing (cap. 10 tpd).



As early as 1949, it was decided to set up an LTC pilot plant when it was realized that practically all the energy required by the domestic sector in India came from cow dung, firewood, charcoal and other agricultural products (94 out of total 97 million tons of coal equivalent) leading to fast denudation of forests and wasteful use of dung. The internally-heated Lurgi spuel gas process was chosen because of several advantages and also because it had been commercially tried elsewhere and found particularly suitable for carbonizing non-caking or weakly-caking bituminous coal and lignites, of which India has a vast reserve. LTC of coal at 550-700°C produces semicoke, a smokeless domestic fuel and by-product tar. The latter can be processed into creosotes, pitch and tar acids.

The LTC plant was purchased from a grant of Rs. 7 lakhs made available by the Industrial Trust Fund. The 25-tpd plant was erected and commissioned in 1953. The first semicoke produced on a semi-commercial scale came out on December 23, 1953. It was named 'Coalsite', subsequently changed to 'Kolsit' (from Kolsa, coal in Telugu).



LTC Pilot Plant

Several additional units were later added to study the character and utilization of byproducts, for example, a 12-tpd coal briquetting plant to examine the various parameters to produce strong briquettes from coal fines obtained during crushing of coal and their carbonization, tar distillation still and a tar acids fractionation unit.

The LTC plant was operated for two decades as a semi-commercial unit. 'Kolsit' was marketed locally and found ready acceptance. The other byproducts like creosote and pitch were also sold. The necessary data for designing a commercial plant were collected. Coals from other states were also carbonized to provide basic information on the coals and their semicokes. This is the first example of a research laboratory in India to carry out commercial operations including economic surveys on consumer potential and product acceptability.

A 900-tpd commercial LTC plant was later established by the Singareni Collieries Co. Ltd. at Ramakrishnapur in Andhra Pradesh.

Cottonseed oil, though a principal edible oil in USA, was hardly produced in India probably because its production was not practised on ghani. The dark oil is not edible till it is alkali-refined when gossypol is removed. Another reason appears to be the mistaken belief that when whole seed is fed to milch cattle, the butter content of milk increases. Cottonseed is a byproduct of cotton ginning which is available to the extent of over two million tonnes.

Realizing the potential of this seed, the CLSIR started exhaustive studies on its processing. All aspects of exploitation of this versatile seed were included in the pilot plant work. A 10-tpd cottonseed processing plant was erected. The critical equipment was imported while accessories were locally obtained. The cost of the plant was met from a grant made by the Industrial Trust Fund. Like the LTC plant, this pilot plant was also erected at the new site of CLSIR. This was also commissioned in December, 1953.

In course of time, various varieties of cottonseed produced in the country were processed on the plant and methods of production of oil and its refining, quality control of raw material and products, and of seed storage were standardized. The technology was available free to entrepreneurs to promote the crushing of cottonseed. Seminars, symposia and workshops were organized to this end. The Government was persuaded to provide incentives to cottonseed crushers. A 2-week long intensive training was provided to the technical personnel of the would-be crushers in the methods of production, quality control and storage. Largely due to these efforts, the crushing of cottonseed steadily went up from an annual oil production of 12,000 tonnes in 1953 to 75,000 tonnes in 1964. The present-day production of cottonseed oil is 3,50,000 tonnes which is still below the potential of 5,50,000 tonnes.

The work was extended later to produce high-protein edible flour from the cottonseed oilcake by removal of toxic gossypol by suitably modifying the process conditions. For this purpose, a continuous solvent extraction plant was installed.

In the years which followed several other pilot plants were erected and operated, e.g. gasification of coal, activated carbons, fatty acids distillation and so on.

## **COAL-BASED INDUSTRIAL PROJECTS**

The mid-50's saw increased activity by the CLSIR in the preparation of coal-based projects for the government and private sectors. This was based on the realization that coal was the only

dependable national resource to meet the energy and chemical feedstock requirements of the country for many years to come. Overawed by the advice of the so-called foreign experts, it was fashionable to talk of the cheaper, imported naphtha. The national policy makers were so much taken in by the pedlers of naphtha-based technologies that they paid scant attention to Dr. Zaheer's plea not only for national self-reliance and security but also to his prediction of world energy crisis, which alas came true. Nevertheless, undaunted by these discouraging trends, the CLSIR continued its efforts in building facilities for large-scale testing and processing of the raw materials to support the projects proposed by the Laboratories. These include LTC and gasification of coals and byproducts processing.

Lamented Prime Minister Indira Gandhi in an address to the 64th session of the Indian Science Congress at Bhubaneswar in January 1977, "Had we listened, in the earlier sixties, to Dr. Husain Zaheer's plea, and based our chemical feedstock policy not merely on oil but on the abundant coal reserves, we would have withstood the oil crisis with much less strain. Thanks to the work of the Hyderabad Regional Research Laboratory and the Dhanbad Institute, when we had suddenly to undertake a programme of large-scale conversion from oil utilization to coal utilization, we had fortunately the scientific data and technological expertise to design and put up carbonization and gasification plants."

Some important industrial projects proposed are listed below.

**Fertilizer** — A project report on the establishment of a nitrogenous fertilizer plant in Hyderabad State was prepared and submitted to the Fertilizer Production Committee of the Central Government. As required, predesign cost estimates for various capacities and product-mix were worked out. These were 100 and 200 tonnes of ammonia per day; 24.3 tonnes of ammonia, 361 tonnes of ammonium sulphate, 368 tonnes of diluted ammonium nitrate and 100 tonnes of urea each per day and 72,700 tpa of N (as 46,000 tpa urea and 2,50,000 tpa kalk ammonium nitrate). The ton/mile calculation and predesign cost estimates were for the location of the proposed plant at Kothagudem, but could be worked out for any other alternative site like Ramagundam.

**Cross-Country Gas Grids** — A study was made of the supply of the fuel gas for domestic and industrial purposes to the cities and townships lying between Calcutta and Delhi. The scheme submitted to the Government of India covered a total population of 8 millions (in 1955) and envisaged production and distribution of 20-30 million cft of fuel gas per day.

A similar scheme for the supply of fuel gas to Hyderabad and Secunderabad was submitted to the Government of Hyderabad.

**Low-Temperature Carbonization of Coal** — The project report on LTC of low-grade high ash coals of Hyderabad State to produce domestic coke and byproducts for capacities of 800, 1600 and 3400 tpd of coal input was submitted to the Government of India in 1954. The cost estimates were routinely revised and brought up to date by including more data provided by the pilot plant work every year and resubmitted to the Government.

The coal carbonization project submitted by the CLSIR was actively considered by the Government. The competing project was one of Madras State (now Tamil Nadu) to establish a lignite carbonization plant at Neyveli. Both the projects envisaged location of fertilizer

plants in the respective vicinities. It was argued on behalf of the CLSIR that the lignite processing was more capital intensive since it involved mining. The project also had long gestation period and return on investment was also low. The coal carbonization, on the other hand, would use lumpy coal of already established mines straight away after crushing and screening. The return on investment was high and would begin after a small break-even period. The acceptability of the product as a domestic fuel had been established through test-marketing and surveys. The use of the product as a foundry reductant has also been proved. It was calculated that if coal carbonization plant were established first, it could finance the setting up of the lignite plant in a few years. The reverse was, however, not achievable. Regrettably, despite these techno-economic deficiencies, the Neyveli Lignite Corporation came into being due to political and regional considerations. It took more than two decades of persistent effort and the world oil crisis to enable the Singareni Collieries Co. Ltd. to set up a 900 tpa LTC of coal plant at Ramakrishnapur, A.P. The Laboratory provided the extended basic designs and the commissioning assistance for the plant.

#### **COMMITTEE FOR LIAISON WITH INDUSTRY**

The GB in its meeting of October 22, 1955, appointed a Committee for Liaison with Industrialists to function under the BSIR with the following membership:

Shri Narayandas Daga

Two industrialists (one each nominated by the Hyderabad Chamber of Commerce and Industry and the Hyderabad Mill Owners' Association)

Shri Tajamul Hussain

Industrial Engineer, C&I Department

A representative of Director, C&I

One Electrical Engineer

Director, CLSIR (Convenor)

Dr. S.A.Saletore, Assistant Director, CLSIR

Shri A.Rahman, Scientific Officer, CLSIR .

#### **NEHRU AND AZAD VISIT THE CLSIR**

Dr. Zaheer invited distinguished scientists and public personalities to visit the Laboratories and sought their help and advice in building the CLSIR. Among those who thus came to visit the CLSIR were: J.D.Bernal, P.M.S.Blackett, Englehardt, D.S.Kothari, S.S.Bhatnagar, J.C.Ghosh, Zakir Hussain, Amarnath Jha, J.N.Mukherjee, S.Bhagavantam, Mouat Jones, H.J.Bhabha, W.C.McBain, J.B.S.Haldane, B.C.Majunath, P.A.Narialwala and P.C.Guha. But the outstanding event was the visit of Prime Minister Jawaharlal Nehru accompanied by Education Minister Maulana Abdul Kalam Azad on September 25, 1952. This was Nehru's first visit when the CLSIR was still located temporarily at O.U. Campus. He later paid two more visits.

Welcoming the honoured guests, Dr. Zaheer said, "On my behalf and on behalf of my fellow workers in the Central Laboratories for Scientific and Industrial Research and the Department of Chemical Technology, Osmania University, I welcome you Sir, not only as the Prime Minister of India, a prince among patriots upon whom the mantle of the Father of the Nation has aptly fallen, but also as one who has given full recognition to science and scientific

methods in the progress and development of the country and in whom, as the founder and first President of the Association of Scientific Workers of India, the interests of scientists safely repose.

“It is a matter of singular good fortune for us that on this occasion, we are also able to welcome another prince amongst patriots, Moulana Abul Kalam Azad, who has been your comrade through the long and arduous years of the national struggle for freedom, a man whose self-sacrifice and erudition has won the admiration and respect not only of his countrymen, but also of men of learning and goodwill throughout the world. Today he is directly connected with us as our Minister of Education and Scientific Research and we pay him our homage and respects.

“Our hearts are full of joy and pride at your acceding to our request and coming to inspect our efforts and give us encouragement. Time is short and we wish to utilize it fully in showing you our achievements, which we confidently feel compare favourably with those of other institutions both in and outside the country, considering that almost all you will see has been done in the short period of about three years and in view of other limitations.



Shri Jawaharlal Nehru and Moulana Abul Kalam Azad being taken round the Laboratories by Dr. S. Husain Zaheer (September, 1952)

“In conclusion, we pledge to you Sir, our unqualified loyalty and fullest co-operation in your efforts to build up a happy prosperous and progressive secular state based on principles of equality and social justice.”

### NEHRU’S ADDRESS

Addressing members of the Central Laboratories and the Department of Chemical Technology, Osmania University, the Prime Minister said that he was happy at least to be able to visit the Laboratories; in spite of Dr. Zaheer’s persistent urging, he had been unable in previous visits to Hyderabad to find time for the visit.

Emphasizing the importance of science and scientific research for the development of the country, he said that all of us had visions about the future of our country and irrespective of differences in the nature of such dreams we would not only find science and scientific research occupying an important place in the development of India but would realise that our dreams could not be fulfilled without them. Therefore, we always looked upon scientific research as an absolute necessity and consequently placed considerable emphasis on its development through the establishment of various national laboratories. He would therefore want the laboratories, which were all over the country, not only to carry out scientific research but also to spread what could be called the temper of science, which was both an insight as well as a rational enquiry.

Commenting on the plan of the new buildings of the Central Laboratories, he said that he had been deeply struck by the entrance pillars which were on the pattern of those at Ellora and Ajanta giving the laboratory the look of a temple. He thought this was a happy idea as it was a pattern that had grown and developed in the cultural traditions of our nation, and it was fitting to incorporate such a pattern in the design for temple of learning which, in fact, scientific laboratories were.

For some centuries, the Prime Minister continued, we in India had lacked the urge and zest to discover things and had become a static nation; one result was that most Indians considered it objectionable to cross the seas, with the consequence that we had become isolated from the rest of the world and had not developed the newer outlook that was taking shape in other parts of the world at that time. In the period when science was going ahead, when European investigators fired by a spirit of adventure were braving danger to sail the high seas discovering new continents, our country had lost what it had discovered previously and developed the outlook of the frog in the well. So what was most important now was not to dwell on the past, but to develop that urge and spirit of science which would kindle inventions and discoveries and to realize the implications of knowledge for the development of our country. Since Independence, whatever had been done that was good or bad and whatever other achievements might or might not have been, the establishment of national laboratories was certainly to the credit of government.

Finally, Pandit Nehru expressed his joy at having come to the Laboratories and at having met and seen the bright faces of so many young men and women imbued with the scientific spirit and trying to serve their country.

## AZAD'S ADDRESS

"Panditji has already spoken to you. All I would like to add is that you are engaged in work very important and useful for the nation because India is in need of scientific work and research. You should know that we also realize the importance of your work and your services to your country."

## CLSIR MOVES TO NEW BUILDINGS

Having been the guests of the Osmania University for nearly one decade, the CLSIR got their own home just across the road on a 222-acre land specially acquired for this purpose. The foundation stone of the main building was laid by Maj.Gen. J.N.Chaudhuri, Military Governor of Hyderabad, on November 6, 1949. The plans of the buildings were approved by the Governing Body on October 12, 1949, when the construction work was started by digging the foundations, clearing bushes to mark the pilot plant buildings, workshop and roads. There was a huge granite rock on site where the present library building is located. This was blasted to provide stone required for the foundations and the basement walls. Later, when P.M. Bhargava entered the basement with his Geiger Counter, it started ticking indicating a level of radio-activity which was considered unsafe till the Bhabha Atomic Research Centre (BARC) cleared it for safe occupation. It is known that granites do carry some radioactivity and the basement also accumulate radon which become responsible for the background radio-activity.

During the monsoon of 1950, the entire staff of the Laboratories assembled at the new site to find that pits had been dug on both sides of the marked avenues, Uppal Road and the connecting road to the OU. Each one was asked to plant as many trees as one wished but take the responsibility of their survival through periodic visits. The *Peltophorum* trees on which mynas sing their prenocturnal songs every evening, and a few which have survived the Uppal Road expansion, serve as a reminder of the tree-friendly environment which was sought to be created. The mango and the bamboo groves fell victims to the "development process" which brought new buildings on the campus.

The main building of the Laboratories is T-shaped. The central block houses the various laboratories and an auditorium is located in one wing. The other wing has the Director's Office. Administrative Office, which was also located in this wing, has now moved into a separate block built on the site where mango grove once used to be. Planning Coordination, Liaison and Technical Information Offices are now located in this wing. The ancillary buildings consist of six pilot plant areas, two of these were constructed in 1953 and the others later, the workshop, the stores, electricity sub-station and the gas house. The central block of the main building had a basement and two floors. One floor was built later as was the library building which also came up in two stages. The original workshop building was also expanded later and a new block housing design & engineering, chemical engineering, computer, instrumentation and analytical services also added. Several other buildings like hydrogenation pilot plant, pesticides pilot plant, LTC laboratory and various other laboratory and pilot plant sheds have come up in the course of years to meet new requirements. The original construction, however, covered a floor area of only 1,46,000 ft<sup>2</sup> in two stages.

## NEHRU OPENS THE NEW BUILDING

The formal opening of the new building of the CLSIR was performed by Prime Minister Pandit Jawaharlal Nehru on January 2, 1954, in the presence of a distinguished gathering which included delegates to the 41st Session of the Indian Science Congress. Since all sections of the Laboratories, except the Paper and Fibre Section, had already moved into the new buildings and the pilot plants had also been installed in their proper locations, it was opening of a working laboratory.

President Dr. Rajendra Prasad in his message on the occasion said: "It goes without saying that money spent on research is rightly regarded by all progressive nations as sound investment made for the common weal. Attempts like these, therefore, deserve all the encouragement that the State could give in the interest of human progress and happiness. I congratulate Hyderabad State on establishing these laboratories and fervently hope that those who will have the privilege of working in these laboratories will be inspired by the lofty ideal of service for humanity."

In his speech, Dr. Zaheer foretold of some problems likely to be faced in the future. He said that at least for some time to come, the main activities of laboratories of this kind should be directed not so much towards making new discoveries or inventions as towards developing and adapting the already known methods and techniques. He claimed that the progress of the Laboratories during the last few years, taking into consideration their limitations, financial and otherwise, had not been insignificant or inconsiderable both in quality and quantity.

Dealing with the role of regional laboratories in the context of national laboratories, Dr. Zaheer said that the Board of Scientific and Industrial Research of the Government of India regularly monitored the research programme of regional laboratories and made valuable suggestions and proposals for collaboration and avoidance of unnecessary duplication. Viewed in this overall perspective, and as part of an overall plan with adequate safeguards and controls, the existence of a series of regional laboratories as supplementary to the chain of national laboratories could be regarded not only desirable but necessary.

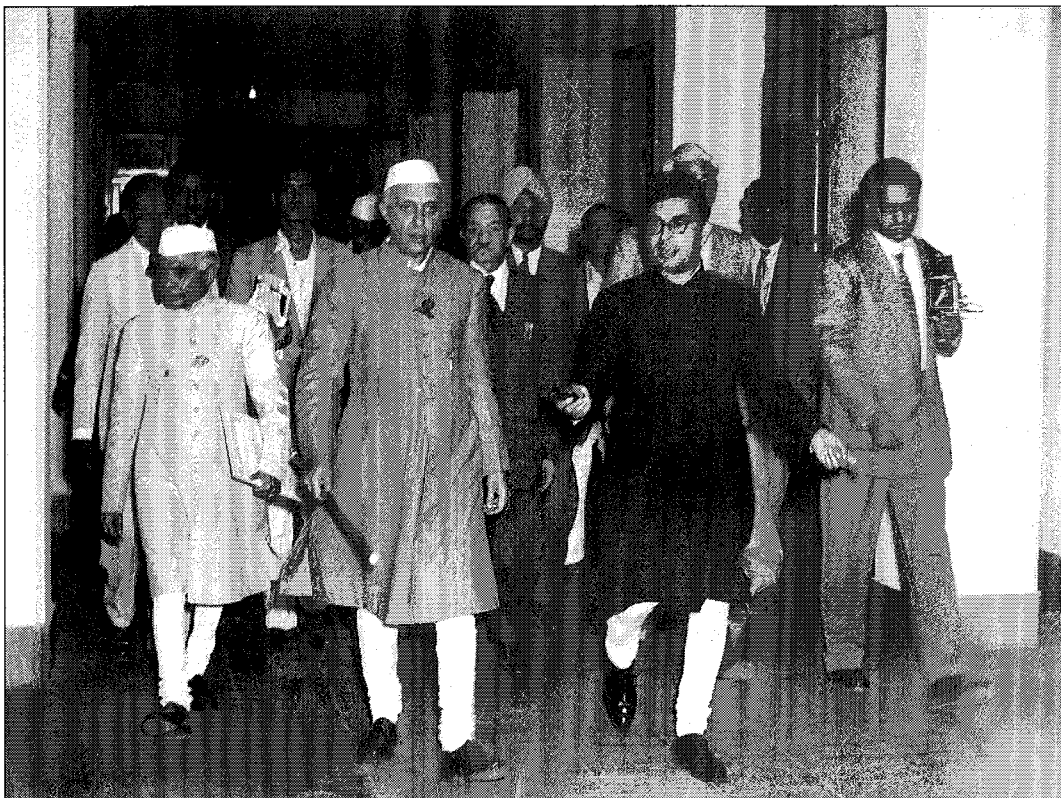
He then mentioned in detail the cooperation between these laboratories and the Central Fuel Research Institute in the field of fuel research and the National Chemical Laboratory in the field of castor oil research. He said that the Hyderabad Laboratories were concentrating mainly on problems connected with the utilization of non-caking semi-bituminous coals, including their processing by low temperature carbonization.

The Council of Scientific and Industrial Research, in cooperation with the Central Fuel Research Institute, had recently established in the Hyderabad Laboratories a regional centre for the survey of the coal deposits of this area as well as of the lignites of South Arcot. Thus a valuable and fruitful basis of cooperation work had been evolved.

Referring to people who were sceptical of scientific research, Dr. Zaheer said, "Science is a philosophy which never rests and which is never perfect. Its law is progress. The point which yesterday was invisible is its goal today and will be its starting point tomorrow."



Dr. J.C.Ghosh, in his address, said that scientific knowledge and technical know-how had become the greatest asset in the storehouse of a nation's resources. Unlike material resources, which diminished with use, this asset improved with use and was enlarged by sharing. It was in the hope that such an asset might be quickly built up in India by Indian talent that the Prime Minister, with the assistance of Dr. Bhatnagar, had set up a chain of national laboratories in various parts of India.



Shri Jawaharlal Nehru opened the new buildings of the Laboratories on January 2, 1954. Hyderabad Chief Minister, Shri B. Ramakrishna Rao, Dr. S.S. Bhatnagar and Dr. S.H. Zaheer are also seen in the picture

Such diversified location of research laboratories was of great value. It stimulated interest in science in that particular area and created confidence in scientific training as a method of elevating the mind and stamping it with a dispassionate, objective outlook.

The outstanding feature of the equipment of the Hyderabad Laboratories, he said, was the large variety of pilot plants which could be used for processing the raw materials of the area with the knowledge gained in the Laboratories. He described the Hyderabad Laboratories as a laudable venture and hoped it would prove to be an instrument for enduring prosperity and freedom from want.

While declaring the CLSIR's new building open, Prime Minister Nehru in his speech referred to the scientific progress the world had made during the last few years and said that science

had, no doubt, changed the whole world. Man had conquered nature to a great extent. He had exploited natural resources considerably. He had discovered and utilized the power and energy of electricity and the atom. But, at the same time, certain things like the atom bomb had been used for destructive purposes.

While the people in India had begun to realize the importance of science, he thought there were still many who did not realize the necessity or importance of scientific research. They had to impress upon the common people about it. They should know all these things in all their aspects. For, in a democracy, it was the public opinion that ultimately prevailed, he said.

Nehru said that a scientist should not have a narrow outlook. He should have an open mind. Science being a search for truth, they would have to accept the results of their experiments. The mind should be developed in that way.

The Prime Minister added that without science no country could progress, however able the administrators might be. Therefore it was necessary that scientific research should progress in the country. He was cheered when he said that the scientists and engineers were far more important than administrators.

Nehru said India had remained behind in scientific progress. But it was no fault of her people. They had no opportunities. Now good work was being done in the various scientific laboratories and institutions in the country.

Dealing with the division of work among the various laboratories the Prime Minister said that for a big country like India both general and special laboratories were necessary. It was desirable to have the laboratories spread out in different regions so that the scientific outlook should spread in the country. But, he added that there should be no waste of energies or duplication of work. An individual or an institution could not do all jobs thoroughly and efficiently. The laboratories should work in a manner so as not to lower the quality of the work, as was, unfortunately, the case with the universities.

Nehru referred to Dr. Zaheer's address which spoke about the Laboratories in Hyderabad contributing to the progress and prosperity of the State. He did not understand, Nehru said, why the benefits of the Laboratories should be confined only to this State. The State would no doubt benefit from the Laboratories but so would the neighbouring areas. There could be no demarcation in scientific progress. He hoped that the Hyderabad Laboratories would do excellent work and contribute to the progress and prosperity of the whole country.

*Nature*, in its issue of March 6, 1954, reported not only the details of the event but also devoted considerable space to the general aims, scientific work and the funding of the Central Laboratories.

The Indian Science Congress which was then holding its 41st Session at the Osmania University (OU) issued a write-up on the CLSIR for its delegates who were invited to attend the opening ceremony.

### **CENTRAL? REGIONAL?**

When the CLSIR was founded in the pre-Independence era in 1944, Hyderabad was a princely State. Being the focal point of R&D in the State, it was named 'Central Laboratories'. But after

the merger of the State with the Indian Union, the CLSIR suddenly acquired a regional character. That a regional laboratory managed by a State Government, should carry 'Central' in its name, did not please some. It was why Dr. Zaheer in his address stressed on the role of the regional laboratories. While the Prime Minister agreed with him and even suggested the setting up of more such laboratories, he pointed out that technology could not have regional barriers.

The limited resources of the State Government could not meet the increasing funding requirements of the CLSIR. Nehru's visit of 1952 paved the way for annual central grants as also for policy direction by the Centre. The Ministry of Natural Resources and Scientific Research asked for the revision of the constitution of the CLSIR and 'merger' of its activities with those of the national laboratories. A perceptible drift towards the Central takeover of the CLSIR could be sensed.

The Governing Body (GB) of the CLSIR in its meeting held on the January 4, 1954, constituted the following Sub-Committee to consider these aspects and make appropriate recommendations.

Prof. M.S. Thacker  
Shri C.S. Tyabji  
Shri S.N. Bilgrami, and  
Dr. S. Husain Zaheer (Convenor)

The Sub-Committee met on March 12, 1954. It recommended that the CLSIR should have an Executive Council (EC) in place of the present GB which would have representatives of the Hyderabad Government, the CLSIR, industrialists and eminent scientists as its members. The Chairmanship of the EC should be decided in consultation with the Hyderabad Government.

A Scientific Advisory Committee should also be constituted similar to those proposed for the national laboratories. "In order that the research programme of the Central Laboratories may be conducted without unnecessary duplication with the work of the national laboratories — especially the National Chemical Laboratory (NCL) and the Central Fuel Research Institute (CFRI) and to effect proper coordination of research programmes between these laboratories, the Directors of NCL, CFRI and Central Mining Research Station, may be nominated on the Scientific Advisory Committee (SAC)." The Sub-Committee further said, "The Director, Central Laboratories, recommends that the Hyderabad Government should accept the recommendations of the Committee. The Hyderabad Government should insist on the EC having full autonomy to manage all affairs of the Hyderabad Laboratories, including expenditure of funds within the sanctioned budget provision. The Hyderabad Government may also propose that the Chief Minister of Hyderabad State may be the President of the EC."

The Committee also considered the financial grants for the next five years and recommended that a non-recurring grant of Rs. 39.35 lakhs for plant and equipment and in addition Rs. 19.24 lakhs for the buildings be made available. The recurring grant inclusive of annual grant of Rs. 5.25 lakhs provided by the Hyderabad Government for the next five years be as: 1955-56 Rs. 8 lakhs; 1956-57 Rs. 9 lakhs; 1957-58 Rs. 10 lakhs; thereafter Rs. 11 lakhs annually.

The Sub-Committee recommendations were considered and accepted by the GB in its meeting held on October 6, 1954. The matter was finally discussed by the GB in its meeting of October

22, 1955, after the comments of the CSIR had been received. Among those who attended the meeting were Dr. S.Bhagavantam, Vice-Chancellor, OU and Professor C.I.Finch, Director, NCL.

The Director, Central Laboratories, informed that the recommendations of the Sub-Committee of the CLSIR, to determine the relationship between the Council and the Central Laboratories had been accepted by the Council and the matter had been referred to the Hyderabad Government for their approval.

The Chairman said that it was doubtful whether Hyderabad Government would be able to continue their existing recurrent grant after the reorganization of the State and the Chief Minister was going to discuss the question of grant from Hyderabad Government with Professor M.S.Thacker (the new Director, Scientific and Industrial Research, CSIR).

After discussion it was resolved: "that the Governing Body recommends that the Hyderabad Government should consider favourably the recommendation made by the Sub-Committee of the Council of Scientific and Industrial Research in its meeting held on the 11th and 12th May 1955 and 23rd and 24th June, 1955, regarding the question of giving grants to the Central Laboratories and the future setup of the Central Laboratories. The Hyderabad Government should stipulate that the proposed Executive Council have full autonomy to manage all the affairs of the Hyderabad Laboratories, including expenditure offunds within the sanctioned budget provision. The Hyderabad Government may also propose that the Chief Minister of Hyderabad State may be the President of the Executive Council."

Another important matter discussed by the GB was the future of the BSIR, Hyderabad, since it had not been dealt with by the Sub-Committee of the CSIR. It was suggested that the Board might be abolished and its funds merged with those of the CLSIR. The Director, however, felt that the Board had an important advisory role and it had several top scientists and industrialists as its members. Though the consideration of the matter was postponed at this meeting, the Board eventually melted away after the take-over of the Laboratories by the CSIR.

#### **HYDERABAD STATE 'WITHERS AWAY'**

An event of utmost political significance involving millions of people took place on December 15, 1952. The Presidency of Madras, carved by the British for administrative and political reasons, comprised besides Tamil-speaking population, areas where Telugu and Malayalam were spoken. The Andhras felt that they were not given their due share of development activity and started an agitation for a separate State. One of the leaders of this movement, Shri Potti Sriramulu, who was on a fast to achieve this end, died on this day. The event was followed by large-scale disturbances and destruction of public property. The principle of linguistic redistribution of the provinces as a political objective had been accepted by the Indian National Congress as early as in 1920. In fact, Andhra was one of the linguistic units of the Congress organization since 1927. In 1949, the JVP Committee comprising Nehru, Patel and Pattabhi Sitaramayya in its report, while reiterating the principle, commended caution. The recommendation formed part of the Election Manifesto of the Congress in 1951.

In view of such long and persistent commitment and the violent agitation which followed the death of Potti Sriramulu, the Government announced the formation of Andhra State which was formally inaugurated by Nehru in October, 1953. The Government also appointed the

States Reorganization Commission (Fazl Ali, Chairman and H.N.Kunzru and K.M.Pannikar, Members) which submitted its report on October 10, 1955, recommending the trifurcation of Hyderabad State. The Marathi and Kannada speaking areas of the State were to be delinked and attached to Bombay and Mysore States respectively. The residual Hyderabad State (Telengana) and Andhra were both Telugu-speaking areas but the people had different backgrounds of their struggles and perceptions of their freedom. The people of Telengana expressed their fear of domination by numerically superior Andhras especially after being at the helm of affairs in Hyderabad State. Finally, the leaders of the two areas signed Gentleman's Agreement providing some safeguards on February 20, 1956. Nehru announced the formation of Andhra Pradesh at a public meeting at Nizamabad on March 5, 1956. The newly-integrated State came into formal existence on November 1, 1956. With this, Hyderabad State disappeared as a geographical and political entity.

### **CSIR TAKES OVER CLSIR**

The Government of Hyderabad and the CSIR reached an agreement whereby the latter took over the assets and liabilities of the CLSIR and renamed it as the Regional Research Laboratory, Hyderabad. The agreement assured the retention of the regional character of this new type of a National Laboratory. It was also stated that the Chairman of the RRL's EC will be the Chief Minister of the State. This thwarted some attempts at dismembering the CLSIR by converting it into a group of extension centres of other laboratories.

Reporting the event, the *CSIR News* of April 28, 1956 said, "In accordance with the decision of the Council of Scientific & Industrial Research and the Government of Hyderabad State, the Central Laboratories for Scientific & Industrial Research, Hyderabad, were taken over by CSIR on April 13, 1956.

A brief ceremony was held when Professor M.S. Thacker, DSIR, visited Hyderabad for the formal taking over.

Dr. S.Husain Zaheer, Director, Central Laboratories in receiving Professor Thacker expressed satisfaction at the recognition of the work done in the Hyderabad laboratories by raising it to national status.

Professor Thacker welcomed the Central Laboratories for Scientific & Industrial Research into the family of National Laboratories and assured the staff that every facility would be given to research workers to enable them to play their full role in the work that lies ahead."

The take-over by the CSIR became effective from October 1, 1956. Till then the Regional Research Laboratory continued to function under the State Government. The last time the CLSIR was mentioned in the Hyderabad Government Gazette was on May 24, 1956 when it carried a notification signed by its Director. Curiously, another notification of the same date signed by the Director, RRL was also printed alongside in the Gazette. A novel method of notifying the take-over indeed!

The event was commented in the Annual Report 1956 as: "A significant event in its development, which we have reason to view with satisfaction as reflecting credit on our work, is the taking over of the Laboratory from the Government of Hyderabad by the Council of Scientific and Industrial Research, New Delhi. Formerly called the Central Laboratories for

Scientific and Industrial Research, Hyderabad, it now functions with a new name Regional Research Laboratory, Hyderabad - implying that its essential regional character is maintained, and that the work continues to be directed towards the investigation and application primarily of local raw materials. The Laboratory thus becomes the first National Laboratory designed to meet regional needs.

“The administrative functions formerly performed by the Governing Body, appointed by the Government of Hyderabad, have now devolved on the Executive Council consisting of representatives of the Andhra Pradesh Government and the CSIR and eminent industrialists and scientists with the Chief Minister, Andhra Pradesh, as Chairman. The scientific programme, formerly supervised by the Board of Scientific and Industrial Research, Hyderabad, through constituent research committees, is now looked after by the Scientific Advisory Committee consisting of scientists from important academic and industrial institutions of the region.”

The Central Laboratories for Scientific and Industrial Research, Hyderabad attained the stature of a National Laboratory as quietly as it was born.

The first Regional Research Laboratory under the CSIR thus came into being.



# **Regional Research Laboratory Hyderabad**







# REGIONAL RESEARCH LABORATORY HYDERABAD

## THE NEW ERA

It was during the last days of Hyderabad State when the Government agreed to 'merge' the Central Laboratories with the CSIR. The political atmosphere of the State was, however, surcharged with uncertainty, especially with regard to the future of the 'residual' Hyderabad State. Nehru had firmly advised on May 8, 1955 that the people of different languages should live together in one state. But events moved against this tide and the Gentleman's Agreement of February 20, 1956 was soon followed by Nehru's announcement of March 5, 1956 regarding the formation of Andhra Pradesh. CSIR's formal takeover by the CSIR took place on April 13, 1956. Chief Minister B. Ramakrishna Rao was nominated as the Chairman of the Regional Research Laboratory's first Executive Council and was also made a member of CSIR's GB. The official takeover of the Laboratory became effective from October 1, 1956 and the new state of Andhra Pradesh came into being on November 1, 1956.

The two events, namely, the formation of Andhra Pradesh and the transformation of a Central Laboratory of a region into a regional laboratory of the Centre ran parallel in time. Though differing in magnitude, they signalled qualitative changes in their respective spheres. Another event of significance to the RRL and the CSIR was the new administrative setup at the Central office of the CSIR following the appointment of Mr. P.M.Sundaram as Secretary CSIR.

When Mr. R.P.Bahadur retired on May 14, 1956, he was succeeded by Mr. Sundaram. Soon Mr. S.K. Bose, who looked after financial matters as Joint Secretary, also retired. Bhatnagar-Bahadur-Bose ran the CSIR as an autonomous body, drawing upon the Government Rules, as and when required. Mr. Sundaram, with his background of work in the Law Ministry, streamlined the administrative procedures and revised the Bye-Laws of the CSIR in a manner which extended Headquarters bureaucratic control over the laboratories. He consolidated the domination further by appointing new Under Secretaries, Section Officers, Purchase and Stores Officers and Assistants and posting them in the laboratories. In the process, the laboratories not only lost their freedom but a system of dyarchy and dual loyalty came into vogue. For RRL, its timing was unfortunate since delicate details of the takeover like the equation of posts and grades of the staff were under negotiation. Commenting on this phase, Dr. Zaheer later said, "Till 1956 or 1957, the Directors (of the National Laboratories) had enjoyed certain wide powers for the creation of posts, appointment to the posts and expenditure within ceiling and, of course, within budget as well as reappropriations from one budget head to another. In 1956 or 1957, these powers were suddenly withdrawn without the Directors being consulted and vested in the Central Office." This trend was later reversed and powers were restored to the laboratories soon after Dr. Zaheer took over as the DGSIR. Today, the Directors demand even more freedom, and "a system where rules are few and the outcome strictly judged."

## EXECUTIVE COUNCILS OF RRL

The first Executive Council (EC) of the newly rechristened Regional Research Laboratory (RRL) had under the terms of transfer agreement, the Chief Minister of the State as its Chairman (Shri B.Ramakrishna Rao till October 31, 1956 and Shri N.Sanjiva Reddy from November 1, 1956). Other members of the EC were Shri Vinayak Rao Koretkar (till October 31, 1956), Shri V.B. Raju (from November 1, 1956), Prof. N.V.Subba Rao, Prof. K.Srinivasan, Shri T.M. Jagtiani, Nawab Zain Yar Jung, Shri P.A. Narielwala, Shri S.Anantharama Krishna, Prof. M.S.Thacker, Dr. S.H.Zaheer and FA to CSIR (G.L. Mehta/Motilal). Shri M.C.Joshi was appointed EC's Secretary.

The first Scientific Advisory Committee (SAC) was also constituted with Director, RRL as its Chairman and Shri S.K. Nargundkar, Shri A.Sinha, Dr. K.Madhava Parnikar, Dr. D.K.Bannerjee, Dr. C.V.S.Ratnam, Shri M.Ali Khan, Dr. M.S.Krishnan, Shri P.Govinda Menon and Shri Amir Ali Rahimutula as its members and Dr. K.T.Achaya as Secretary.

The first meeting of the EC was held under the shadow of historic changes in the State on September 10, 1956. The Chairman, Shri B. Ramakrishna Rao remarked that "Under the new set-up, the scope and functions of the Regional Research Laboratory have been considerably extended and after the reorganization of the States, the Laboratory would be of great use in carrying out the industrial development of the Southern Zone." Agreeing with the Chairman, the DGSIR added that "to this end, the members of the SAC were all from this zone." He also conveyed the CSIR's decision "to set up a permanent station for systematic survey of the coal fields at the campus of RRL and all work would be done with the closest cooperation between the station and the RRL." DGSIR agreed with the Chairman that "the items of work on hand may be completed and the problems referred to RRL by the industries and the Government Departments and those pertaining to local raw materials would continue to be tackled by the RRL."

Earlier, during discussions with DGSIR, the Chief Minister agreed to an annual contribution of Rs. 2 lakhs to RRL as a token of the State Government's abiding interest in the work of the Laboratory.

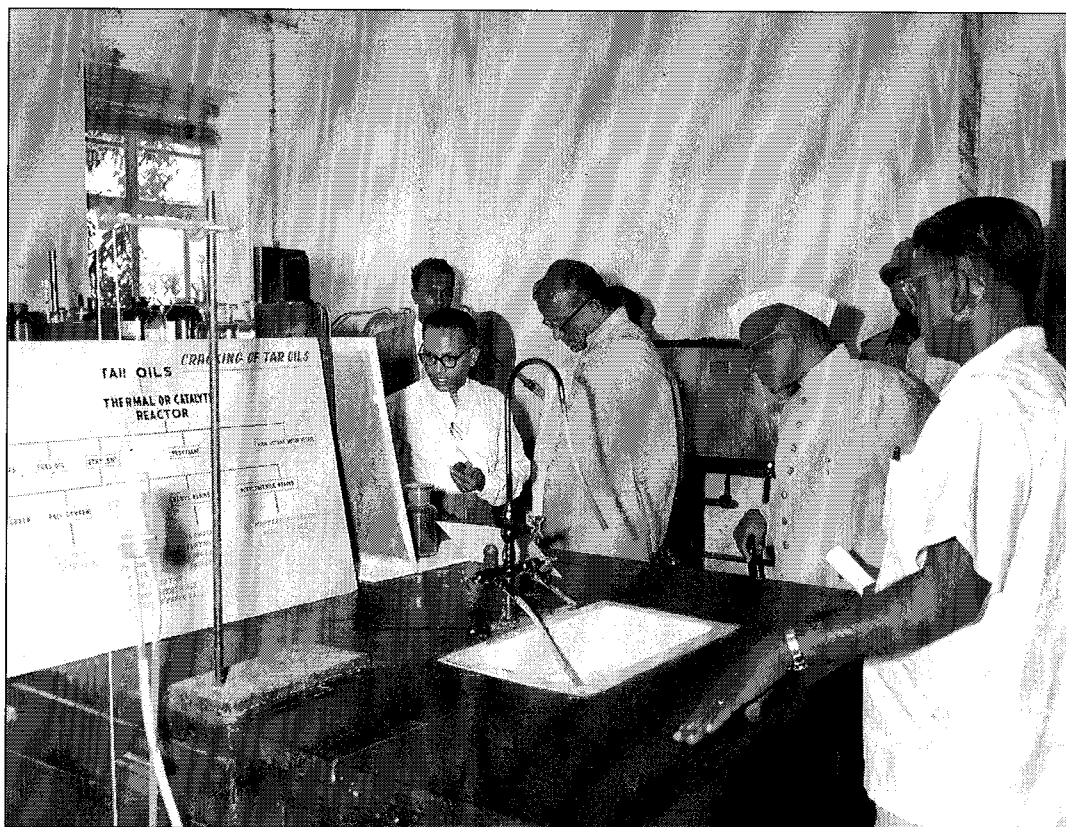
After the formation of Andhra Pradesh, Shri N. Sanjiva Reddy took over as its Chief Minister. He was therefore nominated by the CSIR as the Chairman of RRL's EC. During discussions on the 1957-58 budget in the second meeting of the EC on February 19, 1957, the DGSIR announced that CSIR budget had been drastically cut including a 10 per cent cut in the recurring grant. He, however, dispelled any apprehensions regarding the future of the personnel of RRL and affirmed that CSIR would pay the agreed salaries and honour its commitment. He added that the standing budget for 1956-57 and any additional expenditure consequent on bringing the salaries to the CSIR scales would be met.

The general direction of the CSIR's GB that all laboratories should engage in work of such a nature as could be applied to industries, was brought to the notice of the EC. It was, however, noted that the Laboratory had the same objective right since its inception.

The EC meeting of March 3, 1958 held under the Chairmanship of Shri N. Sanjiva Reddy discussed several issues which touched on the basic approach of the laboratory. Shri Narielwala observed that the RRL had set up pilot plants costing several lakhs of rupees and

of the scale of semi-commercial plants producing saleable products. In his view the size of the pilot plant set up in a laboratory should be the minimum required for the collection of data. It was explained to him that in certain cases, it was necessary to have pilot plants of a size to produce saleable products in order to demonstrate to the industry the successful working of the processes and the marketable quality of the products. This was necessary in India where industry on the whole was not yet enterprising enough to readily invest in the new undertaking without sufficient techno-economic data. The size of the pilot plant was not determined by its cost but primarily on its capacity to provide the data, technical, operational and economic, on a scale which could be converted to the capacity required in a commercial size plant. If the pilot plant products were saleable, both in quality and quantity, they should be disposed off. This would not only reduce the operating costs of the pilot plant but would also provide valuable market data.

Another related decision was regarding the LTC pilot plant. "It was resolved that the CSIR may take over the LTC Plant and negotiate with the A.P. Government the terms and conditions under which this may be done. The EC further resolved that till such time as the negotiations were completed, the plant would be run by the Director, RRL, as herebefore by utilizing the receipts towards expenditure."



Shri N. Sanjiva Reddy, Chief Minister of Andhra Pradesh discussing coal-based projects during a visit

Another project which reflected the basic working philosophy of Laboratory related to industrial water which was of interest to every industry. The limited objectives of the project were "to examine the availability of industrial water, treatment required of such water for boiler feed and the difficulties encountered by the industries in the region with regard to their water and its treatment." Mr. Narielwala suggested to make it specific to a few industries while Dr. Whittaker supported the generalized approach since "the problem of industrial water was indeed important and its great importance was self-evident to any one". Dr. Zaheer said that as desired by Chairman, he would get in touch with the industries who might finance the project. He added that the problem was of universal value affecting all industries and should therefore be taken up whether or not a particular industry was prepared to fund it.

The aims and objectives of the RRL remained the same as they were defined for the Central Laboratories with region' substituting Hyderabad State. The Annual Report 1957-58 noted significant increase in the sponsored research and greater attention on pilot plant research. A number of parties had approached the Laboratory for direct assistance in setting up new industries by making available its scientific and engineering staff to establish working conditions, provide designs, help in the procurement and installation of equipment which was more than the present-day turnkey assignment and" put strain on their resources and talent available." The extent to which *ad hoc* problems from industry might be entertained without impinging upon the long range programmes was important. Also important was "a certain minimum effort in the fundamental scientific work to keep up the tone of research in the Laboratory" and also for understanding "the fundamental aspects of applied problems."

#### COMMITTEE FOR FIXATION OF PAY AND GRADES

The CSIR appointed a high-powered "Committee for Fixation of Pay and Grades of the staff of RRL" with Prof. M.S. Thacker, DGSIR as its Chairman and Prof. B.C. Guha, Dr. D.S. Kothari, Dr. Ing. E. Weingaertner, Nawab Zain Yar Jung, Shri M.Lokanadhan (representing the State Government), Shri D.S. Nakra (FA, CSIR), Shri P.M.Sundaram and Dr. S.H. Zaheer as its Members. The committee met several times. The last meeting was held on December 5 and 6, 1957.

The fixation of pay and equivalent CSIR grades for the administrative and non-technical staff presented hardly any problems. It was with respect to the scientific staff that the issues were made complicated. In the ex-CLSIR, there were only a few grades for the scientific workers and these were Research Assistants, Scientific Officers, Assistant Directors and Director. In contrast, the CSIR had a plethora of grades with several posts carrying more than one grade. There were Junior and Senior Scientific/Technical Assistants, Junior/Senior Scientific/Technical Officers; Senior Scientific Officer Gr.I; Assistant Directors Gr. II and Assistant Directors Gr.I. Even the Directors could be placed in more than one grade.

It was the endeavour of the Central Office to maintain parity between the posts/grades fixed for the RRL staff and those prevailing in other national laboratories. Thus Scientific Officers were attempted to be placed in three categories *viz.*, JSOs, SSOs Gr II and SSOs Gr I purely on the basis of seniority. Similarly, some Assistant Directors were taken as ADs Gr I and others as AD's Gr II. The staff demanded a parity, not between laboratories, but of the grades. The final outcome would naturally have not satisfied everyone but some senior grade posts were

created and advertised. These were eventually filled by the very scientists who were denied these in the name of parity. Among these were G.S.Sidhu, M.G.Krishna, G.S.Chowdhury and K.S.Chari who later occupied positions of higher responsibility with distinction.

A fall-out of the fixation of grades and scales and related issues was that the hitherto virtually non-existent status consciousness made inroads into the laboratory. This negative gain is duly reflected in the Annual Report 1957-58 where the staff, for the first time, is shown designation-wise in contrast to earlier listing which was discipline-wise.

The overall gain, however, was overwhelming since the laboratory's takeover by the CSIR was the first step towards consolidation and progress leading to further expansion of work and influence of the RRL in several areas of industry.

### SCIENTIFIC POLICY RESOLUTION

The setting up of the National Planning Committee by the leaders of the freedom movement and the association of scientists with its work, was an early recognition of the role that science and technology could play in the speedy socio-economic development of the country. The continuing interaction between the scientists and the political leadership eventually resulted in the Scientific Policy Resolution passed by the Parliament in 1958. The main thrust of the Resolution was towards involvement of scientists in solving country's socio-economic problems by application of science and technology and by taking active part in the decision making to achieve that objective. The resolution was also aimed at creating necessary infrastructure like R&D institutes, technical institutes of higher education and at promoting scientific temper for the people to appreciate the role of science and technology in the development process.

The resolution for the first time gave a clear role to R&D in the national development by fixing its social goals.

### NEW EXECUTIVE COUNCILS & SCIENTIFIC SUB-COMMITTEES

During 1958-59 the CSIR constituted a new EC for RRL. The earlier Scientific Advisory Committee was replaced by the Scientific Sub-Committee of EC which had scientist members of the EC as its members. It had powers to coopt more members. The new EC continued to have Chief Minister N.Sanjiva Reddy as its Chairman. The new members were: Prof. T.R. Seshadri (Delhi), Dr. S.Bhagavantam (Bangalore), Lala Charat Ram (Delhi), Dr. G.P.Kane (New Delhi), Dr. V.T.Athavale (Bombay), Shri Anil De (Hyderabad), Shri C.V.D.Murthy (Hyderabad), Shri Syed Kazim (Hyderabad), Dr. D.S. Reddy (Hyderabad), Prof. C. Mahadevan (Waltair), Prof. M.S.Thacker, DGSIR, (New Delhi), Shri A.V.Venkateshwaran, FA (New Delhi), Dr. S. Husain Zaheer, DRRL (Hyderabad). Shri M.C. Joshi was continued as its Secretary. The Scientific sub-committee (SSC) of the EC had Dr. Zaheer as its Chairman and Prof. Seshadri, Dr. Bhagavantam, Lala Charat Ram, Dr. Kane, Dr. Athavale, Shri Anil De, Shri Murthy, Shri Syed Kazim and Prof. Mahadevan as its Members. The coopted members were: Shri P.A. Narielwala (Bombay) Shri M.V.Kamlani (New Delhi), Shri C.P.Shah (Bombay), Dr. Atma Ram (Calcutta) and Shri T.M.Jagtiani (Hyderabad).

**The SSC had the following functions:**

- i) consider the scientific programme of the Laboratory;
- ii) review the programme of research;
- iii) consider the annual report;
- iv) make recommendations relevant to the implementation of research projects;
- v) screen and advise on pilot plant investigations;
- vi) consider and recommend requirement of scientific equipment, apparatus and buildings;
- vii) consider and recommend requirement of scientific and technical staff; and
- viii) such other matters of technical and scientific interest which may be referred to it by the Executive Council.

During the EC meeting of September 13, 1958 which constituted the above SSC, there was considerable discussion on the scope of work of RRLH.

Shri Charat Ram made certain general observations on the programme of work of the Laboratory. There were certain pilot plant projects which had been under investigation for a period of more than three years. An evaluation of these projects as well as the amount spent on them had to be done. Secondly, there are some pilot plant projects in the Laboratory which were neither of a commercial nor of a semi-commercial nature like the LTC pilot plant and hand-made paper. In all these cases, it was essential to consider the size of the pilot plant as well as to prescribe the time limit for the working of the pilot plant. It was also considered essential to determine the point at which pilot plant trials should cease. As these aspects of the question were common to all the National Laboratories/Institutes of the CSIR, it was recommended that the matter be taken by the CSIR as a general question to lay down a uniform policy.

Further, it was envisaged that the pilot plant experiments in the Laboratory may be of two categories: (i) research schemes of a scientific and fundamental nature for which cost estimates could not be prepared; and (ii) pilot plant projects set up for a specific purposes, for producing certain marketable products. For the latter category, it was suggested that detailed financial requirements of the project as a whole be prepared for a limited period, at the end of which it would be necessary to take stock of the position.

The Director, Regional Research Laboratory, gave the following reasons for undertaking some of the pilot plant projects on a large scale in the Laboratory:-

1. To cut down the cost of the products, and
2. To educate the public and popularize the products.

Shri Charat Ram doubted whether this was the function of a research laboratory and observed that for embarking on large scale trials, more capital funds had to be sunk. While discussing this matter, Shri A.V. Venkateswaran, Financial Adviser to CSIR observed that the functioning of the LTC pilot plant in the Laboratory had to be reviewed.

Besides, it was observed that the Regional Research Laboratory, Hyderabad should not as far as possible, undertake work on ceramics when there was a laboratory, the Central Glass and

Ceramic Research Institute (CGCRI) Calcutta devoted entirely to such work. The work envisaged in the Regional Research Laboratory, Hyderabad, should therefore have to be co-ordinated with the work being done in the CGCRI, Calcutta and it would be advisable if the Directors of these Laboratories met and discussed to avoid duplication of work.

In this connection, Shri Charat Ram also suggested that an "Evaluation Committee" be appointed to assess the work of the Laboratory since the time of its taking over by the Council of Scientific and Industrial Research. The Executive Council agreed with the suggestion.

The next meeting of the EC was held on February 24, 1959. The SSC had earlier met on February 10-11, 1959 but its proceedings had not been finalized. Professor Seshadri said that since a number of fundamental issues (like the legitimacy of Biochemistry work) had been raised, consideration of items bearing on the proceedings be postponed. The Chairman suggested early meetings of the SSC and EC to resolve the issue.

Within one year, the EC and its SSC were reconstituted. The Directors of NCL and CFRI were made new members of the two bodies besides retaining Professor Seshadri as EC member. Shri N. Sanjiva Reddy continued to be the EC's Chairman. The members were: Prof. T.R.Seshadri, Dr. K.Venkataraman, Dr. A.Lahiri, Lala Charat Ram, Shri V. Rama Krishna, Shri Anil De, Shri Syed Kazim, Prof. C.Mahadevan, Dr. D.S.Reddi, Shri P.M.Nayak, Prof. M.S.Thacker, Shri A.V.Vankateshwaran, FA and Dr. S.H.Zaheer.

The SSC comprised Dr. S.H. Zaheer (Chairman), Dr. K.Venkataraman, Dr. A.Lahiri, Prof. C.Mahadevan, Prof. T.R.Seshadri and Prof. G.Gopal Rao.

The EC met on August 17, 1959 and on February 9, 1960. It accorded sanction for the new items of equipments and apparatus, including equipment for hydro-refining and catalytic hydrogenation of low-temperature tar. Approval for the construction of auditorium was also given. During discussions on the research programmes, the relevance of areas like Organic Chemistry and Biochemistry in a regional research laboratory was questioned. It was however pointed out that researches in these areas were on the programme since 1944 and had also been agreed as part of the Laboratory's research programme at the time of its transfer to the CSIR. Despite strong plea for the retention of these research areas, the CSIR nominees on the EC persisted in their demand on the ground that they were specialized areas of another national laboratory.

It had become clear from the deliberations that there was concerted move to belittle RRLH and its Director since he was an outspoken critic of the way R&D was being managed in India, which did not please the science establishment. That Organic Chemistry and Biochemistry continued to flourish at RRLH is another story.

It was in this background that the GB of the CSIR appointed a Specialists Committee to consider the issue.



## SPECIALISTS COMMITTEE

The objectives of the Specialists Committee were:

- i) to consider the functions of the Regional Research Laboratory (Hyderabad) and to lay down a suitable programme of scientific work specifying broadly the topics that should be covered and the fields of specialization, and
- ii) to consider in broad detail the research work of the Laboratory in relation to the programme of work of other national laboratories especially the National Chemical Laboratory, Poona, the Central Fuel Research Institute, Jealgora, and the Central Glass and Ceramic Research Institute, Calcutta with a view to avoiding any duplication of work amongst the national laboratories.

The Specialists Committee had the following composition:

Prof. M.S.Thacker, DGSIR	(Chairman)
Dr. S.Bhagavantam, Director, IISC, Bangalore,	Member
Dr. B.C.Guha, University College of Science, Calcutta,	Member
Dr. K.Venkataraman, Director, NCL, Poona,	Member
Dr. A.Lahiri, Director, CFRI, Jealgora,	Member
Dr. Atma Ram, Director, CGCRI, Calcutta,	Member
Lala Shri Ram, New Delhi,	Member
Shri A.N.Khosla, Member, Planning Commission, NewDelhi,	Member
Dr. S.Husain Zaheer, Director, RRL, Hyderabad,	Member

It may be recalled that Professor Thacker, Dr. Bhagavantam, Dr. Lahiri and Dr. Atma Ram (together with Professor McBain and Dr. Finch) had served on the GB/BSIR of the ex-Central Laboratories with distinction and together with the late Dr. J.C.Ghosh were responsible for formulating the programme of research and had thus contributed in a large measure in drawing up the original programme of work of RRL taking special care to avoid duplication.

The Specialists Committee held several meetings. On the basis of its recommendations, changes in the organizational setup of the Laboratory were made mainly to accommodate the demands of the Directors of some national laboratories. The Divisions of the Laboratory were reorganized as follows:

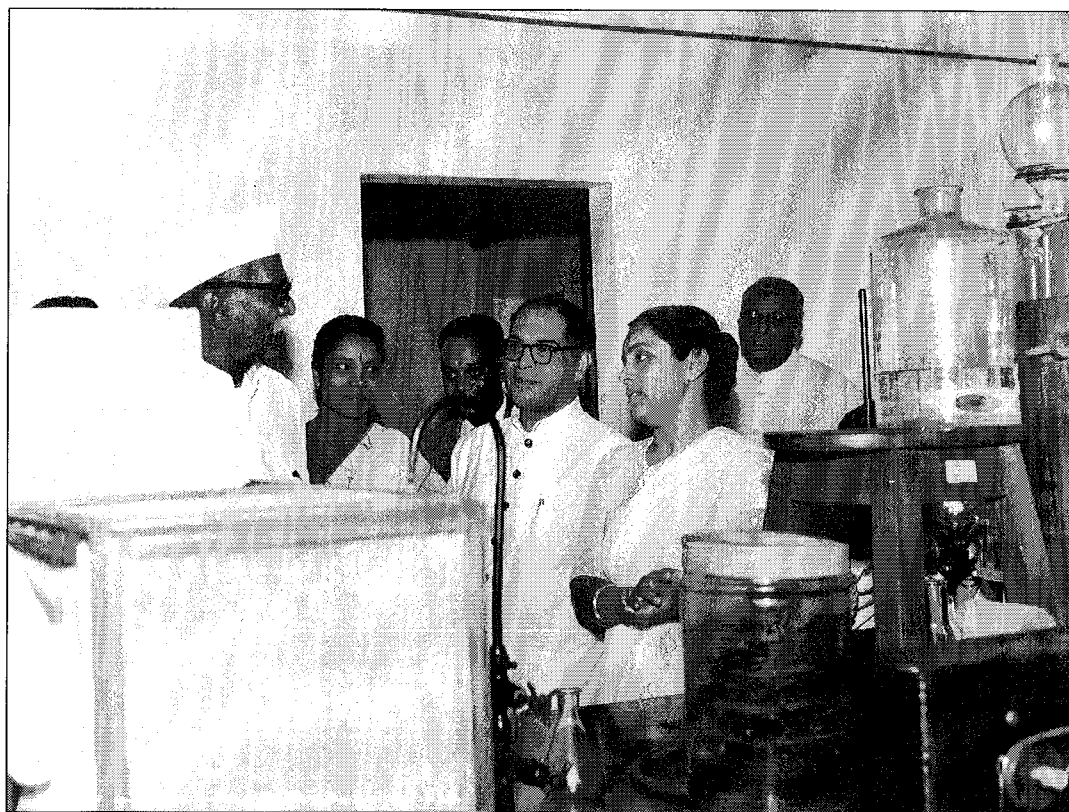
1. Division of Oil and Fats
2. Division of Surface Coatings and Pigments
3. Division of Coal
4. Division of Chemical Engineering
5. Division of General Engineering
6. Division of Technical Services

In addition, there was a Director's Personal Research Section.

The Division of Technical Services comprised the following Sections:

1. Organic Chemistry, Drugs & Pharmaceuticals
2. Essential Oils and Aromatic Chemicals
3. Entomology
4. Biochemistry
5. Hand-made Paper and Cellulose
6. Inorganic Chemicals and Fertilizers
7. Industrial Ceramics
8. X-Rays
9. Physical Chemistry
10. Analytical Chemistry and Industrial Water
11. Operational Research, Technical Information and Industrial Liaison.

The Division of Chemical Engineering was required to undertake pilot plant research based on the results of laboratory research besides carrying out research on problems of Chemical Engineering. The Division of General Engineering was given the responsibility of design and fabrication of pilot plant equipment and services of the Laboratory.



President Dr. Rajendra Prasad visited the Laboratory on July 30, 1957

The Committee also considered the equipment required by the various research areas and rejected the request of all equipments and instruments required by Organic Chemistry and Biochemistry since they were mere 'service' groups in a regional laboratory.

The clubbing together of several diverse groups accounting for about sixty percent of the Laboratory's total research staff was not only clearly bad from the administrative point of view but also defied logic. The insignificant role given to Organic Chemistry, Drugs and Pharmaceuticals in the new set-up is ironic since Dr. Zaheer himself was an organic chemist and all his successors to-date have specialized in the same discipline. Organic Chemistry today occupies a predominant position in the IICT engaging the creativity and devotion of a large number of scientists in innovative research in several of its sub-disciplines. The latest addition in this direction is the Natural Products Laboratory.

The Biochemistry Section had been working in the traditional area of fermentation technology. In 1957-58 when P.M. Bhargava rejoined the Laboratory after completing a Post-Doctoral assignment abroad, he was permitted to initiate a few projects in the areas of cellular and molecular biology which was in keeping with CSIR's policy of encouraging basic research especially in a frontier area of science. The Specialists Committee considered conducting research in such a highly specialised subject inappropriate. The Director pleaded for its retention saying that it would otherwise be unfair both to the Laboratory as well as to the bright young scientist who had initiated the work. When Dr. Zaheer was adamant, he was asked to take up the projects as his personal research interest. Today, the small group which was given opportunity to work has grown into a full-fledged national laboratory, Centre for Cellular and Molecular Biology (CCMB) which not only vindicates RRL's policies but also speaks of the foresight of its Director.

The report of the Specialists Committee was accepted by the CSIR's GB in its meeting held on November 4, 1960. Thereafter CSIR's Central office held up sanction for almost on everything even when the EC had specifically approved budget. An amusing incident was a letter dated February 1, 1960 turning down several items including purchase of Infra Red Spectrophotometer quoting the Specialists Committee which had said that the facilities of NCL, Poona may be utilized for any infrared spectroscopic studies.

The scope and the relevance of RRL's research programme again came up for discussion at the EC meeting held on March 11, 1961 when the DGSIR while summing up said that "as far as this Laboratory was concerned, it was well within its scope and resources to take up any short-term investigations of local interest irrespective of whether or not another Laboratory was doing the same type of work. This question he explained, was carefully considered by the Specialists Committee and in order that the Laboratory may be of service to the local industrialists a new division called the Technical Services Division was approved for the Laboratory in which *ad hoc*, short-term investigations of local interest could at any time be taken up."

In retrospect, it appears that the Specialists Committee suffered from a mistaken notion that the national laboratories had been established as a sort of 'Jagirdari System' of R&D where each laboratory had the national responsibility of a specified discipline or area of research and none else, not even a sister laboratory, could impinge upon its domain. This led to loss in its objectivity. The consequential recommendations of the Committee were therefore narrow

and fragile in nature which not only did not stand the test of time but also caused great harm to the very conduct of research it had professed to promote.

The sequence of events *viz.*, the change in the composition of the Laboratory's EC and the appointment of a Specialists Committee followed by its recommendations took place so soon after the Science Policy Resolution of the Parliament that it cast a shadow on the wisdom of the top management of the CSIR and its bureaucracy. The researchers at the RRL were assured by the Director that the proposed reorganization was only an administrative matter and that the research programmes would not be materially affected. And indeed, the multidisciplinary approach enabled these set-backs to be absorbed despite an unsympathetic and hostile Central Office.

### NEW ORIENTATION

Project-oriented system of research programme was introduced and developed at the RRL as a component part of the operational research (OR) to assist in planning, channelising and periodically evaluating the researches undertaken. The concept, included as a recommendation of the Second Reviewing Committee of the CSIR at the initiative of the late Dr. J.C. Ghosh, viewed the project "as a research programme with well-defined scope and objectives with a time frame for its completion." Each project was divided into component schemes, each with its own objective and time target, some short-term while others long term and a few of continuing nature. "Thus, while in many instances, the project is a broad one likely to continue for many years, the individual schemes under it may terminate or tend to shift in emphasis or content." The Annual Report 1957-58 carried the project-wise research programme of the Laboratory for the first time. The system was later adapted and developed in several other laboratories of the CSIR as well. In course of time, Project Leader became the manager of the project.

Commenting on the system, Dr. Zaheer said that the project is run "by a team of scientists, assistants and technicians under the leadership of a Project Leader. A Project Leader is appointed not on the basis of seniority in the hierarchy but on the basis of his competence for that particular job. All members of the team have equal status, responsibilities and sense of participation. The system proved to be a great success in removing the grievances of junior ones. As a result, an attempt was made that there should be only two types of relationship among the staff working in the laboratories. The first was a scientific relationship, which should be on cooperative basis of a team cooperating to carry out a 'research project' and the second, a personal relationship between the scientists and the Director to deal with the personal problems of the scientist where he had direct access to the Director without an intervening hierarchal ladder."

The project-orientation not only dovetailed into the OR introduced in 1949 but it also served as its additional management tool especially in the later days when project costing came into vogue. The OR teams comprised the research scientists, engineers, OR specialists and the Director which considered each project on the basis of a detailed literature note reviewing the existing knowledge, plan of work, equipment and pilot plant needs with specifications, market data and other relevant information. OR unit organized periodic review of the projects. The mid-term evaluation of the progress could check undesirable side-shooting and provide inputs from other disciplines if needed. The final evaluation in completion of the

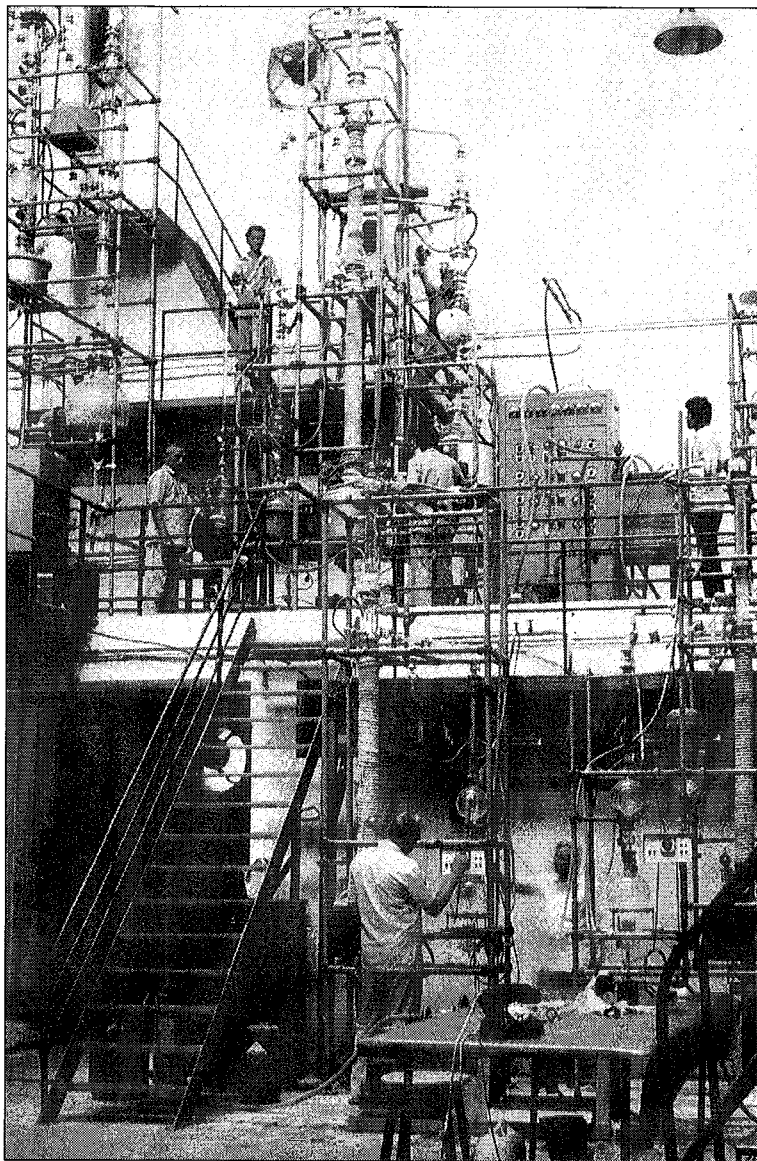
project gave indication of the steps required for the transfer of technology or new scientific knowledge (feasibility/project reports, market studies or scientific papers). Project-orientation of the research programmes greatly helped in consolidating the work in progress by focussing attention on the limited but important objectives and also by pointing towards the future line of action.

Amongst the gains of this new orientation was that an instrument ceased to be an individual's property and became available to all. The contact between the young and the more senior colleagues became further intimate thereby facilitating the cross-fertilization of ideas, so necessary in innovative research. Also the publication of research papers did not remain the only criterion for claiming the professional ladder. The system provided a support by fundamental study to technological research where necessary, on well-formulated and specific subjects.

#### ACTIVITIES IN BRIEF

The multidisciplinary approach provided by the project-orientation greatly helped to consolidate the research work of the Laboratory. The Annual Report 1958-59 noted that "the amount of work

undertaken on behalf of the industry or problems with an applied bias has continued to increase. It may be noticed that most of the research projects relate to some industrial process or product. However, fundamental approach to industrial research is necessary to make



A section of All-Glass Pilot Plants

appreciable improvement in an existing process or even to have a proper understanding of the technical problem in all its aspects. This approach is already showing results by a keen appreciation and understanding by the research workers of the underlying principles to their problems."

While presenting the Programme of work 1960-61 and 1961-62 to the Scientific Sub-Committee, the Chairman said that it "would be fitted into the new organizational pattern as approved by the Specialists Committee and any items which did not fit into this new pattern could either be dropped or specifically approved by the Scientific Sub-Committee." The Annual Reports of these years, however, do not show any discernable change in the programme of work of the Laboratory.

Work on coal occupied the attention of several disciplines. The project on low temperature carbonization of coal comprised pilot plant production and marketing of Kolsit, its consumer acceptability and consumption market surveys, examination and utilization of LTC byproducts, *viz.*, extraction and recovery of tar acids from tar oils and liquors, tar distillation, storage behaviour of tars, chlorination of tar acids, briquetting of coal and char fines and preparation of feasibility and project reports. Coals, not only from A.P. but also from nearby Maharashtra, Orissa and distant Bihar were processed on the LTC Plant to establish their suitability for LTC. Kolsit was not only accepted as a domestic fuel but was also in demand by the larger consumers. NML, Jamshedpur showed "the technical feasibility of production of pig iron using local iron ores and Kolsit." LTC tars could be processed successfully into road tar and creosotes.

The success of LTC project at the RRL was duly noted in India and abroad. CFRI, Jealgora also set up a 10-tpd LTC plant which was inaugurated on May 8, 1961. The manufacturers of LTC plants abroad made several visits to RRL to obtain first hand information on coking characteristics of Indian low-grade coals and related data. An international symposium on "LTC of Non-Caking Coals" during November 20-22, 1961 attracted 74 contributions which focussed attention on the rational utilization of low-grade coals to solve the energy problems of the country and to bring together diverse interests connected with R&D and with scientific, technological and social aspect of LTC and briquetting of coal fines.

Another important project on coal which generated considerable controversy later, *viz.*, gasification of high-ash coals, was also initiated during this period.

A related project, active carbons based on LTC char, made steady progress with the participation of NRDC. 'Hykol' brand active carbons were produced at the RRL and marketed by Voltas. Active carbons from other raw materials like lignites and coconut shell were also taken up for investigation. A survey of mineral resources of the former Hyderabad State revealed the occurrence of Fullers Earth in Chincholi Taluk of Gulbarga District (now in Karnataka). The survey was later extended to other parts of the country but major attention was paid to the Korvi earth discovered earlier. The heat-activated Korvi earth was not only useful in the bleaching of vegetable oils but also in the processing of lubricating oils. It also found application in the reclamation of the used lubricating oils.

The cottonseed project included several laboratory and pilot plant (20 tpd) investigations involving a study of keeping quality of the seed and oil to have data on their long-term storage, development of standards for raw and washed cottonseed oils, seed processing including oil refining and examination of colour fixation under varying processing conditions, and utilization of cottonseed byproducts like cake, soapstock, linters and hulls. As a result of these studies, it was possible to establish processing conditions and yields from different varieties of cottonseed grown in India which was then primarily used as a cattlefeed. To promote a cottonseed processing industry in India, a 3-day symposium was organized during December 5-7, 1958 when representatives from industry, government and non-government agencies, R&D institutions and financial institutions were exposed to different aspects of cottonseed processing technology. It became possible with these and other efforts for the industry to win several concessions by way of incentive from the Government and accept cottonseed as an important source of edible oil and oil-cake as a protein-rich cattlefeed. The utilization of cotton linters was discussed in a Seminar during September, 1962.

The castor oil project was not only concerned with its industrial utilization by chemical transformation but also with its refining itself which is different from the conventional alkali refining of vegetable oil. A seminar organized during August 12-13, 1960 discussed the techno-economic aspects of the castor oil utilization.

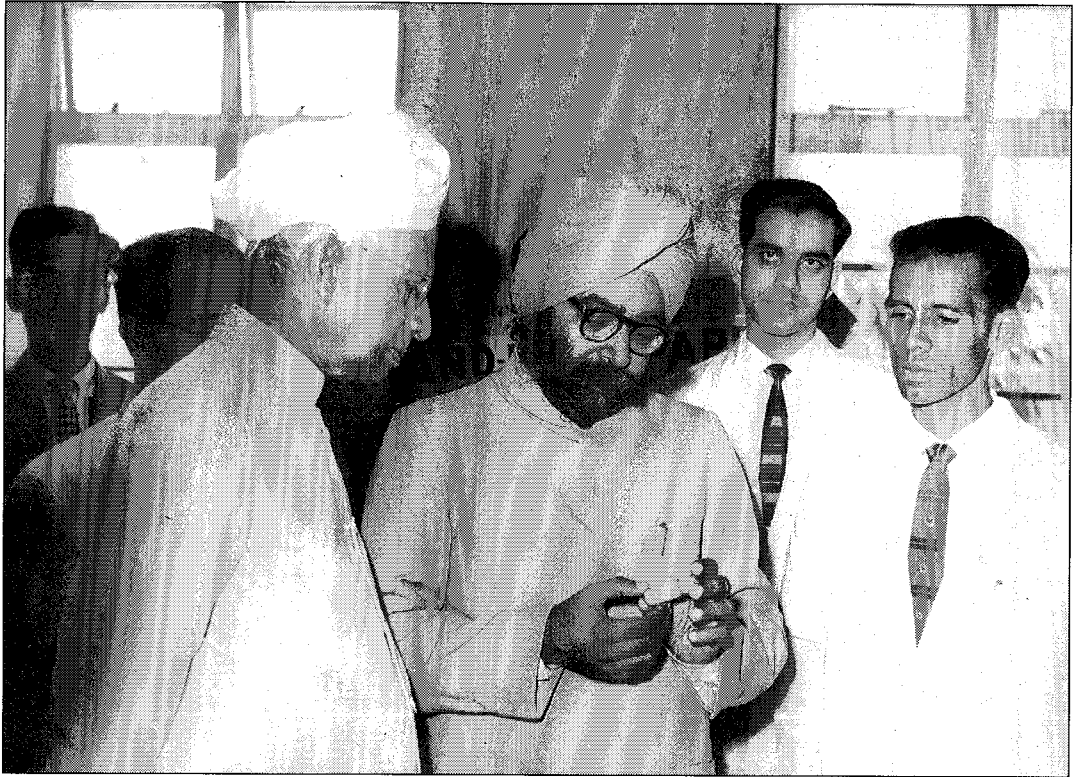
During 1957-58, the production and utilization of dehydrated castor oil (DCO) in producing paints and varnishes had expanded sufficiently to warrant the formation of a separate group on Surface Coatings which was strengthened with the appointment of J.S. Aggarwal as its Head. Cashewnut shell liquid (CNSL) was found to be a versatile material with several possibilities in development of resins for surface coatings and other applications.

Encouraged by the discovery of a hypnotic, methyl methaquinolone, a series of quinolines, isoquinolines and other moieties were synthesized for screening for their activity on central nervous system (CNS). Pilot plant scale experiments were carried out for the production of Citicide (a pesticide), benzyl chloride and related chemicals, Lounginin (a flavouring agent), levulinic acid and chemical cotton. Work was initiated on silicon carbide project.

Other areas of work related to projects on cellular and molecular biology, inorganic chemicals, catalysis, pesticides evaluation and fatty acids.

#### **RADHAKRISHNAN AND NEHRU VISIT RRL**

The Laboratory was singularly fortunate in welcoming both the President, Dr. S.Radhakrishnan and the Prime Minister, Pandit Jawaharlal Nehru during July, 1962. The earlier Presidential visit was by Dr. Rajendra Prasad in July, 1957. It was Nehru's third visit to the Laboratory, the first being in 1952 when he was accompanied by Maulana Abul Kalam Azad. The second visit was in 1954 when he inaugurated the present buildings of the Laboratory. He was then accompanied by Smt. Vijayalakshmi Pandit and a galaxy of Indian and foreign scientists. During the present visit Smt. Indira Gandhi had accompanied him. The Laboratory had been used to the visits of dignitaries, from India and abroad, but the President and the PM gracing the Laboratory by their visits so close to each other was overwhelming.



President Dr. S. Radhakrishnan during his visit to the Laboratory on July 17, 1962

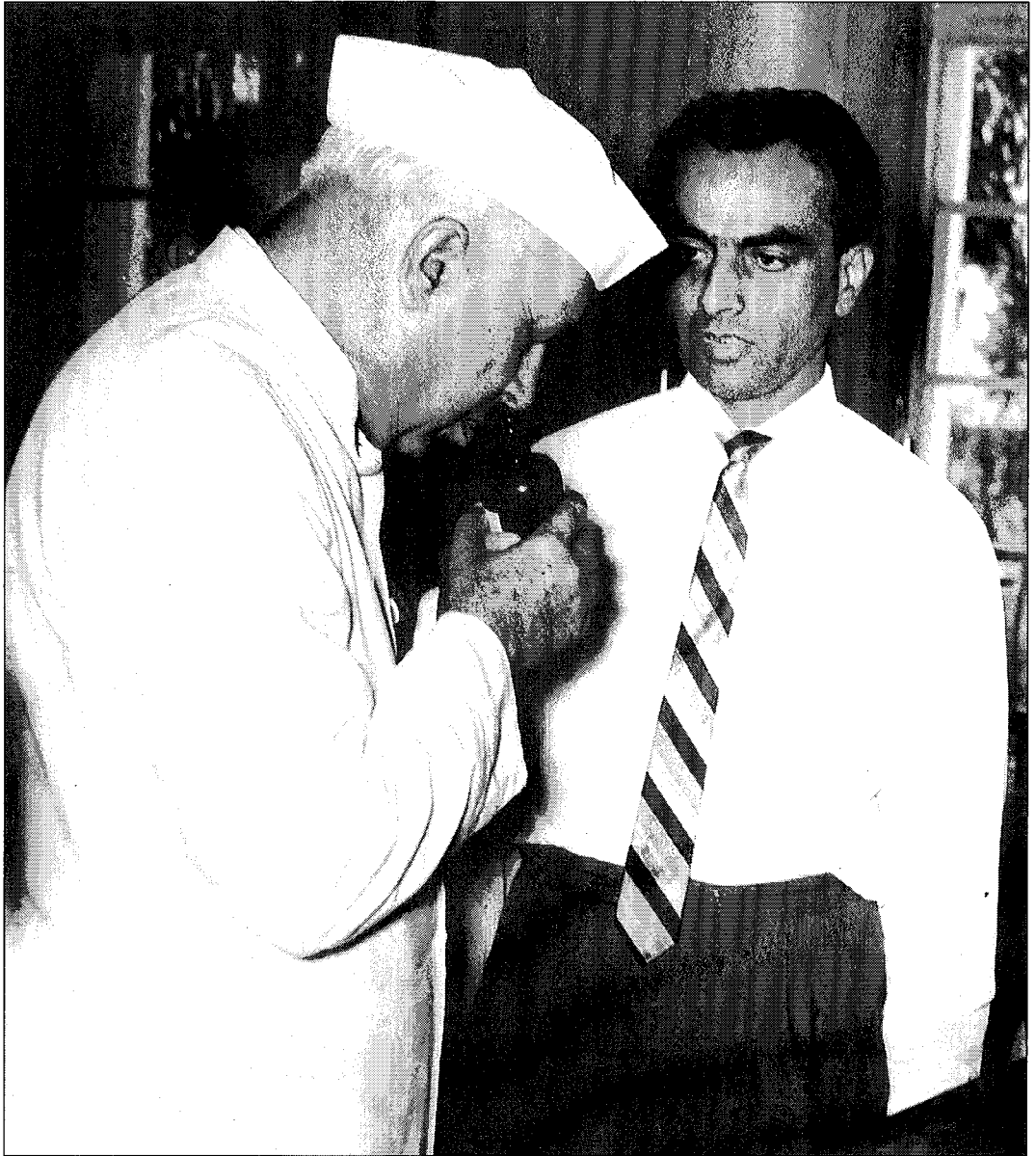
Both the distinguished visitors were impressed by the progress made by the Laboratory. Nehru was particularly struck by its approach and youthful environment.

### **ZAHEER APPOINTED DGSIR**

Soon after the visit of the President and the PM came the announcement appointing Dr. S. Husain Zaheer as the DGSIR which though not entirely unexpected yet carried an element of surprise since Dr. Zaheer had been advocating the appointment of young scientists to positions of responsibility. Years later, he revealed to Sarkar Committee "He (Nehru) felt that I had succeeded in collecting a band of young scientists, men and women, who had a sense of participation and pride in their work and he wanted me to try this on a larger scale because he also felt that science in India was really monopolized by a group of a dozen or so scientists who wanted to sit tight in Delhi and see that they were everywhere and nobody gets anywhere. Mr. Nehru told me to get about breaking this monopoly without upsetting the old gentlemen and suggested my taking action cautiously to break that monopoly."

Dr. Zaheer said that he wanted to convert CSIR into an instrument for social change and economic development through the application of S&T with emphasis on indigenous technology. For this purpose, the CSIR Headquarters should not be a mere administrative





The author explaining his work to Prime Minister, Shri Jawaharlal Nehru during the latter's third visit to the Laboratory on July 19, 1962

office but should function "as a central and technical organization to carry out the detailed and indepth study of scientific and technical development within and outside India and provide the constituent units with objective assessment and priorities."

Dr. Zaheer took charge as DGSIR on September 1, 1962.

**Sidhu Succeeds Zaheer**



## SIDHU SUCCEEDS ZAHEER

With the departure of Dr. Zaheer, Dr. D.S.Datar became In-Charge of RRLH for a brief period. He soon moved to head the Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar. Dr. G.S.Sidhu was then appointed as Deputy Director in-charge of the Laboratory on January 27, 1963. He became Director of RRLH on June 24, 1964.

There were several other changes among the senior staff of the Laboratory. Dr. M.G.Krishna and Shri G.S.Chouduary were appointed to head the Indian Institute of Petroleum (IIP), Dehra Dun and the Central Mechanical Engineering Research Institute, Durgapur respectively. Shri Baldev Singh moved to New Delhi as CSIR's Industrial Liaison and Extension Officer, followed later by Dr. K.S.Chari who went to head the newly formed

Design and Engineering Cell at the Headquarters. Born on July 4, 1920, Dr. Sidhu, a student of Dr. Zaheer at Lucknow, got his Master's Degree in 1941 and Ph.D. in 1949. The University of Heidelberg (Germany) and a couple of laboratories at Graz (Austria) provided him an opportunity for doing post-doctoral work. Dr. Sidhu became a natural successor to Dr. Zaheer as Director.



### A REVIEW OF RESEARCH STRATEGY

Dr. Sidhu had been in the Laboratory almost since its inception and had helped Dr. Zaheer together with other colleagues to give it shape, form and direction. With changes at the Central Office and with a new EC, he decided to review the policies and plan for consolidation and expansion of the Laboratory enabling it to play its legitimate role in the development of the country. Following the tradition of his predecessor, Dr. Sidhu placed trust in his associates and sought their counsel and active assistance in achieving this goal. He was assisted in policy matters and administration by Achaya, Bhargava, Vaidyeswaran, Bharat Bhushan and other senior scientists.

The success of the RRL, limited though it was, in impressing the industry of its capabilities was mainly due to the foresight of its leadership and the devotion of its scientists. It was not without reason, therefore, that CSIR decided to have more RRLs in the country. The J&K State Drug Research Laboratory was taken over on December 1, 1957 and the foundation of the RRL at Jorhat was laid on March 18, 1961. The major infrastructural asset of RRL at Hyderabad was its carefully planned pilot plants. This prompted NCL to set up its pilot plant facilities which were inaugurated on December 26, 1960.

In keeping with the national needs, it was necessary to take up long-term projects requiring large investments which would take long periods to bear fruit. The industry, desirous of having quick returns, was not inclined to invest in these projects. It was decided to continue these projects. At the same time, it was considered useful to demonstrate processes on a pilot plant or prototype plant scale to wean the industry away from the easy option of import of technology and thus win its confidence.

The regional character of the Laboratory had become only historically significant. It had ceased to be a material issue since neither the technology nor the raw materials could be regional in nature. The Laboratory expertise was sought in Gujarat, Maharashtra, Rajasthan, Kashmir, Bihar and West Bengal. When the Laboratory joined the mainstream of the national R&D in 1956, the original objectives of the laboratory of a backward princely State were retained. The Laboratory had since come a long way in a relatively short period of time. It had built expertise in some areas which was disseminated outside the 'region', for example, in the areas of oilseeds processing, organic intermediates and LTC of coals. The time had come to plan and introduce new and aggressive techniques of technology marketing to identify and strengthen weak links in the innovation chain and to streamline the research management system including the information generation and transfer.

The question of basic research was reviewed in all its facets especially the projects in the area of molecular and cellular biology which were marked as the 'personal' interest of Dr. Zaheer. It was felt that this work should not only be continued but supported and encouraged by further inputs.

The recent aberrations resulting from the recommendations of the Specialists ' Committee also came up for review. It was felt that such events could repeat themselves by 'packing' the EC and the work of the Laboratory could be brought to a standstill by a none-too-sympathetic bureaucracy. Only the internal strength of the Laboratory through proper management and deep involvement and commitment of its scientists would meet any adverse situation. And indeed, during the long period of stewardship of Dr. Sidhu, there were several onslaughts on the Laboratory which were successfully withstood!

Thus it was considered imperative to forge strong links with industry and to build, along with other R&D resources, a well- knit information transfer system to speed up development skills in the chosen areas that could face world competition and also to develop strategies for R&D which were in harmony with the economic, social and political objectives of our society. Since an innovation more often results from recognizing and adapting an idea rather than inventing a brand new one, multinationals have well organized information system to transform information collected from elsewhere into innovations. RRLH therefore took deliberate steps to devise open and restricted communication channels as integrated activity linking research, design, planning, production on pilot plants, market surveys and funding in a single operation. The links were provided by the information inputs and outputs.

It was recognized that dialogue with industry plays a key role in the innovation process. This activity was therefore rightly chosen to receive utmost importance. It not only helped to screen the research programmes but also served to bring about an exchange of ideas on several problems needing solution. Thus new projects got born and new products came to be identified. But the most crucial aspect of this interaction in early sixties was the identification

of that 'hard-to-find' entrepreneur. Research-industry get-togethers, seminars, symposia, summer schools and workshops were considered useful means of forging links with industry. Experience had it that it was often rewarding if the specific information was sought based on questionnaires regarding well-thought-out topics at least a year ahead from the consumers, the manufacturers, the traders, R&D institutions and the Government agencies.

The multidisciplinary teams helped the scientist, engineer and the administrator to see the different facets and dimension of scientific communication. While the scientist prepared a detailed literature note on the 'state-of-art' and an outline of plan of work, another group collected market data on the raw materials, products and the equipments and gathered other relevant commercial information. Possible users of technology were identified and contact established at the institutional or personal levels. Periodic bulletins carrying industrial and development news were envisaged as other means of keeping regular contact with industry.

The problems of transfer of technology were also examined in detail. While factors like the size of the market, raw materials scarcity, labour and capital availability, scientific and technological innovation quotient, interaction between R&D and the users of technology, patent system, trade situations and the availability of entrepreneurial skills affected the transfer of technology, it was the lack of faith in the indigenous technology which constituted the major hurdle in promoting its acceptance. Other contributory factors which adversely affected the transfer of technology from RRLH were: artificial price structure, resistance to change, lack of capital, insufficient technological base, socio-religious inhibitions and last but not the least, the ease with which the government agencies permitted import of technology.

#### **EXECUTIVE COUNCILS RECONSTITUTED**

The CSIR reconstituted the EC of the Laboratory. The AP Chief Minister nominated Shri P.V.G. Raju, Education Minister as its Chairman during 1962-63 and 1963-64 and Dr. M.N. Lakshminarasiah, Minister for Panchyati Raj during 1964-65 and 1965-66. On Dr. Sidhu's request, the Chief Minister, Shri K.Brahmananda Reddy, himself took over the Chairmanship of the EC for 1966-67.

The EC Members were:

Prof. D.K. Banerjee, IISc, Bangalore (1962-64); Prof. N.V.SubbaRao, OU, Hyderabad (1964-71); Prof. S.R.Palit, Indian Association for Cultivation of Science, Calcutta (1962-Nov '67); Shri P.R.Ramakrishna, Principal, Coimbatore Institute of Technology, Coimbatore (1962-Nov '67); Dr. C.Gopalan, Director, NRL (now NIN), Hyderabad (1962-64); Dr. S.K.Mukherjee, Fertilizer Corporation of India (1962-Nov 67); Dr. J.N.Nanda, Director, Defence Research Laboratory, Kanpur (1962-64); Dr. N.B.Prasad, Andhra Sugars Ltd., Secunderabad (1962-69); Secretary, Industries Department, A.P. Shri Syed Ali (1962-63); Shri V.K.Rao, ICS (1963-64); Dr. A.N.Kappanna, Bangalore (1962-64); Shri S.K.Nargundkar, G.M., Singareni Collieries Co. Ltd., Kothagudem (1962-Nov 67); Director of Industries and Commerce, A.P. Shri B.L.Oates (1962-64), Shri Pratap Reddy, IAS (1964-Nov 67); Shri S.N.Sahgal, Coal Mining Adviser, Ministry of Steel and Heavy Engineering, New Delhi (1963-66), Shri P.C.Chanda, P.C.Chanda and Co., Calcutta (1964-Nov 67); Shri N. Srinivasan, Industrial Adviser, DGTD, New Delhi (1964 - Nov 67); Shri K.S.R.Chari, Coal Mining Adviser, Ministry of Steel and Mines, New

Delhi (1966-67). The *ex officio* members were: DGSIR; FA to CSIR and Director, RRLH. Secretary: Dr. K.T.Achaya, Scientist, RRLH.

### SOME HIGHLIGHTS

To mark the occasion of the completion of ten years of continuous operation of the 25-tpd LTC plant, a meeting, presided over by Professor Humayun Kabir, Minister for Petroleum & Chemicals, was held at RRLH on December 23, 1963. Complimenting the Laboratory on its pioneering work, Professor Kabir urged that the country should take to LTC industry to provide more appropriate alternative uses for dung and other agricultural wastes. Dr. Zaheer, who was also present, pointed out that the technical and economic feasibility of the LTC process had been proved beyond doubt to set up commercial plants. It was noted with satisfaction that a 10-tpd LTC pilot plant based on a 2-retort system had recently been inaugurated at the CFRI, Jealgora. Earlier, an international symposium on "LTC of Non-caking Coals" was held during December 23-24, 1963 which evoked considerable interest, both in India and abroad.

Another International Symposium, the first of its kind in India in the field of biological sciences, both in regard to the subject matter and the representation of renowned scientists, was organized during January 16-23, 1964 to discuss "Nucleic Acids." An attractive feature was the three popular lectures by Francis Crick, G.Schramm, and C.Heidelberg.

"Central Nervous System Drugs" was the topic of yet another International Symposium which was held during January 24-29, 1966 where papers on the chemistry and pharmacology of these drugs were presented by Indian and foreign scientists.

The period was marked by closer contacts with industry and other organizations. A "Research and Industry Meet on Cotton Linters" was organized on September 28-29, 1962 which brought together diverse interests like producers, consumers, research and development, standards and the Government to discuss steps needed to promote the industry.

A two-day seminar on "Bleaching Earths and Active Carbons" was inaugurated by Dr. M. Channa Reddy, Minister for Finance and Industry, A.P. on August 11, 1964. Forty research and technical papers covered the basic and applied aspects of bleaching earths and active carbons.

A seminar on "Fatty Acids" was held during February 10-12, 1965. The data collected by the Laboratory on production and quality of fatty acids formed the basis of discussion which has been regarded by many as the starting point of fatty acids industry in India.

A summer school in "Oils and Fats" was organized during June 15-17, 1964 which was attended by fortysix trainees from industry. Besides specialized lectures, carefully designed experiments depicting the latest research advances were demonstrated. A similar summer school in "Chemical Engineering" designed as a refresher course to cover recent advances was held during June 14-26, 1965. Some fifty chemical engineers, drawn from industry and educational and research institutions attended the school as trainees.

A pilot plant producing 500 kg per day of cottonseed flour was commissioned by Dr. Sushila Nayar, Union Health Minister on March 20, 1965. Addressing on this occasion, Dr. Nayar said

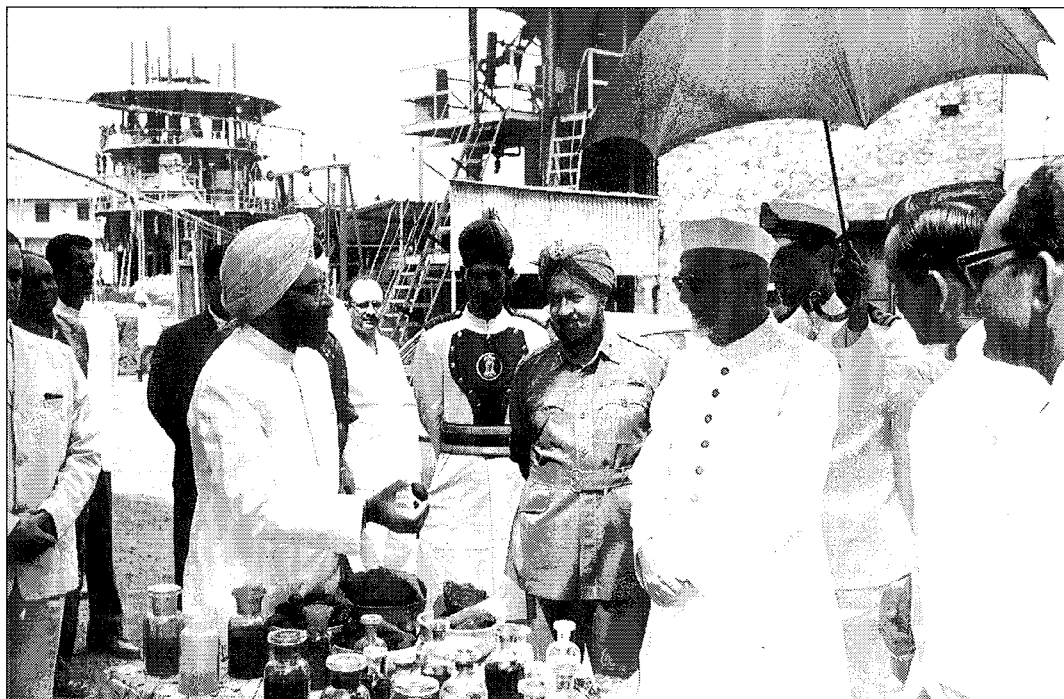
that malnutrition among children was common and it was unfortunate that its effect could not be undone later. She commended the efforts of RRLH in developing edible cottonseed flour which would help in providing the much-needed proteins.

A 2-tpd active carbon plant was commissioned by Shri T.N.Singh, Union Minister of Industry on June 19, 1965. The plant which produced coal-based steam activated carbons was financed by the NRDC and erected at the Laboratory. The technology together with the plant was transferred to an entrepreneur from Gujarat who operated the plant at the Laboratory for sometime before shifting it.

A 250-kg/day benzyl chloride prototype plant was commissioned by Dr. M.Channa Reddy on November 22, 1965.

The National Emergency had its impact on the research programmes. Certain new projects were undertaken while reorientation was effected in some others. The Laboratory undertook the manufacture of sodium azide on an improvised pilot plant to meet the annual defence needs.

The years were marked in particular by increased developmental work though financial difficulties retarded progress in large pilot plant experimentation. Wider and closer contacts with industry resulted in release of a number of processes for commercial exploitation. A new responsibility undertaken was to offer turnkey services to industry. The appointment of



President Dr. Zakir Husain took special interest in the pilot plant work at the Laboratory during his visit on August 26, 1967



the Laboratory for general technical consultancy on annual retainer basis, was another feature introduced in 1963-64. Collaborative research schemes with other institutions also increased which included the Central Leather Research Institute, Madras, the Nutrition Research Laboratories (now National Institute of Nutrition), Hyderabad and the Central Food Technological Research Institute, Mysore. Some leading business houses also sponsored research projects in the Laboratory.

Industrial survey had long been part of operational research to obtain the much needed information for planning of research activities as also for the technology transfer. In this way data were compiled on production, consumption, quality and pricing of materials and equipments. In addition to collection and compilation of routine economic, technical and statistical data, specially designed questionnaires were mailed to gather information on active carbons, bleaching earths, basic organic chemicals and intermediates, catalysts, cotton linters, filter-aids and many other products. But to assess the demand and consumption pattern of domestic fuels, actual door-to-door sample survey was required. Since there was no agency which could be entrusted with this work and since the data were required for the preparation of feasibility reports, the Laboratory undertook this work in Andhra Pradesh and Maharashtra.

A Feasibility Report submitted to the Singareni Collieries Co.Ltd., in December 1964 was accepted. The Laboratory was asked to prepare a detailed Project Report. The LTC plant with an ultimate capacity of 2700 tpd was recommended to be set up at Ramagundam in three phases of 900,1800 and 2700 tpd. The Report which was submitted in February, 1966 included a detailed survey of demand for domestic fuels, the carbonization process and byproduct processing, and details of plant sections. The Report was the result of years of experience and technical skills garnered by running the LTC pilot plant. The coals from Chanda, Raitwari, Sasta and Manjari in Maharashtra were found suitable to produce domestic fuel. At the request of the Maharashtra Government, a Feasibility Report was prepared. A 900-tpd LTC plant was tentatively proposed.

The project on complete gasification of coal, which has had a chequered history, was initiated in 1962-63 when 2-5 kg/hr experimental plant for operation under slagging conditions was installed and operated by adding oxygen and superheated steam. In February 1963, the DGSIR (Dr. Zaheer), enroute to Geneva to attend the UN Conference on "Application of S&T for the Benefit of Less Developed Areas", discussed with industrialists in Europe, "the latest methods of pressure gasification of coal to produce gas which may lead to considerable economy in expenditure on fuel." A scheme for installing an experimental coal gasification plant at RRLH was also finalized for which the CSIR provided Rs.21 lakhs.

All equipment and materials except some motors of the imported equipment of the gasification were received during 1966-67. Specifications of the indigenous equipment development of the site and plans for civil works had been completed earlier. It was at this stage when Dr. Atma Ram took over as the new DGSIR. All work on the project was instructed to be stopped. The equipment remained in its unopened crates. The CSIR-GB appointed an Expert Committee to go into the various aspects of the project *de novo*.

By a simplified process of hydrogenolysis, saturated and unsaturated fatty alcohols were made from fatty acids. The process for the production of hydrogenated castor oil which finds

use in the lubricants and paints was released to industry. Studies on keeping quality of cottonseed indicated that the colour fixation in the seed oil was a function of storage temperature and could occur without increase in free acidity which was a humidity effect. Odd-chain fatty amine N-oxides of optimum chain lengths were found to have excellent wetting and dispersing properties and showed promising antibacterial action. Studies on phospholipids and on the occurrence of aflatoxin in groundnut and its cake yielded some interesting results. Simple tests were developed to detect adulteration in vegetable oils.

Aluminium-zinc oxide primer developed by the Laboratory to replace imported red lead primer for structural steel was found successful on large-scale trials by such major users as the Railways, Defence and chemical industry. An anticorrosive ship-bottom paint developed by the Laboratory was found satisfactory by the Indian Navy after prolonged raft test. Several other surface coating compositions found use after the process for the manufacture of cardanol from cashewnut shell liquid was released for commercial exploitation. Work on silicones, epoxies and new type of phenolic resins was initiated.

A new section for the development and evaluation of catalysts was established in 1963-64. Among the facilities created were a high-vacuum apparatus to determine surface area, pore-size distribution and adsorption capacity, a steel reactor to carry out cracking reaction and a laboratory-scale fluidized-bed ethylene generator. The complete conversion of benzene to cyclohexane by a base metal catalyst hydrogenation was achieved. Other catalysts were developed to carry out fatty oil hydrogenation, ammonia synthesis and cracking of petroleum products.

Significant success was achieved in synthesizing several organic compounds possessing pharmacological activity. These included quinoxalines, benzoximes, azepines, fused triazoles, benzylamines,  $\beta$ -phenylamines, 1,2-diphenylamines, benzhydrylamines and arylalkyl anthranilic acids. The pharmacological screening was done in collaboration with Riker Laboratories Inc., Strasenburgh Laboratories and Smith Kline and French Laboratories, all of USA. The clinical trials of one N-arylalkyl anthranilic acid were carried out at the Gandhi Medical College, Hyderabad and the G.S.Seth Medical College, Bombay.

Know-how developed for benzyl group of chemicals was released for commercial exploitation on a turnkey basis to Orgaroma Chemicals (P) Ltd., Hyderabad and Daurala Sugars Ltd., Daurala, U.P. The products included phenylacetic acid and its amide, required in the manufacture of antibiotics. The process for the manufacture of Citicide — a turpentine-based pesticide, was also released to industry for commercial exploitation. Know-how was also developed for the production of benzoyl chloride, benzaldehyde, benzoic acid and monochloroacetic acid.

Other processes developed by the Laboratory which were released for commercial exploitation included manufacture of fuller's earth, anhydrous calcium sulphate, hydrazine hydrate and X-ray grade barium sulphate, all to small scale industries.

Silicon carbide, synthesized on an 80 kg/day furnace was processed into various grits. After assuring the market acceptability of the products, a detailed scheme for a 2-tpd prototype plant showing the capital investment and returns was prepared for funding by the CSIR. The Laboratory collaborated with the Defence Electronics Research Laboratory, Hyderabad for

the application of various grades of its microwave ferrites. Some special grades of pyrometric cones were continued to be produced at the pilot plant while the process was released for commercial exploitation.

Evidence was obtained to show that in the tissue of higher animals, the presence of intercellular cement (which contains RNA) and cell contact are important factors in determining the permeability of cell membrane. Preliminary evidence also indicated that this control of permeability was lost in cancer cells. A new method, based on varying precipitability of low molecular weight RNA and large molecular weight RNA with zinc ions, was developed to prepare liver cell suspensions. Significant differences were found between the manner and pattern of RNA synthesis by liver cells in suspension and by liver tissue slices, the former showing a significant endogenous respiration. It was also shown that the increased concentration of the cells in a population of hepatic cells in suspension decreased the rate of transport of amino acids from extracellular environment within the cell. The intact liver cells in suspension possessed polynucleotide phosphorylase activity.

The processes developed for the production of lyophilized snake venom (from Cobra and Russel's Viper) and papain (from papaya) were released to industry for commercial exploitation. It was possible to create a market for the sale of lyophilized snake venom abroad. A large order on a long term basis for the supply of this biochemical material was, however, lost due to bureaucratic bungling in Delhi. Other biochemicals sold were soluble RNA, polymerized DNA and some fatty acid esters. The period not only saw great spurt in activities in developmental and basic work, judged by the number of new pilot plants and the research papers published, but also established collaborative arrangements with other research organizations and international agencies. The project-oriented research not only got rid of dead wood, but also convinced the scientist that R&D was not over when the process satisfied them. It had to satisfy the entrepreneur as well. The system also helped to identify bottlenecks which hampered the progress of work and steps needed to rectify the shortcomings. It also pointed out a major gap in the transfer of technology, *viz.*, the design and engineering.

### **NEHRU PASSES AWAY**

Pandit Jawaharlal Nehru, Prime Minister of India and President, CSIR, passed away on May 27, 1964. He was the Founder-President of the Association of Scientific Workers of India. Science and technology were a passion with him. Nehru was one of the few world leaders who made the promotion of science on national scale one of the main concerns, and promoted scientific development for the sole purpose of raising the living standard of the common man. He was not only a source of inspiration to RRLH but also, along with Azad, Bhatnagar and J.C.Ghosh, brought the Laboratory into the mainstream of the national R&D.

### **ZAHEER RETIRES AS DG**

Dr. Zaheer laid down his office after a four-year term. During this period, the CSIR Headquarters was converted from being an administrative office into a central scientific and technical organization equipped to carry out in-depth study of scientific and technical development in the country, to interact with other scientific organizations in India and abroad, and to make an objective assessment of progress being made and suggest remedies and changes where required.

A major change brought about by him was the induction of young blood at all levels of responsibility by breaking the iron ring formed by some older scientists "who monopolized all positions and see that they were everywhere and none else got in anywhere."

The restoration of powers of the Directors and ECs enjoyed by them prior to 1956-57 and their further enhancement after implementation of the recommendations of the Third Reviewing Committee, introduction of project orientation and changes in the system of promotion and designation of cadres led to removal of bossism and hierarchy in the organization, much against the advice and wishes of the vested interests.

As a result of these changes and reforms, there was a marked improvement in the morale of the scientists, a great and all-round expansion in activities, closer collaboration with industry and greater realism in the selection of its projects and better utilization of its results.

During these four years, the CSIR budget was increased from Rs. 9 crores to Rs. 17 crores, a rise which was phenomenal when compared to the general increment of only 20% in scientific research during the first three plans.

In achieving all these, Dr. Zaheer had to tread on the toes of some vested interests who were not only resentful but were also expectantly awaiting the day of his retirement.

#### **ATMA RAM BECOMES NEW DG**

Dr. Atma Ram, Director, Central Glass and Ceramic Research Institute, Calcutta succeeded Dr. Zaheer as the DGSIR. He took charge of the post on August 22, 1966.

Dr. Atma Ram headed CGCRI since its inception. As a member of the BSIR of the Central Laboratories, Hyderabad, he was called upon to assist in the formulation of research programme in the area of industrial ceramics. His views, though none-too-helpful and often negative, were nevertheless accepted in a spirit of accommodation. Recently, he was a member of Specialists Committee with Professor M.S.Thacker as the Chairman to consider the functions and research work of the RRLH which in its report had not only denied simple equipment to the Laboratory but also made serious attempts to dismember it. The news of Dr. Atma Ram's appointment as the DGSIR was, therefore received at the RRLH with some apprehension which, as the events unfolded themselves, was not at all misplaced and there was no long wait either!

Dr. Atma Ram was born in 1908. He had his education at Allahabad, completing his D.Sc. in Physical Chemistry in 1936. He started his professional career at the Industrial Research Bureau at Calcutta. He joined CGCRI, Calcutta as Assistant Director and was quickly promoted as Director in 1952, which post he held till appointed as DGSIR.

Dr. Atma Ram had always been close to the science establishment and had now become part of it. He succeeded Professor T.R.Seshadri as the General President of the Indian Science Congress Association in 1967-68 and was elected President of INSA in 1969. By virtue of his office, he became member of the Committee on Science and Technology to the Cabinet, and of the Governing Bodies of the CSIR, ICAR and ICMR.

## PERCEPTIONS OF NATIONAL SCIENCE IN MID-SIXTIES

Addressing the GB meeting of the CSIR on July 7, 1967, Prime Minister Indira Gandhi stressed the need for a Science Plan that will unfold a national science strategy. She wondered if there was adequate research planning and whether it was suitably linked with specific development objectives and specific time horizons, a programme of action dovetailing with national needs and priorities. In this context, Shrimati Gandhi remarked that certain knowledgeable people seemed to hold the distressing view that Indian Science was "sliding back." The country stood on the threshold of modern technology and a body like CSIR could give it a push and carry it over the threshold. It was therefore necessary for CSIR to set the right guidelines. It should have stability and sense of purpose and direction. It was necessary to stipulate time schedules and procedures and have a machinery for evaluation to overcome delays endemic in our system of functioning. Very often, she said that the projects could not be pursued because of lack of funds and the funds were not available because the projects were delayed.

She saw little reason to bar foreign collaboration whenever it was really needed. But we often seemed uncertain of ourselves even when we had the necessary know-how and experience. There was no need to fear mistakes. She also called for closer links between the CSIR and industry. This contact would fertilize both science and industry and ensure productive results.

Speaking at the CASTASIA Conference on August 15, 1968, the PM said that the role of the State in bringing about the economic progress was well understood and consequently national planning had been adopted. In this context, she made a reference to Nehru's remark "What is planning if not the application of science to our problems?." She again referred to Nehru when she spoke on the occasion of the Silver Jubilee of the CSIR on August 30, 1968 when she said that he was CSIR's President for 17 years and had breathed new life into it making it an instrument of national regeneration and progress. Scientific research could not yield results unless "our culture is cross-fertilized by scientific temper." The Indian scientist faced a tremendous challenge since it was among the basic objectives of the Fourth Plan to reduce our dependence on foreign assistance to half. It was a quantitative determination to promote self-reliance.

Addressing the Joint Standing Committee for Scientific Research and Industry on July 3, 1968, Shri Fakruddin Ali Ahmed, Minister for Scientific Research expressed concern over India's increasing dependence on foreign know-how. Foreign technology should be adapted and improved to avoid perpetual dependence on imported know-how. Industry was not enthusiastic about utilizing the indigenous know-how even when available, he observed.

In reply, Dr. Atma Ram said that no country in the world was technologically independent. The research laboratories could produce commercially feasible results but cannot be expected to provide the entire gamut of production and management know-how.

He expressed similar views at the Research-Chemical Industry Get-together on March 28, 1968 when he pleaded for greater interaction between the scientist of research and industry but felt that industry was in a better position to work out the economic feasibility of the processes worked out by the national laboratories. Dr. J.H.Doshi of Amar Dye-Chem said that the lack of design and engineering facilities was the main bottleneck in the utilization of indigenously developed processes. He urged their development on priority basis.

The GB meeting of the CSIR held on May 14, 1969 considered the research policy issues while discussing the Annual Reports for 1967 and 1968. Dr. K.A.Hameed felt that the laboratories appeared to be taking too many problems resulting in their efforts being too scattered to make impact. Shri Newalkar enquired about the norms with which the work of the laboratories was evaluated. "What was important was not taking patent and developing processes but their application in industry." He suggested creation of a "Research Market." He felt that the infrastructure developed so far related to scientific part and the engineering part of the applied research had yet to be built. The relevant engineering organization was not there to take up the processes from the laboratories and scale them up to the production stage. This explained why utilization was not satisfactory.

The DG said that the translation of results of research to actual production was a somewhat complicated problem. There were several links in process development — research, development, engineering i.e., fabrication and erection of plant, production operations, sales and after-sales services. A research scientist or a research laboratory produced an idea and to know whether the idea would be workable, it has to pass through the development stage. A pilot plant could establish technical feasibility of a process and at best a research laboratory can take research work up to this stage.

It was advisable and helped in expeditious application of results, if the entrepreneur was brought into the picture at the development stage and in order that he was prepared to take the risk, his association should be sought at a very early stage and he should also have the assurance of having the right to utilize useful results.

A pilot plant can establish technical feasibility, but without establishing economic feasibility, nobody could be expected to invest. The important question was up to what stage a research laboratory could undertake work. It was obvious a research laboratory cannot complete the entire chain and this was what sometimes some people expected. Development was far more costly than research and also far more frustrating, but it had to be done and it could best be done by industry. Unless industry was involved and unless this deficiency was made good, our dependence on foreign know-how would continue. He also said that the problem did not stop with know-how. There was the problem of the means of carrying out the know-how, that is to say the plant and machinery. Since we had to import plant and machinery in many cases, it was possible that many collaborative agreements were made for this deficiency, although the basic know-how may be known in the country.

Dr. Atma Ram reiterated these views at a UNESCO-sponsored seminar to discuss the "Problems of Transition from Laboratory Research to Industrial Application" at NCL during December 9-14, 1970. Dr. B.D.Tilak complained that due to sheltered market and the Government's protective policies, indigenous technology found it hard to get any takers. The DGSIR replied that the laboratory's role should be that of "idea producer" and development was the major responsibility of the industry.

As a matter of fact, design and engineering had been identified as a missing link in the transfer of the indigenously developed processes or products. A beginning had therefore been made to set up a Design and Engineering Unit at the CSIR-HQ eventually to be developed into a full-fledged institute to cater for the needs of the CSIR and other organizations in association with industry and consultancy firms. The unit was considered unnecessary and dismantled by the new DG, Dr. Atma Ram.

Speaking at a symposium on "Perception of Problems and Opportunities for Science and Technology in India" held at Udaipur during March 22-24, 1967, Dr. Sidhu said that basic data on our needs had been identified by the Planning Commission and other bodies. What was lacking was the mechanism for translation of these needs into concrete technological projects. *Ad hoc* projects only provide *ad hoc* solutions. He pleaded for rethinking on methodology of planning and functioning and suggested setting up of expert panels to define the projects and objectives instead of the present committee system where the same experts served on widely different committees and provided expertise which was seldom born out of an in-depth study or experience. He regretted that the establishment scientists generally did not appreciate the usefulness of operational research, modern management techniques and systems engineering to plan and execute research projects.

To what extent import of technical know-how from abroad could be dispensed with, extent to which the indigenous know-how could be deemed to be capable of commercial exploitation and what should be the guidelines for allowing foreign collaboration? These questions were addressed to a committee constituted by the Government on February 19, 1966 with Dr. A.Ramaswamy Mudaliar as Chairman and Dr. Zaheer, Shri P.C.Kapoor, Director-General Technical Development and Shri K.J.George, Director, Ministry of Industry as members.

The committee considered the various components of know-how such as process know-how or product design, design and engineering and erection and start-up of the plant. The committee noted the views expressed by the representatives of industry that the CSIR know-how lacked development research and engineering studies and was not offered on a turnkey-job basis nor did it carry any performance guarantees. A separate Project Engineering and Development Institute was suggested to fill this gap.

The Committee recommended increased spending on R&D and positive approach towards import of technology since India's industrial base was slender and at the same time diversified. It was of the view that India should continue to import technology on a discriminating basis so that Indian industry could keep in touch with the technological mainstream and to ensure that scarce resources are not wasted on reinventing or redeveloping processes or products. After importing technology, it should be the endeavour of Indian R&D to build and develop it to suit local conditions of environment and raw material availability as had been done by Japan.

Foreign collaboration agreements often entailed purchase of equipment and raw materials/components which did accelerate the tempo of industrialization but killed indigenous initiative. The committee did not favour any extremist view but commended the avoidance of repetitive import of know-how.

The committee noted that industry had grown substantially in recent times but design and consultancy organization had not kept pace with it. It suggested adequate filling of this gap.

Dr. Zaheer analyzed India's expenditure on scientific research during the first three 5-year plans in a presentation before the Committee on Science and Astronautics of the U.S. House of Representatives and said the top priority shifted from scientific and industrial research in the first plan to atomic energy in the third plan.

The annual rate of growth in the three plan periods was respectively 20, 21 and 26.5 percent. Since Science and Technology had to be the main instruments for accelerated industrial

development and economic growth, the main task before the policy makers and planners of R&D was to bridge the gap which existed between their level of investment and that of the advanced countries. No developing country could afford this nor could it hope to catch up unless it started from an advanced stage and developed special technology of its own thereafter. Transfer of technology from advanced nations was one of the planks for rapid and accelerated industrial growth. The choice of technology from the competing ones, its adaptation and orientation in keeping with the national resources of raw material and the genius of the people should form the main task of science policy. Thus planning of scientific and technical manpower and science education was part and parcel of science policy.

Planning of R&D must be such as to give greater emphasis on research sensitive areas. Use of latest techniques of social research such as operational research, management techniques, systems engineering and programming through computers must be employed to forecast the requirements of the manpower and work out systems in the developing economy where research can be employed to give maximum returns in terms of economic growth.

According to Dr. Zaheer, a vigorous and aggressive policy was followed by the CSIR during 1962-66. An overall technical bias was given to the organization, planning and problem study was done in depth. Research programmes were drawn up in collaboration with the Planning Commission, with other technical and economic ministries and industrial organizations, both public and private. Research effort was given project and priority orientation. This bore rich dividends and brought the CSIR and its scientists out of their ivory towers, and face to face with real scientific and technological problems confronting the industrial and economic development of the country. All this happened in spite of constant criticism, in Parliament and outside, from a group of obscurant politicians and scientists. There has unfortunately been a grave setback recently, prompting the PM to remark that Indian Science was sliding back.

### **COMMITTEE SYSTEM OF SCIENCE MANAGEMENT**

Decision making in Science in India, as elsewhere, is through committees which are appointed by a relatively small establishment. The committees decide on appointments, fellowships, selection and evaluations of research programmes and several other aspects of organized science. The science establishment includes heads of the principal science councils, senior advisors to the Government and a few senior scientists. The high offices of the presidents of the INSA, the ISCA, and other such bodies are rotated within this group. All chiefs of the councils serve on the GB's of each other to promote coordination. In effect, all this results in an exclusive group whom Dr. Zaheer called a "coterie."

Commenting on the system while reviewing "Science Policy and its Implementation" in an article in the *Mainstream* of June 24, 1967, P.K.Naidu wrote "The malaise with institution of committee functioning is due to the extra-academic means adopted by the men in power to give legalistic baptism to their personal whims. If one wants to condemn an organization, the administrator chooses a set of people who do not like the director of that organization. If the extension of the empire of the same director is the aim, another group of persons is chosen."

Professor Ward Morehouse who was a Visiting Professor at the Administrative Staff College of India made a special study of science and government in India. During an informal



discussion, he commented that "the committees exist more in form than in substance as devices for decision-making in Indian Science."

### **OPERATION VILIFICATION**

Nehru was aware of the monopoly position of science establishment and he reportedly asked Dr. Zaheer to break this monopoly "without upsetting the old gentlemen" and by exercising utmost caution. Dr. Zaheer simply brought in "younger scientists in the various bodies of CSIR, in the ECs, in Research Committees, in the Board and in the GB, and in various Selection Committees, without completely throwing out the older scientists." This naturally antagonized the dispossessed.

According to Dr. Sidhu, the science establishment never took kindly to Dr. Zaheer becoming the DGSIR. There were signs of jealousy even when he was the Director of RRLH. Since he was never a part of the establishment, he was regarded as an outsider. He was never elected Fellow of Indian National Science Academy.

The recasting of the functions of CSIR-HQ from administrative and financial control to those having technical bias with the introduction of research planning and evaluation and strengthening and reorganization of technology utilization and manpower and personnel planning groups, and later, the addition of defence coordination and design and engineering groups at the HQ became a sore point with the bureaucracy.

A campaign of vilification and disinformation was started soon after his retirement where the science establishment and bureaucracy joined hands and planned each move in a common cause to undo what Dr. Zaheer had done. Special attention was paid to the politicians with communal appeal and the disgruntled elements in the laboratories, especially RRLH, to start whisper campaigns. The Sarkar Committee was set up by the Parliament as a result of pressure groups thus built.

### **'UNDOING' THE GOOD DEEDS**

After Dr. Atma Ram, took over as the DG, concerted efforts were made to systematically undo all the progressive reforms introduced by Dr. Zaheer. The autonomy given to the laboratories was the first to go. The younger scientists nominated on various committees were replaced by the trusted elements of the establishment. Attempts were also made to tinker with the newly introduced promotion system. But the major assault was reserved for the technical divisions (upgraded as Directorates) of the CSIR-HQ.

The Research Survey and Planning Division was more or less wound up. The Third Reviewing Committee of the CSIR (headed by Dr. A. Ramaswamy Mudaliar) commended the work of the Division and recommended the need to strengthen it. Professor Mahalanobis who was member of this Committee, would, however, run down its work in private conversation and in confidential communications.

The high mark of the Division's work was the CSIR's draft Fourth Plan which was characterized by its lucidity and clarity. It received full support and approval of the GB. The Atma Ram Committee (ARC) appointed to examine the details of the draft plan rejected the major items of thrust like the establishment of the National Biological Laboratory and the Coal Gasification Pilot Plant at RRLH on which a large amount had already been spent.

The interesting points, however, are that four out of the six members of the ARC were members of the GB which had not only enthusiastically approved the draft plan but had also directed the DG to take advance action towards its implementation. Again, Dr. D.S.Kothari and Dr. S.Bhagavantam were members of the Working Group which prepared the draft plan, of the GB which had approved it and also of the ARC which had thrown it overboard. The Design and Engineering Centre at the CSIR-HQ had been set up for the preparation of the project and feasibility reports; evaluation of pilot plant projects and to assist the laboratories and industry to set up prototype plants. The establishment of the Centre was welcomed by the Planning Commission, especially by Ashok Mehta, its Vice-Chairman and by the Ministry of Industry whose Secretary was the first Chairman of the Centre's EC. The Centre died due to starvation of work after Dr. Atma Ram took over as DG!

The CSIR staff was induced to send anonymous complaints against their colleagues to the high-powered Committee of Enquiry presided over by Justice A.K.Sarkar, Retired Chief Justice of India. The members were Shri S.S.Bhandari, Shri Akbar Ali Khan, Dr. K.Ramaiah (all M.P.s from Rajya Sabha), Shri P.Anthony Reddy, Shri K.P.Singh Deo, Shri Indrajit Gupta (all M.P.s from Lok Sabha), Dr. C.R.Rao, FRS, Director, Indian Statistical Institute, Calcutta, Prof. M.G.K.Menon, Director, TIFR, Bombay, Dr. M.S.Swaminathan, Director IARI, New Delhi and Dr. P.K.Kelkar, Director, IIT, Bombay.

The Committee visited most of the CSIR Laboratories and had discussions with scientists, administrators, employees associations and others and also received memoranda from several interested organizations. It examined several important witnesses including Dr. Zaheer and Dr. Atma Ram.

The report of the Sarkar Committee did not find any serious irregularity — not even one case. About one thousand anonymous complaints were left to DG of vigilance to follow up. A few cases were referred to CBI for investigation which led to some harassment and wastage of time. In the end nothing came out. Only the science establishment got some mileage out of it by way of publicity.

## **ROUGH WEATHER**

The first meeting of the EC of the RRLH attended by the new DGSIR was held on October 17, 1966 under the Chairmanship of Dr. M.N.Lakshminarasiah, Minister for Panchayati Raj, A.P. The meeting recorded its sense of gratitude to the retiring DGSIR, Dr. Zaheer, for his meritorious service to the cause of CSIR and his unstinted support to the Laboratory in its work. The Chairman welcomed the new DGSIR, Dr. Atma Ram and sought his support for the Laboratory.

It had been indicated to the Director earlier by the Secretary and FA to the CSIR that as a matter of policy, CSIR was not going to agree to any proposals involving funds. All such proposals were therefore withdrawn or postponed. DGSIR wanted more details of some other proposals before a decision could be made. The question of appointing specialist committees to look into special areas of work, raised by Professor N.V.Subba Rao, was considered in detail, but not agreed to "since the members felt that the SSC itself was a committee of specialists." This was not the first time that this issue was raised and nor was it to be the last time.

The EC appointed a committee comprising Shri S.K.Nargundkar, Shri K.S.R.Chari, Dr. S.K.Mukherji and Shri N.B.Prasad to consider the project on "gasification of coal" in "breadth and length" and prepare a report for the consideration of the GB of the CSIR. Earlier, some discussions arose in the SSC with regard to work on the areas of Biochemistry: did it suffer from isolation and did it contribute to the Laboratory? The Chairman (Dr. Sidhu) said that it was a moot question whether the environment had limited the work, but the success achieved was certainly not only good but brilliant. Shri N.B.Prasad, after listening to various points of view, felt that the only question to be asked was whether the work had benefited science after spending a small fraction of the total Laboratory budget. "The answer was unquestionably in the affirmative, and it would be most unwise to talk of closing this work or shifting it elsewhere." The SSC concurred with this view.

The sub-committee of the EC on 'Coal Gasification Project' met on October 17, 1966 and November 26, 1966 and submitted its report recommending implementation of the Project. While discussing the budget estimates for 1968-69, Dr. Sidhu informed the EC on October 16, 1967 that the work on the project had been stopped on orders from the CSIR. A new committee had been appointed by the Vice-President CSIR on the recommendation of the GB.

In November 1967, the EC of the Laboratory was reconstituted. Shri K.Brahmananda Reddy, AP Chief Minister continued to be the Chairman. Professor T.R.Seshadri, FRS was brought back after a gap of five years. Dr. G.P.Kane, Officer on Special Duty (OSD), Ministry of Industrial Development and Company Affairs, New Delhi and Shri S.B.Sarkar, Chief Combustion Engineer, Coal Board, Calcutta were other members. Shri J.K.Adhya of East Indian Paint and Chemical Works Ltd., Calcutta replaced Shri P.C.Chanda while Professor N.V.Subba Rao was continued. The AP Government representatives were Shri M.A.Abbasi, IAS, Secretary, Industries Department, AP, Shri Anil De, IAS, Managing Director, the Singareni Collieries Co. Ltd., Shri Abid Hussain, IAS, Director of Industries, A P and Shri N.B. Prasad, who was continued. The new EC met on June 12-13, 1968. Since the Chairman could not be present, DGSIR took the chair. When various sub-committees of the EC were announced by the Chairman, the Director, RRLH who was the Chairman of the SSC requested Professor Seshadri to accept the Chairmanship "in view of his eminence." There were some interesting items, equally interesting discussion and even more interesting decisions.

Schering A.G. of Berlin were interested in sponsoring research work on physiologically active plant principles. Having examined the facilities available in different research laboratories in India including the leading national laboratories, they desired to enter into an agreement with RRLH since they found it the most suitable place for the purpose. When a draft agreement was sent to the CSIR for approval, it was suggested that the matter be placed before the EC for decision whether the matter could not be more appropriately handled by the Central Drug Research Institute (CDRI), RRL (Jorhat), RRL (Jammu & Kashmir), or the Central Indian Medicinal Plants Organization, Lucknow.

During the discussion, Professor Seshadri expressed his total opposition to RRLH taking up such work while CDRI, NCL and RRL(JK) existed even if the firm had chosen to give work to RRLH. With such a forceful opposition, the EC did not approve the item. [The recent setting up of a separate Plant Products Laboratory at the IICT reflects the attitude of what was a "packed committee," which expressed views on the Schering-RRLH tie-up.]

Another innocuous item related to the maintenance of two bulls for the supply of their semen for research work. There was discussion on whether there should be one attendant or two for the two bulls. The payment asked for was not agreed to and "the EC desired that the programme of work in Biochemistry may be examined by the SSC in light of the objectives laid down for the RRLH." The EC meeting held on October 19, 1968 again discussed the issue. The Director was requested to prepare a detailed note.

An item which fell in the discipline of the DG himself related to production of silicon carbide. The Laboratory had developed technology on 80 kg/day scale and had ordered a transformer to set up one 2-tonne furnace. Emery India Ltd., Jamnagar expressed readiness to set up a 2-tonne plant at their location if the transformer was delivered to them but paid for in 5-equal instalments or NRDC would participate in the venture. The party agreed to meet all other capital and recurring expenditure. The EC authorized the DGSIR to consider necessary steps for the utilization of RRLH know-how.

Summer break is another item in this connection which is of topical interest. Recently IICT has decided to close down the laboratory for two weeks during summer. This was indeed the earlier practice from the days when Dr. Qureshi was the Director of Central Laboratories and had been continuing since then. The Director explained that by working on certain minor holidays in the year, it was possible to have break during the month of May when water and power are in short supply. The break also provided an opportunity to attend to house-keeping jobs like painting and repairs and also for verification of stores and library. DGSIR wanted to examine the issue on policy level. Eventually, the summer break during May, 1969 was not accepted.

### **DOUBLE-DEALING AND DELAYS**

In November 1968, Dr. Sidhu submitted to the Sarker Committee that the DGSIR encouraged foreign collaboration even when indigenous know-how was available or could be made available in a reasonable time. He also charged that excessive delays in the administrative and financial sanction had seriously impeded the development of technology of RRLH.

Among the many examples cited by him, the case of silicon carbide project makes an interesting reading. The project was initiated in 1965. On techno-economic considerations, a 2-tpd prototype plant was considered necessary to gain the needed experience and data to design a larger commercial plant. This was approved by the EC and by the BSIR and GB. Grindwell Abrasives Ltd., who held a letter of intent for foreign collaboration to manufacture silicon carbide were approached by the Laboratory for participation in its efforts to develop the know-how jointly. They agreed to meet the full running costs for three years but asked the RRL to put up the pilot plant which the company would buy after this period. The DGSIR was informed about the development in October, 1966.

In February, 1967, Grindwell Abrasives applied for an industrial licence for the manufacture of silicon carbide with foreign collaboration. The Scientist-in-Charge, Division of Research Coordination and Industrial Liaison of the CSIR requested that the foreign collaboration be withheld and the party be directed to utilize indigenous know-how. The DGTD and the Ministry of Technical Development delayed the clearance of application in the hope that RRLH would be able to put up at least a 500 kg/day pilot plant to demonstrate the process. The CSIR never sanctioned any funds for this purpose.

In the meanwhile, in the discussions held with Grindwell Abrasives on August 29 and 31, 1967, it transpired that Dr. Atma Ram had already decided to allow foreign collaboration. An extract from the minutes of the meeting reads "Mr. Sidhwa then mentioned that when he met DG in Delhi DG's attitude was entirely different and he did not in any way object to Norton's collaboration and Dr. Sidhu understood from DG that CSIR will not oppose foreign collaboration. Dr. Sidhu replied that DG had told him about this meeting but had not given him any such impression and had advised Grindwell Abrasives to discuss the matter further with DRRL." This was duly conveyed to the CSIR-HQ.

After more than a year, the DGSIR called DRRL to Delhi for a meeting on September 28, 1968 to discuss the Silicon Carbide project. The meeting was interrupted by DG to have another meeting (with Mr. N.R. Srinivasan of India Investment Centre). In the resumed meeting the DG agreed to release Rs. 5 lakhs to set up a 500 kg/day pilot plant at RRLH.

What happened in the other meeting is a sordid story, revealed by a note dated October 11, 1968 from Mr. P.K.Seshan, Industrial Adviser (Chemicals), DGTD sent to DGSIR which said "We have received a record note of meeting which took place on September 28, 1968, in the room of the DG, CSIR recorded by Mr. N.R.Srinivasan of India Investment Centre.

"From the discussion that has already taken place as indicated in the record note that the DG,CSIR is agreeable to the Grindwell's arrangement with Norton for the manufacture of silicon carbide in view of the increasing demand for this type of abrasive as well as glow bars on the condition that they should go into production as early as possible." The note further said that Grindwell should be associated with RRL's work and share expenses if necessary.

A similar case was that of the manufacture of active carbons by Lakshmi Carbons where foreign collaboration was sought in the form of lumpsum payment to a foreign expert which was opposed by RRLH and which was allowed by DGSIR without reference to or even consultation with RRLH. The meeting of Lakshmi Carbons Director-in-Charge with DGSIR took place on April 23, 1968 and DRRL was asked to stand by for any consultation. He was not needed.

RRLH developed a process for the manufacture of edible cottonseed flour and set up prototype plant at the Laboratory to produce 5 tonnes daily. The product was supplied to antibiotic industry and for the manufacture of an infant food named Balahar. At this stage the Laboratory was the leader in technology but aimed to further improve the product by increasing the protein content and also reducing the residual colour which arose due to gossypol and related phenolic pigments. USAID offered to help by a financial grant of Rs. 13 lakhs. A proposal in this regard was submitted in July, 1967 for CSIR's approval which was discussed by the DGSIR in April 1968. The Director was advised that foreign aid was not acceptable and the CSIR itself would grant a loan of Rs. 12 lakhs. DG did not mind a loss of Rs. 2-3 lakhs in the first year's running of the plant. Accordingly the matter was put up to EC meeting of June, 1968 which was presided over by the DGSIR himself (in the absence of the AP Chief Minister). The EC decided at the suggestion of FA to CSIR that the USAID grant be accepted and the Director was asked to resubmit proposals to DGSIR. It was done but nothing came out of it. In the meanwhile, the Americans not only caught up with RRLH technology but also went ahead and offered the improved technology to India!

Another technique of denying or delaying the approval or funding of the RRLH projects was the then familiar reference to the specially constituted expert committees. These committees consisting of busy individuals who neither had time nor any "sense of urgency", would meet periodically and seek more and more hard information but postpone easy decisions. The project for conversion of low-grade noncaking coals into metallurgical coke is one such example. Since India has insufficient reserves of metallurgical coke, its importance was obvious. CFRI also put up a proposal for funding. Both proposals were discussed by the GB on April 16, 1966. It was decided to constitute an Experts Committee to make recommendations. The Committee met in July 21, 1966 and asked for more detailed proposals. It was reconstituted on December 13, 1966 and met on March 14, 1967 to consider only the CFRI proposal. Effort to have the meeting called at Hyderabad to consider RRLH proposals never succeeded.

### COAL GASIFICATION PROJECT

The work on gasification of low-grade, noncaking coals with high fusion point ash of which extensive deposits occur in the region, has formed a major item on Laboratory's research programme since its inception. It received approval of three high-powered committees *viz.*, Priority Committee headed by Dr. J.C.Ghosh (1951); Thacker Committee (1954); Specialists Committee headed by Professor M.S.Thacker (1960).

The proposal to set up a pilot plant for complete gasification of coal was approved by the EC on September 6, 1962 and by the GB of the CSIR on November 3, 1962. A grant of Rs. 21 lakhs was sanctioned. The actual quotations however were found to be higher. A revised sanction of Rs. 45.50 lakhs was, therefore, obtained in June, 1964.

In the meanwhile, the devaluation of Indian Rupee had further increased the cost. With the inclusion of some additional units, the cost went up still further. Besides, a new location of the plant was recommended by an Expert Committee of the EC headed by Shri S.K.Nargundkar. This and the provision of railway siding, made it necessary for the GB to re-examine the project which had then a capital cost involvement of Rs. 107 lakhs.

The GB in its meeting of July 15, 1967 constituted an Expert Committee with Dr. Kane, OSD, Ministry of Industrial Development and Company Affairs as Chairman and Shri S.K.Nargundkar, former MD, National Coal Development Corporation, Dr. K.R.Chakravorty, GM, Planning and Development Division, FCI, Sindri, Shri S.B.Sarkar Chief Combustion Engineer, Coal Board, Calcutta, Director, CFRI, Jealgora and Director, RRLH as members.

Unlike most committees, the Kane Committee acted fast and appeared predetermined. It held three meetings, on November 13-14, 1967 at RRLH, on December 8, 1967 at Delhi and on January 11, 1968 also at Delhi. The Committee visited the Maula Ali site at Hyderabad on November 14, 1967.

The Committee submitted its report on January 11, 1968. It felt that "it would not be advisable to establish and operate the plant in a manner proposed by RRLH." It suggested that the plant should be disposed of through negotiation by the CSIR to fertilizer company like FCI, FACT or GSFC or an interested coal company like the Singareni Collieries. If the CSIR was unable to attract these companies, the plant might be erected and operated as a testing unit for the developmental work on gasification of coals to the extent funds were available."

The report had an abundance of inaccuracies and incorrect deductions regarding the work already done, costing, objectives, etc. The Director, RRLH disagreed with some of the statements and recommendations and submitted a 'note of dissent' which was never included in the final report and thus kept away from the notice of the GB.

Interestingly, while the Kane Committee Report was still under the consideration of the CSIR, an inspired question based on the Report was asked in the Lok Sabha which was answered on July 26, 1968.

That a similar pilot plant existed at CFRI and whether another pilot plant was needed by the country are moot points. The fact remains that research in an important area of national economy, *viz.*, gasification of coals for fertilizer production and as a source of energy and chemicals was scuttled. Among the new activities of the CSIR under Fourth Plan proposals placed before the GB meeting held on May 14, 1969, the coal gasification project of RRLH was deferred.

It was on Christmas Day, 1973 that Mrs. Gandhi wrote to Dr. Zaheer. "It is now abundantly clear that a coal-based energy strategy is the only realistic course for us. Government is therefore proposing to pursue, on a priority basis, the development and utilization of all coal conversion technologies, and to step up coal production to a level which would make the utilization of technologies feasible. It is a measure of the foresight and determination of our scientists and the technologists in the CSIR that at a time when we are embarking on such an energy strategy, we have a core capability in the relevant technologies which we deepen and expand."

Though the erection work on coal gasification pilot plant had been stopped under CSIR orders, other aspects of gasification work continued. In its meeting held on February 16, 1972, the EC of RRLH considered a report of a technical panel headed by, Dr. T.P.S. Rajan reviving interest in the gasification pilot plant whose units were lying in unopened crates. Shri Anil De expressed concern of the Singareni Collieries Co.Ltd. which had a great stake in the gasification processes. The EC agreed that RRL should approach CSIR regarding installation of the pilot plant.

Accordingly, a proposal was prepared for the erection and operation of the gasification pilot plant for a period of three months in a year and envisaging the operation of oxygen plant for the remaining period for supplying gas to the adjacent mini steel plant. The Fuel and Power Group of the National Committee on Science and Technology (NCST) had set up a panel to study the feasibility of using pressure gasification plant for an integrated gasification combined cycle (IGCC). Programme for coal gasification for MHD project were also drawn jointly with the Bharat Heavy Electricals Ltd., Trichy (BHEL-T) and Bhabha Atomic Research Centre (BARC), Bombay.

In May 1974, the GB of the CSIR considered the management investment report prepared by the Laboratory and approved the proposal to run the pilot plant for 90 days in a year and operate the oxygen plant to sell the gas for the rest of the period.

Thus the project got restarted after a lapse of seven years. Who would account for this national loss, if not the establishment scientists of the period? The erection of the plant was

completed by the end of 1982. Assistance of experts of CFRI was obtained to check the performance of some equipments. Two experts from Lurgi, hired under a UNIDO contract, commissioned the plant in October 1983. The plant has facilities for the continuous analysis of gas done through a mass spectrometer coupled with a computer. After collecting data on gasification of coals from different parts of the country, work is in progress on IGCC project, in collaboration with BHEL.

What could be the rationale behind the attitude of the DGSIR?

In a note to the Sarkar Committee in November, 1968, Dr. Sidhu complained that since the then DGSIR (Dr. Atma Ram) had held office, not a single major project had been allowed to get underway. Even projects which had the sanction of the GB, were kept in a state of suspended animation. He ascribed this to the prejudice of the DG to Dr. Zaheer and to any work or institution with which his name was associated. Dr. Zaheer felt that it was more than just prejudice. "I think it is a mistake to have a DG who is a materialist, progressive and socialist succeeded by the DG who is his complete antithesis - a spiritualist, traditionalist and takes pride in being a conservative and devotes almost all his energies in undoing all the progress that had been made during the past four years and in denigrating the previous DG and all his active and progressive directors," said Dr. Zaheer to the Sarkar Committee.

### **MORE ROUGH WEATHER**

According to the terms of transfer of CLSIR to the CSIR in 1956, the Chairman of the EC of RRLH would be the Chief Minister, A.P. with four members each nominated by the A.P. Government and the CSIR. DGSIR, FA to CSIR and DRRL served as *ex officio* members. However, the reconstitution of the EC considered in the GB meeting of May 14, 1969 was as shown in the following page. In the reconstituted EC conveyed to RRLH, however, Dr. Gopalan was replaced by Dr. A.Sreenivasan, Head, Biochemistry and Food Technology Division, BARC, Bombay. Dr. Sidhu pointed to DGSIR that appointing a Chairman other than the Chief Minister of A.P. was violative of the transfer agreement of 1956. He also recalled that even in the earlier reconstitution of EC, he had emphasized that the Laboratory work had strong bias towards technology, especially chemical technology and it was desirable to have members from that discipline. The presence of two organic chemists on the Committee, however eminent, was superfluous. In the reconstituted EC, the membership of the two had not only been continued, a physicist, albeit eminent one, had been made the Chairman of the EC. In addition, a geologist had been nominated on the EC. A packed committee indeed!

The EC was expected to evaluate and approve the current work of the Laboratory and also provide guidelines for future course of action. Dr. Sidhu felt that EC as constituted could not fulfil this role and requested for a change. When this was denied, he refused to call the EC meeting in protest.

When Dr. Sidhu went abroad for a few weeks, Dr. K.T.Achaya acted as Director. Dr. Bhagavantam, thinking that perhaps Dr. Achaya might not take a rigid stand in the regard, approached him personally to impress upon the legal formality of calling the EC meeting. Dr. Achaya expressed his inability to do so saying that was the prerogative of the Director and he was only an Acting Director.



**REGIONAL RESEARCH LABORATORY, HYDERABAD**

Sr. No.	Name of the existing members (excluding ex officio members)		Sr. No.	Proposed
<b>Nominees of A.P. Government</b>			<b>Nominees of A.P. Government</b>	
1.	Shri K.Brahmananda Reddy Chief Minister, Andhra Pradesh, Hyderabad.	Chairman	1.	Dr. S.Bhagavantam Scientific Adviser to the Minister of Defence, South Block, New Delhi.
2.	Shri M.S.Abbasi, I.A.S. Secretary to Govt. of Andhra Pradesh, Industries Dept., Hyderabad.	Member	2.	Dr. M.S.Krishnan C/o Geology Dept. Osmania University, Hyderabad.
3.	Shri N.B.Prasad 28,Sarojini Devi Road, Secunderabad.	Member	3.	Prof. N.V.Subba Rao Principal, University College of Science, Osmania University, Hyderabad.
4.	Shri Anil De, I.A.S. Managing Director, Singareni Collieries Co. Ltd. Meher Manzil, Khairatabad, Hyderabad-4.	Member	4.	Dr. C.Gopalan Director, Nutrition Research Laboratories, Hyderabad.
5.	Shri Abid Hussain, I.A.S. Director of Industries, Government of A.P., Hyderabad.	Member	5.	Shri Abid Hussain, IAS Director of Industries, Govt. of Andhra Pradesh, Hyderabad.
<b>Nominees of the CSIR</b>			<b>Nominees of the CSIR</b>	
6.	Prof.N.V.Subba Rao Principal, University College of Science, Osmania University, Hyderabad.	Member	6.	Shri J.K.Adhya 3/3, Ashutosh Sil Lane, Calcutta - 9.
7.	Shri J.K.Adhya 3/3 Ashutosh Sil Lane, Calcutta-9.	Member	7.	Prof. T.R.Seshadri,FRS Emeritus Professor, Centre for Advanced Study in the Chemistry of Natural Products, Delhi University, Delhi-7.
8.	Prof.T.R.Seshadri,FRS Emeritus Professor, Centre for Advanced Study in the Chemistry of Natural Products, Delhi Univeristy, Delhi.	Member	8.	Shri S.B.Sarkar Chief Combustion, Engineer, Coal Board, 11-A, Hastings Street, Calcutta - 1.
9.	Shri S.B.Sarkar Chief Combustion Engineer, Coal Board, 11-A, Hastings Street, Calcutta - 1.	Member	9.	Dr. G.P.Kane Officer-on-Special Duty (Retd.) Ministry of Industry, Internal Trade & Company Affaris. Udyog Bhavan, New Delhi-11.
10.	Dr. G.P.Kane Officer-on-Special Duty, Ministry of Industry, Internal Trade & Company Affairs, Udyog Bhavan, New Delhi - 11.			

The EC did not meet during 1969-70 and the same team was renominated for 1970-71. There was intense political activity in the country. The campaign for the Presidential election was in full swing. Whosoever won the election, a split in the Congress Party and the General Election were being forecast. DG's disinformation channels suddenly became active. These whisper campaigns, designed to demoralise the staff and to spread disaffection among the employees of the RRL, also served as forewarnings thus permitting the time for planning any counter measures.

It transpired that since the RRLH's EC had not met, the Laboratory's budget had remained unapproved. The DGSIR had therefore decided to disallow any expenditure since he derived his sanctioning authority through an approved budget. The whisper campaign urged the staff to make alternative arrangements for funds to meet the expenses for their urgent needs, as their salaries would not be paid. It did create some commotion and even scare when cheque from the CSIR did not arrive on the due date. But the salaries were disbursed as usual!

The secret was that the Laboratory always had substantial deposits on account of the sale of pilot plant products, especially Kolsit. The amount was periodically remitted to CSIR-HQ. The 'whisper campaign' forewarned the Laboratory authorities about the destabilization plan. The remittance to the CSIR was withheld and distributed as the salaries of the staff.

Dr. Sidhu approached the PM's office for the necessary expenditure sanctions. The PM was extremely busy and was constantly on the move on account of the Presidential election. Dr. Ashok Parthasarthy, Special Assistant in the PM's office who had been briefed on the Laboratory's problems, would get her signature for approval whenever she turned up at her office. The process continued for some months and the Laboratory was run on a month-to-month basis! Some other national laboratories also had problems with the CSIR-HQ, especially the DGSIR, but for the RRLH, it was a veritable war of attrition.

### **SIDHU RESIGNS**

Dr. Hari Narain, Director, National Geophysical Research Institute (NGRI), Hyderabad, one of the appointees of Dr. Zaheer, was facing similar problems with the CSIR-HQ. He was also provided with a 'packed' EC which would not allow him to run the Institute's programme as he had planned and proposed. He therefore asked the DGSIR to change the composition of the EC. When this was refused, he resigned on July 22, 1969 but kept the information to himself. Somehow, the Delhi press got the wind of it and splashed the news. Dr. Sidhu had no knowledge of it but he himself had been toying with the idea of resigning for some time and had even mentioned it to his senior colleagues. Dr. Sidhu had fostered a strong collegiate environment and always sought the views of his colleagues before taking important management decisions. Yet without consulting anyone, he resigned with a strong conviction that he was not alone in his fight against injustice.

The two resignations caused considerable concern to the Prime Minister. She asked Shri P.N.Haksar, to ascertain facts and then directed Dr. V.K.R.V.Rao, Vice-President, CSIR to intervene. In the meanwhile, nine other Directors of the national laboratories threatened to resign. They called on Dr. Rao and later the Prime Minister herself. Dr. Y.Nayudamma, Director, Central Leather Research Institute, Madras, acting as their spokesman, explained

how the DGSIR aided by the CSIR bureaucracy had acted vindictively against certain laboratories, "packed" the ECs and other committees, withheld sanctions and approvals by adopting delaying tactics and hampered the progress of work by other means. They were assured that the remedial action would be taken in due course.

The resignations of the two Directors were not accepted.

### MOVING FORWARD

Despite impediments and irritants, the progress of work at RRLH was substantial judging from the processes released, the work sponsored by industry and from the number of publications and patents. The production on the pilot plants was also steady and an average annual sale of Rs. 11-12 lakhs was maintained.

Several feasibility reports were prepared which included LTC of low-grade coals (cap. 120 tpa) for the Industrial Development Corporation of Orissa, submitted jointly with RRL, Bhubaneswar, and for the Maharashtra Government; processing of salseed for the Utkal Contractors and Joinery Pvt. Ltd., Sambalpur to extract sal fat; and the processing of cottonseed to manufacture cottonseed oil, cottonseed flour, cotton linters and other byproducts. The proposed plant envisaged the use of the fluid cyclones designed and fabricated by the RRLH to obtain low-gossypol cottonseed flour.

For the first time, a CSIR laboratory undertook a turn-key job when the RRLH commissioned the benzyl chemicals complex of Orgaroma India (Pvt.)Ltd., Hyderabad. Modern computer-based techniques were used in determining the design parameters and for optimization of operating conditions.

The 1000 KVA transformer received from BHEL, Bhopal was installed and 3-t/batch silicon carbide furnace was successfully operated at the Laboratory. Another pilot plant put into operation was a rotary briquette maturing plant of 5 tpd capacity. Work on a fluidized-bed coal carbonizer was commenced.

The designs for a 10-t/batch open-stack carbonizer were prepared for the Singareni Collieries Co.Ltd.

Work on active carbon from pine char sponsored by the Hypine Carbons Ltd., Nullagarh, H.P. and on fatty acids from neem and karanja oils sponsored by the Hindustan Lever Ltd., Bombay, was completed. Methods of utilization of indigenously-grown sunflower seeds were explored and conditions standardized for efficient hulling and expelling to get good quality oil and light coloured cake. A method was also worked out for refining and deodorization of sardine oils to enable their use in surface coatings, inks and leather industries.

Silicon carbide produced in the Laboratory was test marketed and had found ready acceptance by the consumer industry for the production of coated and bonded abrasives, lightning arresters and varistors. The process for its manufacture was released to Indian Metals and Ferro Alloys Ltd., Bhubaneshwar to set up a plant in Orissa.

The publication of a monthly bulletin, '*Industrial Development News*' was commenced. Another publication, '*Consumption of Domestic Fuel in A.P.*'; was based on an extensive survey carried out by the Laboratory.

The scientists of the Laboratory were recipients of several honours and awards. Following Dr. Zaheer's footsteps, Dr. Sidhu received the K.G.Naik Gold Medal. The Jaipuria Gold Medals were awarded to Dr. K.T.Achaya and Dr. M.R.Subbaram. Other scientists who were honoured in various ways included Dr. P.M.Bhargava, Dr. V.Kesavulu and Dr. M.B.Naidu.

The Laboratory was honoured by the visit of the President, Dr. Zakir Hussain. Other distinguished visitors included Shri Morarji Desai, Deputy Prime Minister, Shri M.C.Chagla, Shri Asok Mehta, Shri Khandubhai Desai, Governor, A.P., Shri K.Brahmananda Reddy, CM, A.P., Shri K.Hanumanthaiya, Chairman, Administrative Reforms Commission of India, and Professor B.D.Nag Chouduri, Member, Planning Commission, New Delhi.

### **NAYUDAMMA TAKES OVER AS DGSIR**

Dr. Y.Nayudamma, Director, CLRI, Madras took charge of the office of the DGSIR on August 27, 1971 upon the retirement of Dr. Atma Ram. His appointment was widely acclaimed by the scientific workers though the so-called "science mafia" appeared as unhappy as they were when Dr. Zaheer was appointed as the DGSIR. About his appointment, Dr. Zaheer wrote to the Sarkar Committee of Enquiry "When my appointment was under consideration, I made several attempts to induce both the President and Vice-President of CSIR that the appointment should go to a much younger Director, like Dr. Nayudamma who was still only forty. The names besides mine, which were under consideration were, however, those of Dr. Venkataraman, Dr. Atma Ram and Dr. Lahiri - all three of whom for more than one reason, I considered as quite unfit to hold the post. While I would have been rejoiced and perfectly happy to continue as Director, RRLH with Nayudamma as DG, but owing to great incompatibility in our approach and thinking with regard to the role of science, its organization and its development in India, I would have left my post in Hyderabad in case any of the three named earlier was appointed DG."

These were the views expressed before Dr. Nayudamma got appointed as the DGSIR. The major recommendations of the Sarkar Committee for structural changes were in line with the thinking of Dr. Zaheer and the reforms he introduced. It was therefore appropriate that Dr. Nayudamma had to immediately take this challenging job. In accordance with the recommendations, he took steps to delegate more autonomy to the national laboratories and to make the central office function more as a technical headquarters than merely as an administrative one.

Born on September 10, 1922, Dr. Nayudamma graduated from the Benaras Hindu University in Industrial Chemistry and received advanced training in leather technology in U.K. and U.S.A. during 1946-51. After his M.S. and Ph.D. degrees in leather chemistry from Lehigh University, he returned to join CLRI in December, 1957. He took over as Director of the Institute in February, 1958 and remained at this post till his appointment as DGSIR.

### **RECONSTITUTION OF EC**

The EC of the RRLH was reconstituted for the year 1971-72. The last EC was constituted in 1969-70 and was continued during 1970-71 but did not meet even once and was replaced by the following EC.

Shri K.C.Shroff (Chairman) and Shri Anil De, IAS; Shri N.Luther, IAS; Dr. L.K.Behl; Dr. B.Rami Reddy; Prof. L.Ramachandra Rao; Shri Yogindra N. Mafatlal; Shri C.J.Bhumker; Shri D.C.Gami; Prof. R.C.Mehrotra; Dr. K.L.Mukherjee and Dr. T.P.S.Rajan, as members with DGSIR, FA to CSIR and DRRL as *ex officio* members. Dr. R.Vaidyeswaran acted as the Secretary to the EC.

The EC had a leading chemical manufacturer as its Chairman for the first time and another leading industrialist was its member. The EC had a strong technology orientation though the universities also had a fair representation. The EC met on September 2-3, 1971.

The research programme and related issues like equipment needs were considered in greater details by the experts in the specific research areas. For this purpose Panels were constituted with a known scientist/technologist as the Chairman and a scientist from RRLH as the Convenor. These Panels which met later, reported to EC meeting of November 27, 1971, and covered Oils & Fats; Surface Coatings; Organic Intermediates and Pesticides; Industrial Ceramics; Coal; Mineral Products and Inorganic Chemicals; Chemical Engineering; Speciality Papers and Cellulose.

The business-like approach of the EC was refreshing. The September 1971 meeting approved the work on epichlorohydrin sponsored by the Space Research Centre, Thumba who desired the development of a process for its production on 200 kg/day scale, with attention being paid to byproduct glycerol. The Gujarat State Fertilizers Co. Ltd. (GSFC) had been associated with hydrogenation of benzene to cyclohexane. The work on this project was continued.

In addition, a 75 kg/day bench-scale unit for the production of melamine was approved. Urea needed for the project would be supplied by the GSFC. Other projects which were approved for continuation were cottonseed flour, utilization of slack coal, design of a rotary kiln, and carbon black from agricultural wastes.

The programme of work by the Biochemistry Division also came up for discussion arising out of the proceedings of the last EC meeting (October 19, 1968). Dr. K.L.Mukherjee spoke highly of the work of the Division which had brought international fame to the Laboratory.

The EC also approved proposals for taking up sponsored work on behalf of Schering A.G., Berlin, for the production of cyclohexane in collaboration with the GSFC, and for undertaking survey on behalf of the Tamil Nadu Government with a view to establishing a cottonseed processing plants in the State.

The EC meeting of November 27, 1971 considered the reports of the Experts Panels which were approved. A note on the Gasification Pilot Plant was put up giving revised programme on the project and requesting financial sanctions so that the work could be restarted.

### **A WHIFF OF FRESH AIR**

The change at the CSIR-HQ and the steps towards decentralization that followed brought in a new wave of enthusiasm among the scientists. The RRLH by now had established a reputation that it could take a stand to fight for a cause. It was no longer considered 'regional'. It had a national standing.

With impediments and shackles removed, it boldly planned for new programmes of work which had been held over or obstructed during the past few years.

### **EXECUTIVE COUNCIL BECOMES EXECUTIVE COMMITTEE**

The Executive Council (EC) was replaced by an Executive Committee (EC) headed by the Director of the Laboratory and the Scientific Sub-Committee (SSC) by a Scientific Advisory Committee (SAC).

The EC members were: Dr. G.S.Sidhu (Chairman), Dr. R.Vaidyeswaran, Shri Bharat Bhushan, Shri H.S.Rao, Shri S.R.Ramamurthy, Shri D.C.Gami, Prof. R.C.Mehrotra, Shri S.P.Kaushika and Shri R.N.Sharma. The SAC members were: Dr. G.S.Sidhu (Chairman), Shri A.Ramachandran, Shri B.B.Ramaiah, Dr. K.P.Karanth, Dr. V.Subba Rao, Shri V.L.Karwande, Dr. A.D.Damodaran, Shri K.V.Antony, Shri A.P.Rao, Shri Y.V.S.Murthy, Prof. C.Chiranjeevi, Prof. M.M.Taqi Khan, Dr. B.Rami Reddy, Dr. B.K.Verma, Dr. T.P.S.Rajan, Dr. Vasant R.Gowarikar, Shri K.S.Hinge, Dr. P.G.Menon, Dr. Hamsagar, Dr. S.Ramachandran, Shri R.D.Shroff, Dr. S.K.Pradhan, Dr. M.D.Narsimahan, Shri S.K.Das Gupta, Dr. S.V.Krishna Rao, Dr. R. Vaidyeswaran, Shri H.S.Rao, Shri D.C.Gami, Prof. R.C.Mehrotra, Representative of DGTD, and Shri Bharat Bhushan (Convenor).

The first meeting of the EC was held on October 30, 1973 in which the new organizational structure as well as the revised charter were approved. In the new organizational structure, which became effective from May 1974, the total work of the Laboratory was functionally divided into six categories as:

- Process Development
- Design and Engineering
- Basic and Exploratory studies
- Planning, Coordination, Technical Information and Industrial Liaison
- Engineering and Technical Services
- Administrative Services

The research work was project-oriented under these categories. The organizational structure was one more step towards delegation of authority and responsibility to a wider section of the scientists.

### **ORGANIZATIONAL RESTRUCTURING**

Dr. Sidhu and his colleagues were keen on adopting newer management techniques to monitor and expedite the work of the Laboratory. The EC approved the appointment of the Administrative Staff College of India (ASCI) to carry out the studies of the existing management information system at the RRLH and make suggestions for developing a modern management information system.

The ASCI Report suggested that the managerial structure should be based on project management rather than on discipline-wise divisions. Based on this report and as a result of intensive discussions among the senior staff members, an organizational structure more

suited to the needs of RRLH was evolved which was approved by the EC in its meeting held on October 30, 1973.

It was envisaged that

- The entire R&D work of the Laboratory would be project-oriented,
- the Project Coordinators and Project Leaders would have well-defined functions and financial and administrative powers,
- the mobility of staff between the projects would be enhanced because there would be no divisional barriers, and
- areas which attract more sponsored work would be strengthened by reallocation of staff as it became necessary.

The ASCI Report appreciated that decision-making at the RRLH took place in an informal collegiate environment and went on to suggest that it should be formalized by appointment of some advisory committees. As a result, DRRL constituted a Committee of Management with the following members:

Dr. G.S.Sidhu (Chairman); Dr. R.Vaidyeswaran; Shri Bharat Bhushan; Dr. P.S.Murti; Dr. P.M.Bhargava; Dr. E.R.Saxena; Shri H.S.Rao; Dr. M.A.Sivasamban; Shri P.S.Kolhatkar; Dr. G.Thyagarajan, Shri S.P.Kaushika; Shri R.N.Sharma; (Members) and Dr. G.S.Rao (Member-Convenor).

The Committee which was advisory in character, had scientist members by rotation. It had the following functions:

1. Screening of project proposals in terms of laboratory objectives, formulation of short-term and long-term research programmes of the Laboratory and laying down *inter se* priorities between different projects,
2. Choice of Project Coordinators, Project Leaders and allotment of staff and finance to projects,
3. Determination of priorities for purchase of equipment costing more than Rs. 10,000 and allocation of foreign exchange,
4. Periodical review of progress of projects,
5. Formulation of policies on various aspects of the functioning of the Laboratory, and
6. Any other function assigned to the Committee by the Director.

The first meeting of the Committee took place on October 5, 1973.

On the basis of the recommendations of the Sarkar Committee Report, Director, RRLH constituted committees to assist him and the EC in the relevant matters. These Committees were:

Research Planning and Coordination Committee  
Finance Committee  
Appointments and Assessment Committee  
Stores and Purchase Committee  
Royalties and Process Release Committee  
Patents and Publications Committee  
Library Committee  
Engineering and Maintenance Committee  
Personnel and Welfare Committee

This was approved by the EC in its meeting held on October 30, 1973.

### **CHARTER OF RRLH**

Dr. Nayudamma was known for his unconventional approach and venture-oriented management. He introduced 'decentralized, democratized, internalized collegiate management' not only at the GB level but also at the EC level. The structural changes at the CSIR-HQ were taking place at around the time when RRLH was busy implementing the relevant suggestions of the ASCI Report. A common topic in both was redefining the goals and objective to bring the charter into sharper focus.

A charter was drawn and approved by the EC meeting held on October 30, 1973. It stated in the preamble that RRLH was multidisciplinary in character concerned mainly but not exclusively, with R&D in the field of chemical technology. Among the stated objectives was to carry out basic research in areas where the scientists are capable of making significant contributions to the advancement of knowledge.

The conventional discipline-oriented areas were changed. The new areas of work were: Mineral-based products; Agro-based products; Synthesis; Design and engineering; Basic/exploratory studies; Research planning and coordination, technical information and industrial liaison; Analytical services; Engineering services; and Administrative services.

The charter also described the mode of selection of projects, methodology of work to achieve effective functioning and immediate goals.

The new charter, sharper objectives and the general decentralization of the CSIR gave fillip to RRLH taking up work in new areas to fill the gaps in the development and transfer of technology. A few of these are described.

### **TRAINING RESEARCH MANAGERS**

Dr. Sidhu had followed his predecessor's philosophy of building qualities of leadership among his younger colleagues. When the ASCI was retained to study the management information system at the RRLH, he exposed them to discussions during the preparation of the report. He also persuaded the DGSIR to ask the ASCI to conduct a course on the management of research laboratories for the benefit of the CSIR scientists. Eventually an intensive course was organized at the ASCI during November 1973, which was attended by



some fifty scientists drawn from different CSIR laboratories. The Faculty was drawn from the ASCI and the CSIR. The Course Director was Professor Gopalakrishnaiah who had earlier done the RRLH report.

This was followed by a seminar a year later on 'Concepts and Techniques of R&D Management' held at the ASCI during July 31 - August 3, 1974 which was attended by 32 Directors of the national laboratories. It provided an opportunity for exchange of views between management experts and Directors, as well as among the Directors themselves.

The inaugural session had discussions confined mainly to the role of NCST in transforming the needs of the people into research programmes and in tying up the research programmes with national plans. Further discussions of the seminar were focussed on setting up of objectives; organizational structure and dynamics; project management; and human resource management.

### **AN ACCOUNT OF ACTIVITIES**

The seventies recorded a tremendous spurt in activities at the RRLH. The liberating influence of the changes in the CSIR resulted in a wave of fresh enthusiasm. The government policies moved towards self-reliance from the previous import substitution. The new incentives were announced for industry to sponsor research and development work. The sponsored research thus suddenly became an important fact of the R&D activity of the Laboratory. The NCST also played a significant role in bringing research and industry nearer. The CSIR too moved closer in this direction by organizing more research-industry get-togethers, both at the national as well as at the laboratory level.

The changes within RRLH included the inter-disciplinary composition of the project teams with the project leaders and project coordinators having freedom to operate within specified limits. The project monitoring system was refined to expedite the progress of the selected projects. The PERT was employed to determine the critical path of the progress. The procedures which caused maximum bottlenecks were modified to the extent possible. A system was devised to have improved interaction with industry and other users of technology.

Some new work areas were developed. A few of these are described.

### **DESIGN AND ENGINEERING**

An identified and often talked about major gap in the transfer of technology from a research laboratory to industry had been the design and engineering of a project. The design and engineering companies, who undertook to engineer the project, were not only expensive but they also demanded the generation of basic design data from the laboratories. Even working on a laboratory or pilot plant scale on process involving several steps, the experimental equipment required had to be selected or designed based on scale-up criteria. In addition, an economic evaluation of the competing processes would also be found necessary which entailed an evaluation of the process at every stage of development to ensure against any pitfalls which might arise during the commercial production.



Design and Engineering of commercial plants filled a major gap in the transfer of technology

When a design and engineering company entrusted with the project engineering asked for specifications and the design data for a critical equipment, it invariably covered most of the equipment since the company had no background experience of the process.

The EC meeting held on July 5, 1972 considered these issues during discussion on a proposal to establish a process design and evaluation group at the RRLH. While approving the proposal, the EC recognized that sufficient attention had not been paid in the country to equipment design especially that required by the chemical industry. The proposed group would fill this gap. It would also carry out techno-economic evaluation of the process developed in the Laboratory and would also prepare process design and detailed project reports.

The group started functioning in 1973 and did some commendable work. In a few years time, it gained lot of experience and confidence in designing commercial plants. While reviewing its work, the SAC in its meeting on March 2-3, 1977 felt the need for its expansion into a semi-autonomous centre which should be able to cater to the design and engineering needs of other national laboratories also.

Accordingly, a proposal was prepared for the establishment of this Centre involving an expenditure of Rs.100 lakhs and sent to the CSIR for its inclusion in the Sixth Plan. It is understood that the proposal was not considered further due to opposition by the NCL.

The small design and engineering group in the course of two decades has grown into a large division. The experience has demonstrated that the chances of smooth and successful transfer of technology are greatly enhanced when design and engineering services are its component.

The first major assignment was of the LTC plant set up by the Coal Chemicals Complex of the Singareni Collieries Co. Ltd., at Naspur in A.P. in 1979 at an estimated capital investment of Rs. 130 million. Since then some fifty chemical plants based on RRLH know-how including design and engineering have come up in different parts of the country.

### COMPUTER-AIDED WORK

Dr. Zaheer realized the importance and potential of computers which, even in early sixties, had ushered in entirely new dimensions in the process of information handling. It was only in 1966 when Dr. Sidhu was able to procure a second generation digital computer (IBM 1620) which had been rejected by another laboratory since it was too slow for their work, he built a small but competent group to carry out some pioneering work in the area of chemical engineering especially in optimization, modelling and simulation.

The interest in optimization arose when the know-how for benzyl group of chemicals was being commercialized. The temperature programming of the side-chain chlorination of toluene through use of multistage dynamic optimization techniques, helped to limit the undesirable products to the minimum.

The probability of experimentation using mathematical model of a system rather than the system itself provided a new dimension to computer-aided work. Thus simulation became a powerful tool to analyze the effect of changing various process parameters in a chemical reaction and thereby helps in its control and efficiency. The GSFC provided a suitable opportunity to carry out an exercise which extended over a four-year period. Plant data available on the panel-board and the analysis of various streams formed the basis of the exercise. Models of various plant units were written based on physicochemical characteristics in each. They were then solved on a fast computer. The representative models were subsequently used on the plant when not only the ammonia yield improved but also helped in cutting down the purge of costly hydrogen which had contributed to an increase in productivity valued at Rs. 16.8 million.

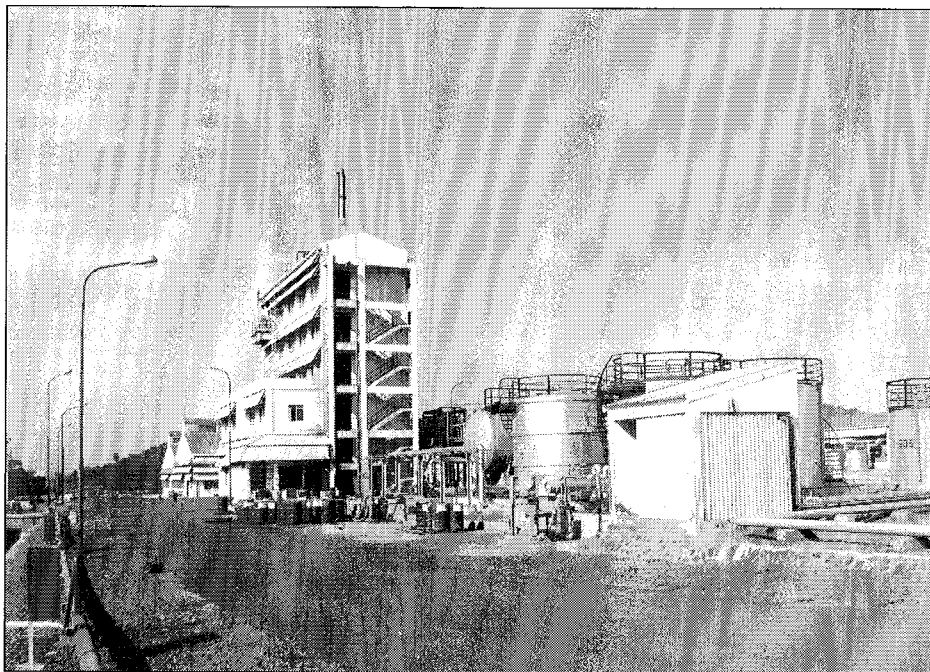
Other important computer-aided area is the online digital control of highly complex processes ensuring uniform and high quality products and at the same time conserving the material and energy resources, thereby reducing the costs.

There are other success stories too. The scope has increased since 1981 when a fourth generation computer (UNIVAC V/77/800) was installed, which greatly enhanced the capability of Design and Engineering Division.

### DEVELOPMENT OF PESTICIDES

The area of pesticides had been on the research programme of the Laboratory since its inception. A small entomology group was formed to evaluate the pesticidal properties of plant products. A turpentine-based insecticide, 'Citicide' was studied in detail on a pilot plant scale but not pursued further. Another promising material was the seed oil of *Annona squamosa* (Sitaphal) which ran into problems of isolation of the active principle. Interest in work in the area of pesticides was revived in 1971 when during a review meeting, it was felt that the efforts be made to develop technologies to manufacture known pesticides which were imported rather to discover new compounds requiring long period for their evaluation on the farm-scale. A reappraisal of the programme of work on pesticides was done by the EC in its meeting on August 22, 1974. It was noted that the in-house programme was proceeding

satisfactorily and the sponsored work was also on the increase but the country's urgent requirements demanded still greater effort.



Monocrotophos plant set up by NOCIL

The R&D on pesticides was considered in depth by the pesticide group of the Panel on Chemical Industry constituted by the NCST and by the Pesticides and Agrochemicals Research Committee of the CSIR. The NCL and RRLH were represented on both by Dr. B.D.Tilak and Dr. G.Thyagarajan respectively. The involvement at the national level and a continuing demand from industry resulted in the formulation of a comprehensive and integrated programme involving the process, formulation, analysis and evaluation.

The NCST Group had identified 98 pesticides and recommended that additional items could be chosen on the basis of bioefficacy and a cost benefit analysis. Depending on the expertise and specialization existing in each laboratory, a group of pesticides was allotted to NCL and RRLH for development under a time-bound programme. A while later, when Dr. Thyagarajan moved to RRL, Jorhat as its Director, some items were allocated to the Jorhat Laboratory for development. Other laboratories involved to some degree were: Central Food Technological Research Institute, Mysore; Indian Toxicological Research Centre, Lucknow and Central Drug Research Institute, Lucknow.

The development of process know-how was only one step towards pesticides manufacture. The project had to be engineered. The RRLH was all set for it and offered its services to other laboratories as well. But the manufactured product or its formulation could not be applied on the farm unless it had been approved by the Central Insecticides Board. Under the Insecticides Act, all manufacturers and formulators were required to submit to the Board all toxicological data under Indian conditions, within a period of three years of marketing the product. The

inadequacy of facilities for such evaluation and also for developing the appropriate formulations was identified as a major handicap in the national pesticides development programme. The EC meeting of August 22, 1974 therefore directed the RRLH to fill these gaps and offer its facilities to industry and other research institutions.

Thus, aspects on the development of technology for pesticides included: development of know-how; process design and engineering; detailed design engineering and commissioning assistance; development of formulation know-how and its engineering for commercial production; and generation of data for the registration of the product or formulation under the Insecticide Act.

Several pesticides plants based on technology developed at RRLH and, in some cases jointly with RRL, Jorhat, have been set up in different parts of the country. The estimated value of production is Rs. 1400 million/year. These pesticides are: Monocrotophos; Butachlor; DDVP; Diazinon, Quinalphos; MBC; Chlorpyrifos and Vepacide. There are several others for which technologies are being developed or are in various stages of transfer to industry.

#### **THYAGARAJAN APPOINTED DIRECTOR RRL, JORHAT**

The RRLH felt proud that another of its young scientist, Dr. G. Thyagarajan was chosen to head the RRL at Jorhat in Assam. Dr. Thyagarajan took charge of this difficult and challenging assignment on December 30, 1974.

Dr. Thyagarajan joined RRLH in 1957. He obtained his Ph.D. degree of OU in 1962. He worked with Professor Rapoport at the University of California at Berkeley as a post-doctoral fellow (1964-65) and as a visiting scientist at the National Institute of Health, Bethesda, MD, USA (1969-71). His research interests included heterocyclics, pesticides, drugs and organic intermediates. He acquired specialized knowledge in research management, by doing a semester course of the Institute for Advanced Studies, Princeton in 1970, by undergoing an In-service Training for managers and executives of industrial research institutes organized by UNIDO in The Netherlands in 1973, and by doing an intensive course at the ASCI also in 1973.

Dr. Thyagarajan was a member of the Planning Group on Pesticides of the Panel on Chemical Industry, NCST and member-convenor of CSIR's Pesticides and Agrochemicals Research Committee. He was instrumental in organizing and coordinating the pesticides development research programmes of several CSIR and other laboratories.

Earlier another former RRLH scientist, Dr. M.G. Krishna, Director, IIP, Dehradun, was appointed Director, CFRI, Jealgora on May 25, 1974. Dr. Krishna passed away at Hyderabad on June 5, 1978 where he had come on a visit.

#### **OTHER ACTIVITIES**

The basic design report for a 900-tpd plant for the LTC of coal, based on the experiments carried out at the 25-tpd pilot plant, was prepared in 1974 for the Engineering Projects India Ltd (EPI), New Delhi, the turnkey engineering consultants of the Singareni Collieries Co. Ltd., (SCCL). The report included detailed designs of all the critical equipment. Subsequently, an extended basic design of tar distillation section of the LTC plant having a capacity of 2,700

tpd of coal was also prepared. This was in addition to the 3-part basic design report already given. The process know-how and design for the effluent treatment plant, based on the data generated at the Laboratory LTC pilot plant were prepared by the National Environmental Engineering Research Institute (NEERI) and handed over to EPI.

The establishment of a commercial LTC plant had been the goal of the RRLH since 1953 when the LTC pilot plant was commissioned. The plant which uses the low-grade coals of Andhra Pradesh to produce smokeless fuel and byproducts tar, has been in commercial operation since 1979. The capital investment on the plant was Rs. 120 million.

During mining about one-third of the coal is crushed to fines which, besides being a waste, is a fire hazard. The LTC plant also generates both coal and char fines in large quantities. Their utilization will add to the returns of the LTC industry. A compound binder was developed to produce briquettes from char fines.

An RRLH technology-based 600-tpd silicon carbide plant, set up at Therubali (Orissa) by the Indian Metals and Carbides Ltd. (IMCL) was erected by the engineering consultants under the Laboratory supervision. The plant was commissioned in 1975. Both black and green varieties of grains were produced satisfactorily. The furnacing section performed satisfactorily but downstream equipment required to grind and screen the grit failed to function properly. The raw material section also did not perform well. The project was eventually dropped when the Grindwell-Norton plant came up with imported technology.

The RRLH supplied designs of critical units of plant to manufacture active carbon from sawdust by fluidized-bed technique at Manila (Philippines). Special design features were incorporated in the conventional rotary kiln for the manufacture of steam-activated carbons.

Technical assistance was provided to Daurala Sugar Works, Daurala in setting up a plant to manufacture benzyl group of chemicals and to Ranbaxy Laboratories, Mohali for the manufacture of diazepam and other drugs with the know-how provided by the Laboratory.

A nickel-on-alumina catalyst developed by the Laboratory which could produce cyclohexane from benzene by hydrogenation in a single pass at a relatively low temperature, was successfully tested for its continued performance on a 1-tpd pilot plant set up at the GSFC, Baroda. A computer programme was developed for obtaining temperature profile for packed-bed reactor by the two-dimensional model which was used to simulate data on the pilot plant.

The inter-laboratory programme on the development of technology for the manufacture of various pesticides also included the know-how and design for the manufacture of key intermediates and some basic raw materials like phosgene and phosgene-based chemicals, *p*-chlorophenol, 2,4-dichlorophenol, *m*-chloroaniline, allyl chloride, diketene and diketene-based chemicals, trimethylphosphite, etc. A special plant was set up to produce phosgene and a new laboratory facility was created to produce phosgene-based chemicals. Other intermediates on which attention was directed were epichlorohydrin, glyoxal, phthalic anhydride, vinyl acetate and pentaerythritol. Work on methoxychlor was carried out at the instance of Excel Industries Pvt. Ltd., Bombay. A plant for the production of monochloroacetic acid (capacity 450 tpd) set up with the RRLH know-how, went into production in 1977.

A modified procedure for the production of the hydrogenated castor oil (HCO) which permitted an improvement in quality and reduction in costs was worked out. Conditions for obtaining mixed HCO fatty acids were also standardized. The HCO fatty acids have a market abroad for manufacturing lithium soaps used as high pressure greases. A procedure was evolved for simultaneous splitting and dehydration of castor oil to provide light-coloured dehydrated castor oil (DCO) fatty acids in one step. Like-wise, a hard fat having tallow-like consistency was also produced in simultaneous dehydration and hydrogenation. Urethane oils were produced from castor, safflower, linseed and sardine oils and DCO for use in surface coatings and other industries.

After completing the double-blind tests on an N-arylalkyl anthranilic acid (code named, RH-8) which had shown promising anti-inflammatory activity, it was introduced in the market by the Unichem Laboratories Ltd., Bombay in 1980. The drug was, however, withdrawn later due to it having shown some side-effects over long periods of use.

In pursuance of CSIR's decision to adopt some backward districts for their development through application of science and technology, Karimnagar District in A.P. was chosen at the suggestion of the State Government. The RRLH, in collaboration with other laboratories, prepared a comprehensive plan for its development which not only described the philosophy behind the adoption but also gave an outline of resources of the District and the schemes to utilize these.

Dr. G.S.Sidhu was honoured with an award of Padma Shri (1976). He also shared the FICCI cash award (1976) for excellence and outstanding contributions in R&D with particular reference to its interaction with industry. Several other scientists also won awards especially those working in the area of oils, fats and surface coatings.

### **PROJECT KARIMNAGAR**

Project Karimnagar, an integrated project for rural development was an example of innovative and unconventional approach of Dr. Nayudamma towards 'Science for the common man', which he said was his life mission. He called it 'adoption of the backward district' with a view to changing the face of underdevelopment through application of science and technology. The area of Karimnagar District is 11,800 km<sup>2</sup> and net domestic product per capita was about \$50 (1971). The key to the Project was that CSIR in association with other apex R&D bodies was to bring about growth and modernization through a deliberate use of S&T by maximum utilization of available resources following an integrated approach based on, what Nayudamma called, "grassroot planning instead of diffusion of urbanized science" into rural environment.

The RRLH, being close to the Project area, naturally became the hub of activity and provided coordination with the national laboratories participating in the Project on one hand and the State Government on the other. DGSIR appointed Directors of RRLH, NGRI and Central Road Research Institute, New Delhi as the Co-Directors of the Project. A high-powered committee with Chief Secretary of A.P. Government, DGSIR, the three Co-Directors, Collector, Karimnagar District and several other officials of the State was constituted to steer and periodically review the progress.

The RRLH was assigned the task of preparing the basic documents and detailed project plans, taking the help of scientists from other laboratories and the District Collector, where necessary.

The project plans which were thus drawn by a multidisciplinary group, encompassed various aspects of compatible and mutually supporting programmes. The integrated programme was divided for operational convenience into activities like soil-water-crop management; land reforms; agricultural practices; processing of agricultural products; public utility services like housing, roads, drinking water, and sanitation; health, maternity care, nutrition and family welfare; agro-, agro-waste-, forest-, mineral- and animal-based industries; pollution, effluent and ecological systems and utilization of wastes; education coupled with work experience, etc. The project was launched in 1974.

The implementation was effected, as far as possible, through the available infrastructure. Whereas normal public funds were the source of funding the public utility activities, funds for investments in industrial, agricultural and other activities were raised through financial institutions and entrepreneurial participation. The envisaged financial outlay (1974-79) was about US \$ 55 million.

The strategy adopted was to direct efforts towards development possibilities arising out of the resource inventory of the district. The criteria for selection of schemes were that they were need-based, used indigenous skills and resources, provided scope for using local talent for self-employment, had multiplier effect, produced visual impact, produced demonstrable improvement in the existing technology and finally, were designed to promote social justice.

In order to prepare a total plan for the utilization of natural resources, an assessment was carried out using air-photo interpretation technique followed by ground checks. (The use of satellites was not available in those days). In this fashion geological, geomorphological, geohydrological, soil and water maps were prepared on a scale that their use by the layman was facilitated.

A detailed analysis of the data on climate, soils and cropping pattern was made to suggest new cropping and intercropping patterns and agricultural techniques.

Similarly, detailed investigations were carried out on the traffic density, availability of local materials, soils, skills, and on economics of road construction. Designs and specifications were prepared. Training workshops were held to transfer technology for laying roads more economically and by using local materials. A total of 450 km road length was thus laid or improved.

Alternative housing technology and designs were demonstrated by using improved construction techniques based on multidisciplinary technological inputs. Several housing colonies were built.

A training workshop was conducted on various public health technologies to the village-level workers and engineers. Several rural water supply schemes were executed and a number of biogas plants and night soil-digesters were built. A plan for environmental control in an industrial complex was also prepared.



Several agro-industries were set up. An improved technology for rice milling was introduced. Mini rice and maize mills were designed and demonstrated for introduction in the villages. Nearly 300 satellite poultry farms and an animal feed unit for an egg powder plant were established which have been successfully operating even though the plant did not come up. Two small scale paper and strawboard plants were established. Small units to manufacture ferrocement building materials and biogas plants were also set up. Tannery workers were provided in-plant training in the modern methods of curing, tanning and leather goods manufacture.

Despite many limitations and weaknesses, the project activity generated self-competence and confidence in the people to utilize their own skills and resources for gainful productive activity by using science and technology as a deliberate tool for growth and modernization. The multiplier effect of some the demonstrated technologies was also visible. The project attracted the attention of international funding bodies interested in providing assistance to the developing countries. The World Bank President, Mr. Robert McNamara visited Hyderabad and held discussions with some community representatives, entrepreneurs, officials and scientists. He also saw a full-scale demonstration of various technologies introduced in Karimnagar and was highly impressed.

The project, however, failed to make the desired impact. The shortcomings were many. To begin with, the CSIR decision-making was top-heavy and the actual field workers had no channel to express their views and share their experiences. The project was run according to the Government rules and regulations causing loss of time, and even money. The project staff had no incentives and suffered monetary loss during their long stay in the Project area. DGSIR was also not willing to add more staff.

The greatest weakness of the Project was its failure to actively attract other S&T agencies like the Indian Council of Agricultural Research, the Indian Council of Medical Research and the universities. Agriculture is the principal activity in rural India. Without adequate S&T inputs to improve the agricultural practices and output, other efforts to improve the economy would meet only marginal success. The voluntary agencies who usually play a catalytic role in propagation of new ideas also did not come forward in this government official-dominated activity.

## **TWO STALWARTS PASS AWAY**

Dr. Husain Zaheer died of a massive heart attack on December 22, 1975, while at work at the RRLH where he was working as an honorary consultant.

Recipient of Padma Bhushan, Dr. Zaheer had been honoured with several awards which include K.G. Naik Gold Medal and N.K.Sen bronze medal for his contributions to scientific and industrial research. The Regional Research Laboratory (now Indian Institute of Chemical Technology) is a living tribute to his memory.

The President of India, Shri Fakhruddin Ali Ahmed, in a message of condolence, said: 'In his demise, the country has lost not only an outstanding personality in the field of science but a great patriot committed to the higher social and human values'.

The Prime Minister Shrimati Indira Gandhi's condolence message said: 'The country has lost a person of distinction, of strong convictions and of dedication who strove to make Indian science self-reliant. He was a person of widest intellectual and cultural interests and took active part in the freedom movement'.

Dr. A.Ramaswami Mudaliar, the eminent educationist died at Madras on July 17, 1976. Born on October 4, 1887, Dr. Mudaliar was the Founder-President of the CSIR. He was the Chairman of the Third Reviewing Committee of the CSIR which was appointed in 1963. He was also associated with the National Physical Laboratory and the National Metallurgical Laboratory as the Chairman of their EC's. He played a significant role in the establishment of the Central Laboratories at Hyderabad in 1944.

Dr. Y. Nayudamma, Director General, Scientific & Industrial Research, described Dr. Ramaswami Mudaliar as a 'putative father of CSIR'. He said that Dr. Mudaliar had a unique vision and looked decades ahead of his contemporaries. He had realized in the forties that India must build its own band of scientists and technologists to achieve self-reliance in economic and social development by the application of science and technology.

### **THE CELL DIVIDES! THE CCMB IS BORN**

A major event which brought about a structural change in the Laboratory, was the establishment of a semi-autonomous Centre for Cellular and Molecular Biology (CCMB) on April 1, 1977 with the Biochemistry Division of the Laboratory forming its nucleus and Dr. P.M. Bhargava its head. The Centre was designed to use the infrastructural facilities like workshop, stores, library and administration of the RRLH but having a separate SAC and its budget earmarked. The arrangement was expected to effect economy in expenditure yet permit freedom to the CCMB for its growth and expansion. In 1981 the CCMB was accorded the status of a full-fledged national laboratory with its own EC and SAC.

The proposal to establish the CCMB was mooted by the RRLH in 1975. The CSIR was approached in this regard. The DGSIR appointed a specialists committee to examine the proposal and suggest ways to implement the proposal. The committee which comprised Dr. G.P.Talwar, Dr. Obaid Siddiqi, Dr. S.Ramachandran, Dr. T.V.Subbiah and Dr. P.M.Bhargava met on August 10-11, 1975 at the RRL, Hyderabad and again on September 28, 1975 at the Tata Institute of Fundamental Research (TIFR), Bombay.

The committee recommended the establishment of the CCMB in view of the importance of work in this frontier area of science. It also spelt out the objectives of the centre and worked out the financial implications. The recommendations were referred to another committee for scrutiny and suggestions. The committee which consisted of Dr. A.Ramachandran, Secretary, DST (Chairman); Shri A.B.Datar, FA to CSIR; Shri M.R.Raman, Planning Commission; Dr. G.S.Sidhu, DRRL; and Shri A.Rahman, Chief (Planning), CSIR (Convenor) also recommended that a major project support should be provided to the CCMB.

The GB of the CSIR considered and approved the proposal in its meeting held on June 29, 1976. It also outlined an organizational pattern for the Centre and appointed its SAC.

The proposal was approved by the EC in its meeting held on December 10, 1976. Thus the CCMB came into existence on April 1, 1977. The matter again came up for discussion before the EC of RRLH on November 5, 1979, when a proposal for according to the status of a full-fledged national laboratory having its own infrastructural facilities was recommended. The CSIR approved the proposal. The CCMB still shares the library and some other facilities with RRLH.

The objectives of the CCMB are:

- a) To conduct research in frontier and multidisciplinary areas of modern biology and to seek potential applications of this work.
- b) To carry out exploratory work with a view to aiding the development of biochemical and biological technology in the country on a sound basis.
- c) To train people in the advanced areas of biology with special provision for short-term training of staff from other institutions in techniques for which adequate facilities may not exist elsewhere.
- d) To provide centralized facilities in the country for new and modern techniques in the interdisciplinary areas of biology and to ensure that these facilities are put to maximum use by research workers from other laboratories and institutions in the country.
- e) To interact adequately with other institutions (in India and abroad) doing basic or applied work in areas related to the activities of the Centre.
- f) To collect, collate and disseminate information relevant to biological research.

The Prime Minister Shri Rajiv Gandhi dedicated to the nation, and to the cause of science, the new complex of the CCMB on November 26, 1987, in presence of a galaxy of Indian and foreign scientists. He also declared open 'Jonaki', a CSIR-DAE project on production of labelled biomolecules.

With the establishment of the CCMB as a new national laboratory, the controversy about the relevance of molecular and cellular biology research as part of the programme of the RRLH starting with report of the Specialists Committee headed by Professor M.S.Thacker and persistingly pursued by some through the years in the ECs and SACs, was set to rest.

#### **CHANGES IN CSIR-HQ**

Dr. Nayudamma relinquished charge of the office of the DGSIR on July 27, 1977 after completing a six-year term which was full of challenges. His unconventional and innovative approach led to decentralization in the CSIR releasing forces that propelled the laboratories towards progress. Dr. Nayudamma returned to the CLRI to pursue his research interests as a Distinguished Scientist.

Dr. A.Ramachandran, Secretary, DST assumed the duties of DGSIR on July 28, 1977 as an additional charge. Recipient of Distinguished Alumnus award of Purdue University, he was Professor and Head of Mechanical Engineering Department of IISc, Bangalore, when he joined as Secretary, DST in 1973. He left a year later to take up an assignment with UN.

Professor M.G.K.Menon, FRS, an eminent physicist and Director, TIFR, Bombay, succeeded Dr. Ramchandran as DGSIR and Secretary, DST. He assumed charge of the twin offices on October 9, 1978.

Professor S.Nurul Hasan, an eminent historian and an educationist was nominated as the Vice-President of the CSIR in place of Shri K.C.Pant with effect from January 1, 1980. Professor Hasan was the first whole-time VP of the CSIR.

Dr. Atma Ram, former DGSIR, was appointed as Chairman, NCST on June 30, 1977.

### **PRIORITIES IN SCIENCE AND TECHNOLOGY**

In view of the critical importance of identifying priority areas in science and technology in achieving national goals, a seminar on Determination of Priorities in S&T 'was organized jointly by the CSIR and UNESCO during April 14-23, 1980 in New Delhi'. The aim of the seminar was to optimize the scarce resources of men and materials. It was pointed out by Professor S.Nurul Hasan that the concept of priorities in S&T must have a strong component for creating self-reliance. The determination of priorities in science and technology could not be achieved by simply using one technique or the other. The priorities should get their roots from the stated social goals which needed defining of the socio-economic-cultural development perspective.

Professor M.G.K.Menon, DGSIR, said that determining priorities became necessary due to restricted resources and the concern of the people about the cost of research and the scale of financial allocations required for science and technology. He pointed out that development was a multidisciplinary effort and every single major task required consideration of its multiple facets.

Dr. S.Varadarajan, Chairman, IPCL, pointed out that while India had been quite successful in operating new technologies and had also developed high level of capabilities for design and engineering, the industries did not operate efficiently in terms of productivity standards.

Professor A.Rahman, Chief (Planning), CSIR said that the priority development was essentially a problem of choice from amongst a number of scientific and techno-economic possibilities. He also laid emphasis on the impact of the choice on other areas of science and technology and on society.

The RRLH had successfully grappled with this problem by introducing an efficient internal review and control system.

### **SIDHU RETIRES AS DRRL ..**

Dr. G.S.Sidhu, Director of the RRL for nearly two decades, laid down his office on January 31, 1981. Dr. Sidhu had taken over the stewardship of the Laboratory when Dr. Zaheer was appointed as the DGSIR in 1962. Under his dynamic leadership, the Laboratory grew from strength to strength despite the difficult circumstances created by 'an actively hostile DG' and 'packed committee.' With an eye on the future, he built the design and engineering group, considerably extended the scope and availability of analytical facilities for process development, and expanded upscaling facilities by building more general and specific pilot plants and other infrastructure. In doing so, he did not allow the interests of basic research to suffer. It was due to his foresight that the CCMB came to be established as a national laboratory.

Due to retire on July 31, 1980, Dr. Sidhu was asked to continue till a suitable successor could be located. His popularity with the staff was so high that various staff associations represented to the authorities for an extension of his services.

### **..AND APPOINTED AS DGSIR**

Dr. G.S.Sidhu took over from Professor M.G.K.Menon as DGSIR and Secretary (CSIR Affairs) to the Government of India in the Department of Science and Technology on May 5, 1981.

Addressing CSIR scientists, on assuming office, Dr. Sidhu said:

“CSIR has been headed by eminent scientists. Therefore, it is with a great deal of diffidence that I have accepted this high appointment. It is not going to be an easy task to measure up to the high standards set up by my predecessors, but with the cooperation and collaboration of my colleagues within the organization, and friends in industry, academe and government, I shall try my best to take the organization forward towards its goals.

“It has been a real and special pleasure to have worked as a Director with Professor Menon. It is rare to meet a person of such scientific brilliance, a very wide spectrum of knowledge and endearingly human qualities. I am counting on his wise counsel and guidance continuing to be available to us in CSIR.

“I cannot but think back today of Professor S.Husain Zaheer whom I joined as an undergraduate honours student in 1937. As my research supervisor, then as Director of RRL, Hyderabad, and later as Director-General, CSIR, he greatly influenced my thinking. I regard my elevation to this office as a fitting tribute to his memory.

“It will be my endeavour that research in CSIR should meet the technological needs of our country. I am confident that industry will take more and more interest in technologies developed within the country. We will always aim to develop modern and efficient technologies and will not be purveyors of obsolescent know-how. We will continue to maintain close relationship with the universities.”

### **M.G.K. MENON SCIENCE CONGRESS PRESIDENT**

Professor M.G.K.Menon was elected General President of the Indian Science Congress Association for 1981-82.

### **VENKATARAMAN PASSES AWAY**

Professor K.Venkataraman, Director of NCL during 1957-66 died on May 12, 1981. Born on June 7, 1901, he obtained his Ph.D. with Sir Robert Robinson and was later awarded D.Sc. of Manchester University. He started his career at the Forman Christian College, Lahore in 1933 and later moved to the Department of Chemical Technology, University of Bombay in 1935 where he became Modi Professor and Director. He was awarded Padma Bhushan in 1961. His 2-volume classic Chemistry of Synthetic Dyes has been translated in several world languages.

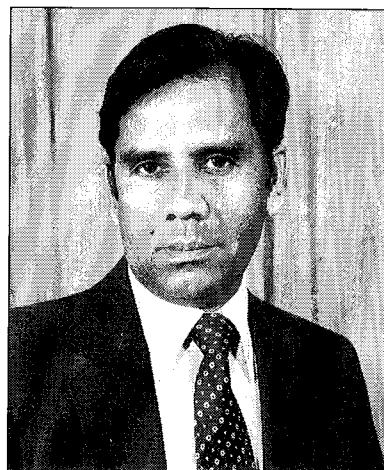
## **Thyagarajan – RRLH's New Director**

2

## THYAGARAJAN – RRLH's NEW DIRECTOR

Dr. G.Thyagarajan, Director, RRL, Jorhat took over as Director, RRLH on February 2, 1981. For Dr. Thyagarajan, it was 'home-coming' but, unlike the proverbial wasteful prodigal son, he returned after winning many fresh laurels. It was like a pupil coming back to his school as a headmaster. It gave Dr. Thyagarajan immense professional satisfaction to head an institution where he began his career as a predoctoral researcher in 1957 under Dr. Sidhu and Dr. Zaheer.

His earlier achievement of organizing inter-laboratory pesticides technology development programme on a national scale stood him in good stead at Jorhat where he had 'willingly shouldered difficult and challenging assignments.' In a short period of time he transformed a rudderless RRLJ into 'an active and pulsating research institute.'



His return to RRLH was thus more than welcome.

### ECs & RACs

The Executive Committee of the RRLH had the following members during 1981-82: Dr. G.Thyagarajan (Chairman); Dr. E.R. Saxena; Dr. M.Sriram; Dr. S. Raghavendar Rao; Dr. P.B.Sattur; Dr. P.K.Mukhopadhyay, Engineers India Ltd. (EIL); Dr. B.C.Subba Rao, Hindustan Lever Ltd. (HLL); Shri B.Pratap Reddy, IAS; Administrative Officer, (AO) and Senior Finance and Accounts Officer, (S.F.& A.O.)(*ex officio*).

The Scientific Sub-Committee (SSC) of the EC was replaced by a powerful Research Advisory Council (RAC) by the CSIR. The RAC members were Prof. C.N.R.Rao, Indian Institute of Science, Bangalore (Chairman); Dr. L.K.Doraiswamy, Director, NCL, Pune; Prof. J.C.Kuriacose, IIT, Madras; Dr. P.K.Mukhopadhyay, EIL, New Delhi; Shri C.R.Reddy, Coal Chemical Complex (CCC), Naspur, A.P.; Prof. T.Gopichand, IIT, Madras; Dr. B.C.Subba Rao, Hindustan Lever Research Centre, Bombay; Prof. D.Rebello, UDCT, Bombay; Shri A.P.Rao, BHVP, Visakhapatnam; Shri N.Selvarajan, CCC, Naspur, A.P.; Prof. U.R.Ghatak, Indian Association for Cultivation of Science, Calcutta; Prof. G.Aravamudan, IIT, Madras; Prof. D.Chakravarty, IISc, Bangalore; and DGSIR, DRRL and Chairman, Chemical Sciences Coordination Council, CSIR (*ex officio*).



The EC and RAC were reconstituted on a 2-year basis with effect from July 1, 1982. The EC members were: Dr. G.Thyagarajan (Chairman); Shri K.Seshagiri Rao; Dr. U.T.Bhalerao; Dr. Asad Ali Khan; Shri V.K.Bari (EIL); and A.O. and S.F & A.O. (*ex officio*).

The new RAC comprised Shri Lovraj Kumar, Ministry of Petroleum, Chemicals and Fertilizers, New Delhi (Chairman); Prof. Govardhan Mehta, University of Hyderabad, Hyderabad; Prof. A.R.Vasudeva Murthy, IISc, Bangalore; Prof. S.Sarkar, IIT, Bombay; Prof. S.D.Shukla, Director, HBTI, Kanpur; Dr. K.D.Paharia, Plant Protection Adviser to the Government of India, New Delhi; Dr. G.S.Raju, SIRI, Vijayawda; Prof. E.C.Subba Rao, Tata R&D Centre, Pune; Dr. M.R.Kurup, Vikram Sarabhai Space Centre, Trivandrum; and DGSIR, DRRL, and Chairman Coordination Council, Chemical Sciences Group (*ex officio*).

### **ATMA RAM PASSES AWAY**

Dr. Atma Ram, former DGSIR, passed away on February 6, 1983. Dr. Atma Ram was Director, CGCRI since its inception and later succeeded Dr. Zaheer as DGSIR in 1966.

### **REAPPRAISAL OF RESEARCH PROGRAMMES**

Dr. Thyagarajan returned to the Laboratory with a lot of goodwill. He had known the Laboratory and the people and was back in a familiar and friendly environment. Earlier he saw the Laboratory from a researcher's view and now he had to reset the sights for he was a Director. Suddenly it looked big but with tremendous resources and potential. He felt grateful to his predecessors for their foresight. They had toiled against odds in building an infrastructure that could be made use of not only in promoting and expediting the ongoing projects but also to introduce new ideas and new programmes.

Among the other assets was the project-oriented work manned by multidisciplinary teams with an organized project monitoring and evaluation system. He began his task by a reappraisal of the existing programmes with a view to formulate a research strategy for obtaining optimal results with the available resources.

The projects were given a hard look. It soon emerged that in some areas, the unproductive projects needed to be tapered off and the programme be reoriented and rescheduled in a harmonious manner. Industrial ceramics, oils and fats, surface coatings and entomology were such areas which required deeper consideration. There were other areas which required more thrust and consolidation, and therefore more attention and resources. Pesticides, design and engineering, active carbons and catalysis were among those identified for this purpose. New areas which were suggested for further discussion and programme formulation included photochemistry, catalytic reaction engineering and mass spectrometry. The imminent restarting of work on coal gasification pilot plant also came up for discussion. During these reappraisal exercises some equipment needs like electron microscope, NMR and mass spectrometer were also identified. Since Dr. Sidhu had taken over as the new DGSIR, he counted on his guidance and support for the Laboratory's research programmes.

Dr. Thyagarajan wished to draw on the earlier experience of the successful inter-laboratory, well-coordinated programme of development of technologies for the pesticides manufacture which wove together several CSIR laboratories, industry and other organizations in a giant effort to produce results within a time-frame. He wanted not only to extend the experiment

of pooling of the resources of men and materials in such formidable combination which guaranteed success but also to expand its horizon to include international agencies as well for what he called strategic planning for commercialization of technologies. The multi-laboratory consultancy provided to the Oil and Natural Gas Commission (ONGC) by which the CSIR, as the prime contractors, together with the TNO of The Netherlands and Snamprogetti of Italy, successfully competed in a global tender. And when the MIC leakage tragedy struck Bhopal, Dr. S.Varadarajan, the new DGSIR, entrusted the RRLH the task of organizing and coordinating an inter-laboratory and inter-agency work force not only to identify the causes of the explosion and consequent leakage from a storage tank but also to 'neutralize' the remaining MIC stored in other tanks. Some of these projects are described in the following pages.

### **MULTI-LABORATORY CONSULTANCY TO ONGC**

The crudes of the Bombay High are waxy in character (wax content *ca.* 13%). The Oil and Natural Gas Commission (ONGC) therefore faced rheological problems in transporting this crude through the 203 km long submarine and on-shore pipeline which eventually told on the on-shore processing units. In a series of interactions involving the Ministry of Energy, Department of Petroleum, the ONGC and the CSIR, it was viewed that the vast scientific and technological expertise and the physical resources built up by the CSIR could be utilized to solve the problem of transportation of the waxy crude.

The CSIR asked Dr. Thyagarajan to examine the possibility of pooling the resources and expertise available in different CSIR laboratories and outside and offer consultancy to the ONGC on a formal basis. The complexity of this simple-looking problem became evident when its various aspects were discussed in a meeting held on October 26, 1984, at the RRLH which was attended by the scientists from the CSIR laboratories and the ONGC officials and that it required a comprehensive study as a multidisciplinary team effort. The CSIR laboratories which could contribute different facets of expertise were: RRLH; RRL, Jorhat; IIP, Dehra Dun; MERADO, Pune, and later CLRI, Madras. When the details of the tasks to be performed were worked out, two important gaps in the expertise were identified, *viz.*, the determination of viscosity and its correlation with the flow behaviour of the crude and the second, experience of laying pipelines. Dr. Thyagarajan used his personal contacts to involve the TNO, the CSIR counterpart of The Netherlands and the well-known Italian company, Snamprogetti who had experience of pipelaying the world over. The loose ends thus tied up, Dr. Thyagarajan was then prepared to bid for a global tender which the ONGC had floated, with the CSIR as the prime contractor and the TNO and Snamprogetti as sub-contractors.

The TNO and Snamprogetti had lot of experience but hardly any scientific manpower to study the crude, its rheology and friction parameters, nor did they have sufficient knowledge of antifreezing compounds and flow improvers, which were available with the CSIR. Their expertise and experience became complementary with that part of the whole — the total expertise became possible for delivery to the client. It was masterminded by Dr. Thyagarajan who had the fullest backing of the DG, Dr. S.Varadarajan.

The contract valued at Rs. 52 lakhs was won by the CSIR. It gave lot of name and fame to the organization. It was true internationalization of the CSIR.

The assignment which was successfully completed involved:

- identifying and establishing controlling parameters,
- establishment of methods for the preparation of standard sample of the crude oil,
- examination of compatibility limitations of pour point depressants with other additives,
- to standardize methods for simulation of field conditions in the laboratory,
- effective interaction and coordination between the participating laboratories on one hand and with TNO and Snamprogetti on the other; and finally,
- constant interaction with the ONGC.

### **THE TRAGEDY AT BHOPAL**

Tragedy struck Bhopal on the night of December 2-3, 1984. An uncontrolled release of toxic gases took place from a buried stainless steel tank in which fortytwo tonnes of liquid methylisocyanate (MIC) had been stored for the previous two months for the manufacture of pesticides at the ill-located plant of Union Carbide India Ltd.(UCIL). Several hundred people died and thousands were injured. The environment was damaged and all public life virtually immobilized.

Dr. S.Varadarajan, the then DGSIR, had arrived in Bhopal on a visit to RRL on December 5, 1984 when he was requested by the State Government to provide urgent technical guidance regarding the quality of water and air which had been suspect and had led to more panic. He quickly assembled environment protection and toxicology specialists at Bhopal. It was some satisfaction that air and water were free from any toxic contamination.

A visit to the site of accident by the DG to get a firsthand picture of the happening provided the horrifying information that about 15 tonnes of MIC was still lying in another nearby tank. A leak from this tank could be potentially as dangerous as the first one. Based on an appreciation of chemical reactivity and other properties of MIC, a number of measures were adopted to minimize the recurrence of another leakage and contain the effects of such eventuality.

Experts from CSIR laboratories, Indian Council of Medical Research (ICMR), Indian Petrochemicals Corporation Ltd. (IPCL), the Department of Environment (DOEn), Hindustan Organic Chemicals Ltd., (HOC), Defence Research and Development Organization (DRDO), University Department of Chemical Technology (UDCT), Bombay, conferred and analyzed the likely causes of the December 2/3 gas leak — prerequisite to prevent a similar leak. Pros and cons of alternative methods for disposal of MIC in the second tank were to be in tune with the limitations imposed by the facilities available at the plant site.

The crisis was successfully managed. The processing operations (Operation Faith) were started on December 16 and completed on December 22. Each scientist had specific duties assigned and work was carried out round the clock. A total of 21 tonnes of MIC was reacted.

The RRLH scientists were involved right from the beginning in the investigations and the subsequent safe disposal of MIC during Operation Faith. The RRLH report gave details of the experimental evidence of chemical transformations which took place in the ill-fated MIC tank. It also contained the results of experimental simulation of conditions believed to be

prevailing in the tank at the time of the accident. Predetermined proportions of MIC, chloroform and water were subjected to reaction under various conditions and the products identified. The analysis of residue left in the tanks also confirmed the sequence of reaction as postulated earlier.

Dr. Thyagarajan was also involved as the CSIR nominee in the team sent to USA to select a competent American law firm to represent Indian Government in its suit against Union Carbide Corporation (UCC) of USA for damages, costs and appropriate relief and had extensive discussion with the selected law firm on technical aspects of the case, especially the counts on which UCC was culpable.

Thus another exercise of inter-laboratory collaboration in performing a well-coordinated task was completed successfully. Though DG had stationed himself at Bhopal till the end of Operation Faith, he counted on the experience and assistance of Dr. Thyagarajan in the management and organization of inter-laboratory teams.

#### **HAZARD STUDY AND RISK ANALYSIS**

The Bhopal tragedy had a sequel — the awareness of hazardous situations arising in the modern manufacturing plants which are operated at extreme conditions of temperatures and pressure and where use is made of highly toxic chemicals. Dr. Thyagarajan, who was deeply involved in the 'rescue' operation at Bhopal, took the initiative to establish a hazard study and risk analysis group at RRLH with the active help of the TNO of The Netherlands. The group was enlarged to include the CLRI scientists when Dr. Thyagarajan moved to Madras.

The RRLH had already had some experience in the risk analysis situations when the technologies for carbon monoxide, phosgene, cyanuric chloride, sodium azide, monochloroacetic acid, and several pesticides were developed on pilot plant scale. With this background, the constitution of a multidisciplinary team became quickly possible. Its members received specialized training in the hazard analysis, maximum credible accident and consequence analysis, fire and explosion indices, hazard and operability studies, plant safety audit, fault tree and event tree analysis, risk and risk contour mapping and emergency preparedness plans.

Two assignments in which the CLRI and the TNO were also involved were taken up. The first one, hazard study and risk analysis of Hazira Gas Processing Complex, Surat, Gujarat, and the other, Risk Assessment of IPCL plant at Baroda Complex, Gujarat were taken up in 1984 and have since been completed.

The group, known as Process Safety Centre, has grown further and done many more assignments.

#### **TECHNOLOGY POLICY STATEMENT**

Since the Science Policy Resolution of 1958, India had expanded its scientific and technological base and exhibited its capacity to use science and technology for socio-economic advancement. The Government considered it necessary to make a Technology Policy

Statement announcement by the PM in January 1983 at the Indian Science Congress Session at Tirupati with a view to lay down guidelines for development of indigenous technology and for import of technology and their interrelationship and interaction.

The basic aims of the Technology Policy Statement are:

- to attain technological competence and self-reliance, to reduce vulnerability, particularly in strategic and critical areas;
- to provide maximum gainful and satisfying employment to all strata of society, with emphasis on the employment of women and the weaker sections of the society;
- to use traditional skills and capabilities, making them commercially competitive;
- to ensure a correct mix between mass production technologies and production by the masses;
- to ensure maximum development with minimum capital outlay;
- to identify obsolescence of technology and arrange for modernization of technology and equipment;
- to develop technologies which are internationally competitive, particularly those with export potential;
- to improve production speedily through greater efficiency and fuller utilization of existing capabilities and enhance the quality and reliability of performance and output;
- to reduce demands on energy, particularly energy from non-renewable resources;
- to ensure harmony with environment, preserve the ecological balance and improve the quality of habitat; and
- recycle waste material and make full utilization of byproducts.

Presiding over the meeting of the CSIR Society on April 13, 1983, the Prime Minister drew attention of the members to the Technology Policy Statement and urged the CSIR to issue guidelines for the implementation of the technology policy. She reiterated her views at the CSIR Directors' Conference held in New Delhi on June 28, 1983.

#### **ZAIL SINGH VISITS RRLH**

Giani Zail Singh, President of India, visited RRLH on July 23, 1983. He went round the Laboratory and the pilot plants and evinced keen interest in projects having agro-industrial bias. He was accompanied by Dr. G.S.Sidhu, DGSIR.



President, Giani Zail Singh during his visit to the Laboratory on July 23, 1983

### **CSIR-INDUSTRY GET-TOGETHER**

Against the background of India's Technology Policy which the PM placed before the nation while addressing the Indian Science Congress at Tirupati in January, 1983, the CSIR having committed itself to implementing its various facets, invited the industry to join hands in the development of indigenous technology and for efficient absorption and adaptation of imported technology. The get-together which was inaugurated by the Union Minister of Industry, Shri N.D.Tiwari on April 21, 1983 in New Delhi, was addressed by Professor M.G.K.Menon, Member(Science), Planning Commission, Professor Nurul Hasan, VP, CSIR, Shri Ramakrishna Bajaj, VP, FICCI and Dr. G.S.Sidhu.

Some of the important points made were that the Technology Policy encompassed not only industry but also agriculture, health, rural development and other sectors of economy which would necessitate wider interaction. The role of design and engineering in the successful transfer of technology was also emphasized. It was pointed out that the get-together had been organized by the CSIR after a gap of 18 years and a more frequent interaction was desirable.

Some more significant recommendations were:

- CSIR should further strengthen its linkages and mechanisms of communication with industry;
- CSIR should critically evaluate the technology before releasing it to industry and also ensure proper selection of entrepreneurs;
- CSIR-Industry should jointly undertake technology forecasting; and
- A risk fund to finance the first user should be established.

In a reference to the get-together with industry, the PM while presiding over the CSIR Directors' Conference in New Delhi on June 28, 1983, said that the CSIR linkages with industry had improved and should be further improved or else the users would look for foreign technology. The PM called for more frequent dialogues with the user which should be organized more often. Such meets should be developed into an institutional framework and at the constituent laboratory level also.

#### **ICMA-RRLH GET-TOGETHER**

A largely attended meet on September 3, 1983 at the RRLH in which the representatives of the Indian Chemical Manufacturers Association and of the RRLH had fruitful discussions on the development of indigenous technology and its transfer to industry. The ICMA members also had the opportunity to see the facilities of laboratory and pilot plant work, the impressive output of the design and engineering group and the role of the analytical services in the process development at the RRLH.

The get-together stressed the need of closer links between industry and research system in the country to develop internationally competitive technologies based on the indigenous know-how. It was revealed that investment in R&D, especially the in-house R&D, was not adequate to bridge the present technological gap with the advanced countries. It asked for encouraging indigenous know-how development by disallowing import of technology where indigenous technology was available. Where import of technology was necessary, steps should be taken to absorb, develop and update technology so imported.

#### **SIDHU RETIRES — VARADARAJAN TAKES OVER**

Dr. G.S.Sidhu, DGSIR, retired on May 4, 1984 after completing a three-year term. Dr. S.Varadarajan, Secretary, DST, took over as DGSIR on June 22, 1984.

Dr. Varadarajan had been associated with the CSIR since 1964 as a member of various committees, as a member of the CSIR Society since 1974 and of the GB during 1974-81. He organized and headed with distinction the R&D wing of the Hindustan Lever Ltd., Bombay during 1960-74. He then moved over into the management of the public sector companies. During 1974-82, he occupied top positions as Chairman & MD, IPCL, Vadodara; Chairman, Petrofils Corporation Ltd.; and as Chairman & MD, EIL, New Delhi. He became Secretary, DST in May 1982.

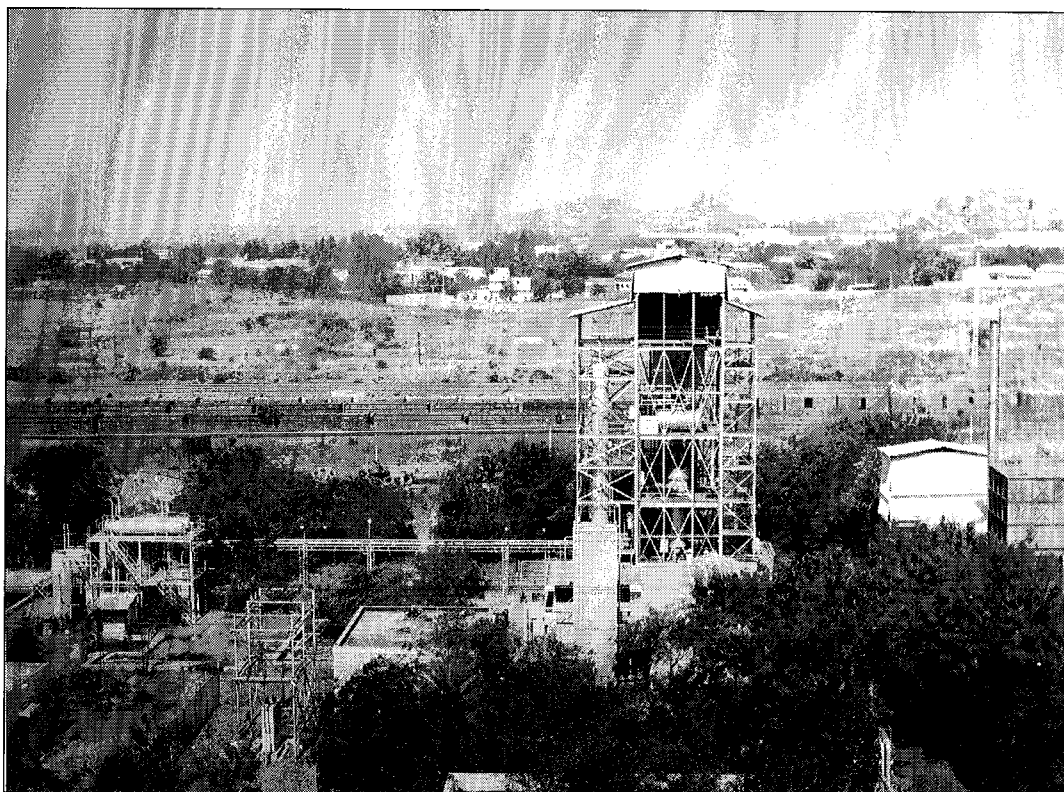
## INDIRA GANDHI ASSASSINATED

The Prime Minister, Shrimati Indira Gandhi died under tragic circumstances when she was shot from a close range at her residence in New Delhi on October 31, 1984. She was President of the CSIR since January 1966 when she became the PM. In paying tribute to her, the CSIR said that it "has lost not only its President but also its consistently staunch supporter, benefactor and guide. A person with a genuine interest in and commitment to science and with the hard determination to promote it for the benefit of masses, she was indeed the Patron Queen of Indian Science."

Indira Gandhi strongly believed that science and technology had an important role to play in India's socio-economic development. While presenting the Bhatnagar Prizes on July 25, 1980, she said: "I belong to a generation which knows science as a basis of development and as a catalyst for change. No foreign power should be in a position to pressurize to exploit our shortages. The more self-reliant we become the less vulnerable we are."

"Indian science is dedicated to peace. Its motive is development. All the major achievements of Indian science so far have occurred in its search for peaceful uses and not as a spin-off of defence requirements. This is true of Pokharan and of Sriharikota."

Indira Gandhi was succeeded by her son, Rajiv Gandhi as the Prime Minister of India and President of CSIR.



An aerial view of Coal Gasification Pilot Plant



## **COAL GASIFICATION PILOT PLANT COMMISSIONED**

While procuring the pilot plant, the RRLH had entered into an agreement with the suppliers, Lurgi of Germany, on the availability of their experts for commissioning of the plant. The project having run into controversies, the erection of the pilot plant was completed in 1982 without Lurgi's assistance but the commissioning required a fresh secrecy agreement which was not acceptable. Lurgi's assistance, however, became available under a UNIDO contract. The pilot plant was commissioned in December, 1983. A grant by the UNDP had made possible the installation of a quadrupole mass spectrometer coupled to a computer for continuous gas analysis and datalogging, indicating-cum-recording type on-line gas analyzers, a thermogravimetric analyzer for studying the reactivity of char with steam, carbon dioxide and hydrogen under pressure.

A number of runs were made with coal from Godavarikhani colliery of Ramagundam area, and later coals from Wardha valley, Ranigunj and Singarauli were studied. The data so obtained were analyzed and evaluated to arrive at material, energy and elemental balances across the gasifier and for gasification characteristics of various coals tested.

The pilot plant later became part of power generation study by Integrated Gasification Combined Cycle (IGCC) where the Laboratory collaborated with BHEL.

## **OTHER HIGHLIGHTS**

It was a matter of satisfaction that the R&D efforts of the past few years had resulted in successful commercialization of some of the processes developed. The lag between the demonstration of technology and commercial production was minimum where the transfer of technology was accompanied by the design and engineering assistance of the Laboratory. The pesticides complex of Sudarshan Chemicals at Roha (1982) and the monocrotophos plant of NOCIL at Lote Parshuram (1983) were commissioned. Commercial production at two glyoxal plants, Manish Organics, Ankleshwar and Rajasthan Glyoxal, Udaipur, was commenced in 1983. The MBC plant of Ankur Chemicals was successfully commissioned in 1982. In the same year, United Catalyst India also started regular production of RRLH technology-based catalyst for GSFC, Baroda for production of cyclohexane from benzene.

Process know-how at an appropriate pilot plant scale was developed for the production of phosgene, butachlor and epoxy resins based on Card-bisphenol. The process for the manufacture of chlorpyriphos was demonstrated to Indian Detonators Ltd., Hyderabad. Basic and detailed designs for setting up a 50 kg/day pilot plant were also prepared for the party. The NRDC-sponsored basic engineering package for the production of  $\beta$ -naphthol (1000 tpa cap) based on the CFRI know-how was completed.

A feasibility report for setting up an LTC plant based on Talcher coal was prepared for the IDC of Orissa Ltd., Bhubaneshwar. Rallis India Ltd., Bombay was provided technical assistance under a consultancy agreement. By another consultancy contract at-site technical assistance was provided to Carbon Products, Sdn Bhd, Kuala Pilah, Malaysia.

A rotary kiln capable of producing steam-activated carbon (cap 1 tpd) incorporating novel features of steam injection and discharge system was commissioned.

Vice-President, Shri M. Hidayatullah, unveiled a statue of Dr. S.Husain Zaheer on December 11, 1981. Founder's Day Lecture and another lecture in honour of Dr. G.S.Sidhu were instituted during 1981. The inaugural lectures were by Shri Mohd. Fazal, Member, Planning Commission and Professor M.G.K.Menon, respectively.

An international conference on Water Hyacinth was held in the Laboratory during February 7-11, 1983. The event synchronized with the successful conclusion of a 5-country project on "Management of Water Hyacinth."

A school on 'Toxicology of Pesticides' was conducted during November 7-19, 1983 which was attended by 30 participants from research laboratories, agricultural institutes and pesticides industry.



Vice-President, Shri M. Hidayatullah inaugurating the Computer Centre of the Laboratory on December 11, 1981

The Laboratory and its scientists were honoured with several awards including FICCI Award (1981).

### **THYAGARAJAN MOVES TO MADRAS**

The CSIR had been finding it difficult to locate a permanent Director for CLRI, Madras. After much discussion and consultation at the highest level, Dr. G.Thyagarajan was appointed as the Director of CLRI. He was asked to hold charge as Director, RRLH as well till his successor at Hyderabad was appointed.

Recalled Dr. S.Varadarajan, the DG at that time, "Recognizing such unusual combination of talents and committed leadership for recognition of new opportunities, motivation of entire teams for performance and readiness to venture into new unfamiliar areas, Dr. Thyagarajan could be persuaded in 1984 to accept the Directorship of CLRI and move from a large well established Laboratory with multiple area and product interests to a relatively small one devoted to a single area. Within a short time, CLRI was transformed to modernity and cohesion with high responsiveness in growing needs of sophistication."

Dr. Thyagarajan said that he was initially amused at the suggestion and resisted but gave in. "His (Varadarajan's) stress on the urgency of new scientific and engineering inputs into CLRI work programme and the relevance of my own strength in industrial chemistry demolished my defences."

#### **NAYUDAMMA DIES IN AIRCRASH**

Dr. Y.Nayudamma, Distinguished Scientist, CLRI, Madras died in an aircrash when an Air India aircraft in which he was travelling exploded in midair off the Ireland coast. Dr. Nayudamma was the former Director of CLRI, Madras and DGSIR. He will be remembered for his dynamic yet down-to-earth approach in the management of research. He made significant contributions to leather technology and was mainly responsible for improving village level leather tanning. He was the prime mover of Project Karimnagar.

## **Rama Rao – The New Director**



## RAMARAO – THE NEW DIRECTOR

Dr. A.V. Rama Rao, a senior scientist and Head of Organic Chemistry Division (Natural Products) of the NCL, Pune was appointed Director of the RRLH with effect from July 15, 1985.

Born on April 2, 1935, Dr. Rama Rao graduated from the Andhra University (1956) and obtained B.Sc(Tech) degree in Pharmaceuticals and Fine Chemicals of the University of Bombay (1960). The Ph.D.(Tech) degree followed (in 1965) for which he worked under the guidance of Prof. K.Venkataraman, Director, NCL. In 1965, he joined the regular staff of the NCL as Scientist B.

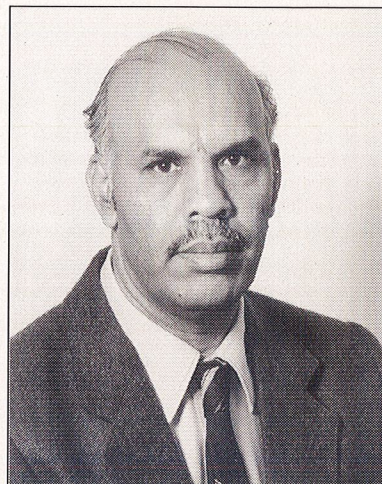
Dr. Rama Rao came to RRLH with great reputation having made significant contributions in the areas of natural products, synthetic dyes, synthetic drugs and synthetic organic chemistry. His work on antitumour anthracycline antibiotics, a highly competitive research area, won him international recognition. The development of simple procedures for the preparation of optically active anthracyclonones, and the total synthesis of macrolide antibiotics and the novel approach for the synthesis of the aliphatic fragment of rifamycin with eight chiral centres, are achievements of a high order. He had also developed a number of innovative and cost-effective processes for the manufacture of basic drugs like vinblastine and vincristine (anticancer agents), ibuprofen and ketoprofen (anti-inflammatory agents), chloroquin (antimalarial), dapsone (antileprosy), salbutamol, terbutalin (antiasthmatic), vitamin B6 and several other drugs and drug intermediates.

Dr. Rama Rao's work at the NCL won him several awards like K.G.Naik Gold Medal, VASVIK Award (1984) and Amrut Modi Research Award (1985). He was elected Fellow of the Indian Academy of Sciences and later, of the National Academy of Sciences (in 1985).

Dr. Rama Rao had worked in the laboratories abroad with some famous scientists - with D.H.R. Barton at the Imperial College of Science and Technology in 1974 and with E.J. Corey at the Harvard University during 1975-77.

### **RRLH's POTENTIAL**

Prior to taking over as Director, Dr. Rama Rao had studied various reports, documents and RRLH-related papers available at the NCL. He also visited the Laboratory on several occasions, once specifically to assess its potential. He also had discussions with Dr. Thyagarajan who had given thrust and direction to many major projects, especially the ones on agrochemicals.



Among the assets of the RRLH identified by him were:

- highly qualified technologists,
- excellent pilot-plant set-up and well-organized up-scaling facilities,
- first-rate design and engineering group,
- a well-organized planning, coordination, evaluation and information system,
- a fourth generation computer, and
- a good rapport with industry.

A major asset of the RRLH was its well-established project-oriented system which permitted the constitution of multidisciplinary teams for the execution of the projects without any interdivisional barriers. This multidisciplinary approach not only helped complete the project early but also change its course midstream. This was in contrast to his experience at the NCL where up-scaling work presented endless problems. Alongside these assets, Dr. Rama Rao noted several weaknesses which had impeded the progress of work of the Laboratory. There were some non-yielding projects including a few dating back to the early days of the Laboratory. Inbreeding over a period had not allowed a healthy flow of new ideas which was so essential for creative activity. It had also resulted in high average age of the scientists and accumulation of 'dead wood'. There were various staff associations, which over the years had deteriorated into pressure groups disrupting the routine of administration and other activities.

Dr. Rama Rao found that the Laboratory had considerably grown in stature and size and had made significant contributions in the area of chemistry and chemical technology and in the development of chemical industry. He had set his sights high not only to pursue his personal research interests but also to consolidate, develop and expand other areas of R&D. This called for a strategy which made full use of the existing assets, eliminated weaknesses and created new assets.

### REORGANIZATION

Dr. Rama Rao reviewed the ongoing projects and the future research plans with his colleagues at different levels. He stressed upon the need to have a fresh approach. The exercise resulted in dropping some activity, tapering off a few programmes and reinforcement of the more important ones with more men and materials. To bring about a 'cohesion' in its activities, the Laboratory was reorganized into major divisions and supporting/infrastructural groups.

The major divisions were:

- Organic Chemistry
- Physical and Inorganic Chemistry
- Oils and Fats
- Coal
- Organic Coatings and Polymers
- Chemical Engineering

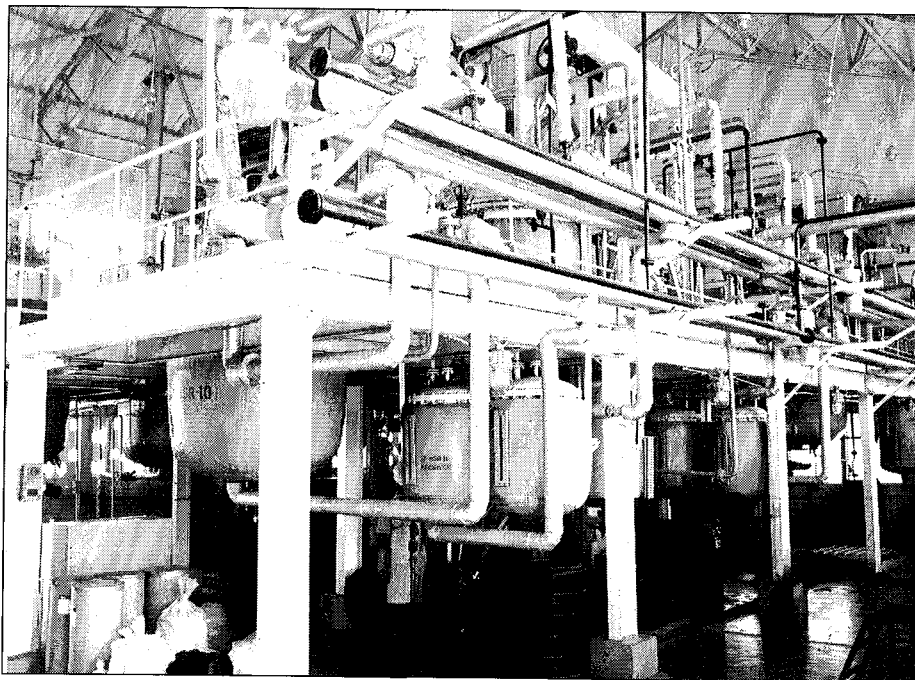
Mechanical Engineering Design and Development  
Planning, Coordination and Liaison

The supporting groups were:

Analytical Chemistry  
Biology (Pharmacology, Entomology, Toxicology)  
Pilot Plants  
Workshops  
Instrumentation  
Library and Documentation

The Pulp and Paper group which existed in the Laboratory since its inception was operated in a restricted manner and the new Materials group drew on the manpower made available by the Industrial Ceramics and other groups.

Organic Chemistry Division was subdivided into three groups: Organic Chemistry I (natural products); Organic Chemistry II (mainly agrochemicals); and Organic Chemistry III (Organic synthesis and drug technology). The last group working under the direct guidance of Dr. Rama Rao was designed to develop technologies using innovative approaches for some essential and life-saving imported drugs and to carry out total synthesis of complex natural products with specific biological activity.



CIPLA's Etoposide plant based on technology provided by the Laboratory



## ACCENT ON INNOVATIVE APPROACH AND HUMAN RESOURCE DEVELOPMENT

A firm believer in 'good science leading to good technology' Dr. Rama Rao emphasized the need for inputs of science in developing technologies even for known products. This approach, apart from being more creative, often resulted in improved and more economical processes.

To carry out the activities assigned to Organic Chemistry III, initially, two senior-level and 'bright young' scientist from NCL, were appointed. Many more, including some former students of Dr. Rama Rao, followed. Fifteen research fellows, registered for their Ph.D. programme, were also transferred to Hyderabad. Many more were recruited later to support and enlarge the research activity. Dr. Rama Rao introduced an ingenious, though somewhat 'exploitive', training programme for the research fellows. After a routine exposure to spectroscopy, chromatography and other relevant techniques which aid research, a research fellow was allotted one or two sets of the synthesis of an industrially important organic compound — a life-saving drug or a high-priced intermediate — for optimization of the yield using innovative approach, before he could start his Ph.D. work. Fresh from the university, the student would learn to search literature, apply his mind to problem-solving and work for long hours to achieve his immediate objective. The training which would last for 12-18 months, would ensure secrecy of a multi-step synthesis. The system was particularly suited to research sponsored by the industry which also financially supported the research fellow. In course of time, industry-supported research fellows almost equalled the CSIR-supported ones (34 against 36 in 1994). Dr. Rama Rao's deep involvement in his research group was evident from his not uncommon late night visits to the laboratories and on-the-spot discussions with the researchers.

For the expansion of the activities and to develop new areas of work, additional laboratory and pilot plant space and manpower were contemplated. Temporary laboratories were built in the infrequently used sheds, especially for Organic Chemistry III (Dr. Rama Rao's group), followed later by construction of new laboratories to locate synthetic organic chemistry and fine chemicals, bio-organic chemistry groups and several others.

The area leaders and senior scientists from the various disciplines were encouraged to initiate newer research activity lying within the charter of the RRLH by taking research fellows and training them appropriately. The research fellows, after completing their Ph.D. programme were, in most cases, asked to join the Post-Doc work. Thus, in a few years, the RRLH evolved an enlightened human resource development programme.

Dr. Rama Rao was determined to achieve results of his endeavours in the shortest time. He was sometimes harsh in his comments on ongoing programmes. He also introduced unpopular restrictions on the movement of the staff and insisted on punctuality. This brought him in conflict with the staff associations. The RRLH had a tradition of openness and these democratic institutions were encouraged once. As years went by, their functioning deteriorated and they degenerated to become pressure groups. An office-bearer of the NGO's association was suspended. There was a direct confrontation with the management. It was resolved in favour of discipline.

## EXECUTIVE AND RESEARCH ADVISORY COMMITTEES

The EC consisted of Dr. A.V.Rama Rao (Chairman), Dr. P.L.Sanjeeva Reddy, Dr. M.Sriram, Dr. G.Lakshminarayana, Shri T.S.R.Anjaneyulu and Shri M.M.Hasan as Members with Administrative Officer (SG) and Senior Finance and Accounts Officer (SG) as *ex officio* Members and Chairman Coordination Council (Chemical Sciences), Dr. L.K.Doraiswamy and DGSIR as permanent Invitees.

The RAC comprised: Prof. M.M.Sharma, UDCT, Bombay (Chairman); Dr. M.Sriram, HOC, Rasayani; Dr. P.L.Sanjeeva Reddy, APIDC, Hyderabad; Shri V.S.Sanghani, GSFC, Vadodara; Dr. A.Gopalakrishnan, BHEL Corporate R&D, Hyderabad; Dr. N.V.Bringi, HL Research Centre, Bombay; Prof. S.V.Kessar, Punjab University, Chandigarh; Shri D.Basu, CMP&DIL, Ranchi; Dr. P.V.Krishna, Ministry of C&F, New Delhi; Prof. D.N.Saraf, IIT, Kanpur; Dr. T.S.R.Prasada Rao, IPCL R&D Centre, Vadodara; Dr. A.V. Srinivasan, ASCI, Hyderabad; Prof.(Mrs) Maharani Chakravorty, BHU, Varanasi (Members); DGSIR; Chairman, Coordination Council (Chemical Sciences) and Director, RRLH (*ex officio* Members); and Dr. G.Lakshminarayana (Secretary).

## CURRENT ACTIVITY AND FUTURE RESEARCH PROGRAMME

The areas of Organic Chemistry received further impetus with the reorganization and additional inputs. In the field of drugs and drug intermediates, the Laboratory already had some achievements to its credit. The current interest was to discover suitable compounds which had either analgesic/anti-inflammatory activity, or wound-healing ability or were calcium antagonists. Work had also been initiated to develop improved technology for vitamin A synthesis. With the Government decision to eradicate night blindness among children, the work assumed added importance. The conventional process, based on citral as the starting material, was being used by three companies to produce vitamin A. With limited availability of lemon grass oil and its competitive use in perfumery chemicals production, the envisaged programme to develop a completely synthetic route, would be attractive as indicated by a number of Indian firms who are willing to sponsor the project.

The area of agrochemicals, chiefly pesticides and formulations technology development and their evaluation had made significant contributions to the establishment of many manufacturing plants producing monocrotophos, diazinon, chlorpyrifos, butachlor, DDVP, quinalphos, MBC and so on. With such success and keeping the future needs in view, it was decided to strengthen the group and expand the scope of work in the area to cover pyrethroids like flucythrinate, fungicides like metalaxyl and thiophenates and weedicides like chlorosulfuron and thiobencarb. With a view to propagate the concept of integrated pest management at the most suitable, environmentally friendly, economic and long-term control strategy, work on pheromones was initiated. The development of plant growth promoters was also taken up. Two new organo-phosphorus compounds possessing a high degree insecticidal activity were undergoing extensive field evaluation and a number of new heterocyclic compounds were being tested by FMC Corporation of USA. Work on biologically active crop protection extracts from neem kernels and their formulations made steady progress which were being tested for insect control on cereals and other commercially important crops. Technology development for the products manufacture in a rural set-up was taken up.

As a component of Oilseeds Mission, efforts were directed towards the extraction of edible rice bran oil using a fluidized-bed technique and on heat stabilization of rice bran, towards direct solvent extraction of oil from whole kernels of edible oilseeds, and on developing a process for aqueous extraction of oil and protein from oil-bearing materials.

Efforts to develop a catalyst for ammonia synthesis which could perform at a lower pressure, were continued. Other catalysts which were being studied, related to oxychlorination, C-alkylation of phenol and ammoxidation. Significant contributions were made in heterogeneous catalyst preparation by synthesizing anchored catalysts in the interlayers of naturally occurring montmorillonite. The new catalysts had shown amazing catalytic activity consistent over long periods of time and having space selectivity making them superior to polymer anchored complexes.

The Laboratory's efforts in the design, synthesis and process development of oil-field chemicals in association with IIP, Dehradun, RRLJ and CLRI were reinforced. The CSIR undertook to carry out a study for the Oil and Natural Gas Commission (ONGC), on optimization of transportation of waxy crudes through submarine pipelines under an agreement signed on January 10, 1986. The high wax content of the crude caused flow problems in a 203-km long pipeline from offshore structure to the shore terminal. The large technology gap was envisaged to be covered by the consultancy by generating the requisite data. To augment the rheological evaluation facilities and pipeline simulation studies, TNO of The Netherlands and Snamprogetti of Italy were associated for some specific aspects of the comprehensive consultancy programme.

The group on organic coatings and polymers, concerned with the development of new anti-corrosive chemicals and coatings for offshore oil installations and petroleum and petrochemical industries, had made progress. It had also developed improved techniques for surface preparation of substrates, coatings application and curing. New types of polymers for adhesive manufacture for structural uses were also being developed. Studies on photopolymerization had also been initiated.

Work on a-tonne-an-hour coal gasification under pressure using a moving bed system was further intensified to study coals from Godavari and Wardha valleys, Neyveli lignite and some coals from Raniganj and Singareni. Plans for setting up a combined cycle power plant using coal gas were considered.

Since production of liquid fuels from high-ash coal by direct hydrogenation was known to be uneconomical, R&D work on the development of an alternative process was undertaken. The initial emphasis on production of low-boiling olefins was shifted to the generation of middle distillates. Direct liquefaction of coal by extraction with a supercritical gas (SCG) was investigated. The residual char was used for hydrogen production by gasification. With toluene as SCG, coal conversion up to 20-22 per cent and an extract with high oil fraction content were obtained.

The integrated approach of process development wherein a multidisciplinary team worked on a project, from the laboratory stage through upscaling, generation of design data and detailed design packet to transfer of technology, was continued to be adopted. Basic and detailed designs for agrochemicals like butachlor, monocrotophos and chlorpyrifos were at different stages of completion for several clients. Detailed engineering services were provided to clients for the manufacture of DDVP and glyoxal, and for lime calcination plant.

Accurate values of the physical, thermo-physical, thermo-chemical, thermo-dynamic and transport proper-ties of chemical substances and other related materials were essential for rational and reliable designing of chemical plants and equipment. Recognizing this need, RRL established a centralized system for properties data collection, collation, computerized calculations along with experimental facilities for determination of properties where literature data were not available. This facility, primarily aimed at catering for the needs of the chemical and design engineers of the Laboratory, could be extended to others as well. The data bank has all relevant information on properties of well over 2,000 chemicals/substances. The available and generated information is being stored and retrieved using the UNIVAC V77-80 computer system available at the Laboratory.

The processes for the manufacture of monocrotophos, diazinon, DDVP, MBC and quinalphos developed by the laboratory had already been commercialized while those of butachlor and chlorpyriphos were under implementation, altogether accounting for 6500 tpa capacity. The transfer of technology was effected through demonstration on pilot plant, basic design report, detailed design report and assistance in commissioning of the plant.

The Laboratory was also engaged in developing technologies for the production of some insect sex pheromones and intermediates needed in synthetic pesticides manufacture. The technology for pesticides formulation had also been developed.

A novel process to obtain a potent insect anti-feedant and insect growth regulator from neem kernals was also developed. Named 'Vepacide', the active fraction has anti-feedant activity in contrast to the toxicity in the customary pesticides.

During 1985-88, twentytwo parties availed of RRLH process know-how paying premium and royalty of Rs. 4.5 million. Additional Rs. 20 million were earned from sponsored research and consultancy assignments. The number of papers published was 242 and 15 patents were filed. Among the processes released were monocrotophos (3 parties), butachlor (4 parties), chlorpyriphos, DDVP, phosphomidon, glyoxal, sodium azide, flurbiprofen, norfloxacin, speciality papers (2 parties), thermoscopic bars and rings (2 parties), benzyl alcohol, urethane varnishes and paints, CNSL and cardanol resins, DCO (2 parties) and adhesive formulations. Among the consultancy and sponsored research assignments were generation of data and design of commercial plants for many of the released processes and for development of process know-how for vitamin A, oripyridamole, pyrantel palmoate, norfloxacin, minoxidil, AZT, sulbactam, timolol maleate, flurbiprofen, pheromones, cyanuric chloride, oxychlorination catalyst, mefloquine and for platinum alloy catalyst dispersed on active carbon. An interesting assignment was hazard study and risk analysis of ONGC gas processing complex at Hazira. Fluidized-bed gasification of coal and gasification of rice husk were two energy related projects. A highly chemistry-intensive process was evolved for the synthesis of etoposide, an anti-cancer drug. The innovative process used *Podophyllum emodi*, a naturally occurring plant in the Himalayan areas.

The Laboratory organized two symposia under the co-operation programme between India and the USSR. The first, on 'Recent Advances in Catalysis and Catalytic Reaction Engineering', was held during 25-28 November 1986 and the second, on 'Chemistry of Natural Products' on December 8-12, 1986. Earlier, the Laboratory had organized a school on 'Toxicology of Pesticides' during 20-31 October, 1986 which was attended by participants from industry and

R&D institutions and a seminar on 'Role of R&D Newer Concepts in Cost Effective Production of Bulk Drugs' in collaboration with the Indian Drug Manufacturers Association. A seminar on 'Quality Assurance in Chemical and Allied Industries' was also held on November 22, 1986.

While welcoming the participants of workshop on 'Pesticides Development' for South Asian Association for Regional Cooperation (SAARC) countries during 21-26 September, 1987 held at RRLH, Dr. Rama Rao offered to provide technical assistance to the member countries in the establishment of pesticide industry and related matters.

Director and scientists of the Laboratory were recipients of several research and development awards which included FICCI Award (1986), The Indian Merchant Diamond Jubilee Endowment Award (1986), Ranbaxy Research Award (1987), CSIR Young Scientist Award (1987 & 1988), NRDC Invention Award (1987), S.H.Zaheer Memorial Award (1986 and 1987), Mascot National Award (1986), Dayabhai Vadalia Memorial Award (1987), R.B.G.V. Swaike Memorial Award (1987), IPA Award (1986), IDMA Research Award (1985-86), J.G.Kane Memorial Award (1988), C. Achuta Rao Memorial Award (1988) and GUFIC Award (1988).

Two former scientists of the RRLH, Dr. P.M.Bhargava, Director, CCMB and Professor A.Rahman, Director, NISTADS, New Delhi were honoured with Padma Bhushan and Padma Shri awards respectively.

The Laboratory identified new areas of thrust and expanded its activities in the development programmes to generate more funds. In the meanwhile, the CSIR announced its plan for the modernization of administration.

#### **MANAGEMENT COUNCIL AND RESEARCH COUNCIL**

The ECs and RACs of the national laboratories were replaced by the Management Council (MC) and Research Council (RC) in each laboratory.

The MC of RRLH comprised: Dr. A.V.Rama Rao (Chairman); Dr. U.T.Bhalerao; Mrs. J.Swaminathan; Shri Y.Bhaskar Rao, Dr. M.K.Gurjar (all RRLH Scientists), Dr. A.Mashelkar, NCL, Pune; Dr. B.N.Dhawan, CDRI, Lucknow; Shri H.R.Mehta, SF&AO (Members) and Shri S.V.Samuel, COA (Member-Secretary).

The RC consisted of: Dr. S.Varadarajan (Chairman), Prof. Govardhan Mehta, University of Hyderabad, Prof. S.V.Kessar, Punjab University, Chandigarh; Prof. R.Kumar, IISc. Bangalore; Prof. D.V.S.Jain, Punjab University, Chandigarh; Dr. R.B.Mitra, CLRI, Madras; Mr. M.K.Mulky, Hindustan Lever Research Centre, Bombay, Dr. K.Venkatramana, IDPL, New Delhi; Shri M.S.Murthy, Department of Chemicals & Fertilizers, New Delhi; Dr. A.V.Rama Rao; Dr. M.M.Dhar, CDRI, Lucknow; Shri N.Sen, CSIR, New Delhi (Members) and Mrs. J.Swaminathan (Secretary).

The DGSIR was a permanent Invitee to both the Councils.

#### **BIO-ORGANIC LABORATORY**

Organic Chemistry Division's Group III under Dr. Rama Rao, which had been engaged in the synthesis of biologically active compounds, had developed into a centre of excellence in

organic synthesis. The group had also undertaken sponsored assignments for the development of technology for drugs. Work was also initiated on some emerging areas of research like peptide synthesis, enzymatic chemical conversions and nucleotides which were vital for nation's health programme and which would also lead to an interaction with biologists. Initially, the research would be directed towards synthesis of cyclosporin A, a cyclic peptide which was widely used as an immuno-suppressant during organ transplantation. Some peptides showing significant anticancer and other physiological activity were planned to be synthesized and their biological properties evaluated. Stereospecific synthesis of chiral molecules using enzymes or chemical transformations by enzymic reactions would also be undertaken.

The Bio-Organic Laboratory was formally inaugurated by Dr. S.Varadarajan on November 7, 1987 - RRL's Foundation Day.

### **CCMB COMPLEX DEDICATED TO NATION**

It was an event of much joy to the scientific community when Prime Minister Rajiv Gandhi dedicated to the nation and to the cause of science, the complex of CCMB on November 26, 1987. "Jonaki", a laboratory to produce labelled biomolecules, set up jointly by CSIR and DAE, was also declared open by him. The function was attended by a galaxy of Indian and foreign scientists. Speaking on the occasion, the PM said that there should be tangible link between science and social welfare. The results of investment in science and technology must relate to the national struggle for removing poverty, malnutrition and unemployment. Modern biology, he added, was on the threshold of doing good for the mankind but genetic engineering without caution could lead to dangerous consequences. He therefore suggested an interaction with social sciences to avoid such dangers.

The CCMB was initially set up as a semi-autonomous unit at the RRLH in 1977 and became a full-fledged national laboratory in 1981.

The research activities of the CCMB cover cell division and malignant transformation, developmental biology, structure and conformation of proteins and nucleic acids and their interaction, membrane barriers, ribonucleases, protein degradation, micelles and membrane-active proteins, reproduction, osmoregulation and transcription, integrated biological systems and some new techniques like DNA 'finger-printing', and ELISA (enzyme-linked immunolysis assay).

CCMB's Founder Director, Dr. P.M.Bhargava has since retired; Professor D.Balasubramanian, a well-known scientist and a science writer, is its present Director.

### **CSIR ASKED TO DEVELOP SCIENTIFIC ADMINISTRATION**

Presiding over a conference of the Directors of the national laboratories on May 28, 1986, Prime Minister Rajiv Gandhi said that he saw CSIR as a very basic tool in the country's development programme. The restructuring and reorientation of the society was possible only if substantial achievements were made in the areas of frontline technology. The pace of development all over the world was faster than even before and India could not catch up unless we thought ahead of others and even looked beyond. Taking up thousands of projects only diluted the efforts. One had to redeploy to concentrate on priorities and, most of all, one

needed an accurate monitoring system to indicate the progress and the direction of a project for a review and decision making. This called for a scientific administration which was different in tone and content from the general bureaucratic system. Science administration was a specialized task and people in this area must be developed. When we put good scientists in charge of administration, we lost the scientists and did not gain administrators.

The Prime Minister referred to the three societal missions, potable water, oilseeds and wasteland development and the related issue of environment and urged the need for zeal and vigour and personal involvement of all — from the top scientist to the junior-most worker in the laboratories — for early and satisfactory solutions to the problems.

### **MODERNIZATION OF CSIR ADMINISTRATION**

'CSIR - Administration of Science' was the theme of an exhibition organized at CSIR Vigyan Kendra in New Delhi on 7-8 February, 1988 which depicted a programme for modernization of administration primarily to meet new challenges of resource crunch and rapid advances in technology elsewhere. The goal was to generate at least 33 per cent of its budget as cash through sale of technology and services, going to about 40 per cent at the turn of the century. The main points of the modernization programme were:

- A revised organization structure with Technical Advisory Boards at the CSIR level and Research and Management Councils at the laboratory level
- Clear guidelines for monitoring the performance of the laboratories with identified milestones, crystallized thrust areas and time targets
- Greater authority and autonomy to the laboratories
- Scientists to have better career avenues
- Rationalization of purchase procedures to minimize delays in procurement (which hampered research work) with more authority delegated to the bench-level scientists
- Computerization of financial management
- The CSIR-HQ to confine itself to laying down of policy framework for recruitment, promotion, and budget allocation.

The programme was designed in response to the recommendations made by the Fourth CSIR Review Committee (Abid Hussain Committee).

### **S&T MISSIONS**

Inaugurating the Indian Science Congress session at Madurai on January 7, 1989, Prime Minister Rajiv Gandhi stressed the need for using science and technology for the good of mankind and not for promoting private profit or vain glory of narrow nationalism. He expressed his concern about growing world expenditure on military research and deteriorating environment. He pleaded that the world should put an end to the use of science for destructive purposes. The environmental conservation should be regarded as an integral element of the cost of development. He felt that the growth of science and technology in India had not made adequate impact on the national development. He urged the strengthening of links between S&T on one hand and the economic and productive sectors on the other.

CSIR's Director-General and General President of the Congress, Dr. A.P.Mitra gave an overview of India's science and technology missions over the years which had been successfully undertaken. The current five missions in which the CSIR was participating were: Drinking water; Oilseeds; Adult literacy; Immunization, and Telecommunications.

### **CSIR REVIEW COMMITTEE SUGGESTS NEW NAME FOR RRLH**

The Prime Minister, in his capacity as the President of the CSIR, appointed in April 1986 a Committee to review the functions and structure of CSIR. The committee comprised Shri Abid Hussain, Member, Planning Commission as Chairman and Dr. K.K.G.Menon, Hindustan Lever Ltd., Bombay, Dr. T.K.Roy, Chemical & Metallurgical Design Co.Ltd., New Delhi, Dr. R.P.Shenoy, Electronic Research and Development Establishment, Bangalore, Professor M.M.Sharma, UDCT, Bombay, Shri T.V.Mansukhani, Hindustan Machine Tools Ltd., Bangalore, and Professor Deepak Nayyar, Centre for Economic Studies and Planning, JNU, New Delhi, as Members.

The terms of reference to the Review Committee were:

To identify the broad thrust of activities of CSIR laboratories so as to optimally utilize their capabilities.

To suggest how capabilities in different laboratories can be brought together by appropriate networking to meet identified objectives and specific missions.

What should be the system for an organic institutional link between CSIR and its prospective users, particularly major Government departments/public sector undertakings so that research is oriented towards the needs of users?

The role and corresponding structure of the CSIR HQ in coordinating work between different laboratories, linkages with users, and to ensure that the whole system works towards the identified objectives.

A broad review of personnel policies to ensure optimum development of the human resources in CSIR, which could include arrangements for mobility of scientists, their training, etc.

How to build in a principle of accountability in CSIR where scientific work is judged by peer group appraisal and technological work by ability to meet needs of users?

Review the existing arrangements for transfer of technology and suggest how they can be strengthened, including a review of the NRDC mechanism.

The Committee submitted its Report on December 31, 1986 which suggested a set of measures to 'integrate the CSIR system with the mainstream of our economic and industrial activity.' It also recognized that the need for a radical change in the CSIR, and the environment in which it functioned, was stronger now since 'we are setting our sights higher' in the belief that a deliberate transformation could be engineered in the society through a conscious use of science and technology. The real issue, the Committee felt, was to manage science and technology so that full potential was harnessed for national good.



The Committee visited the national laboratories to have firsthand knowledge of their working and had discussions with a wide spectrum of scientists working there. It also sought advice and suggestions from some eminent scientists, technologists and economists.

The Report covered performance of CSIR, programmes, projects and funds, interaction with users and universities, management, personnel policy, restructuring of laboratories, dealt with the size of the laboratories, modernization of equipment, and redesignation of Regional Research Laboratories.

The Committee noted the high average age of the scientists working in the CSIR — the so-called 'greying of CSIR' as Dr. A.P.Mitra termed it. Among its recommendations were:

- a) CSIR should earn 1/3 of its budget from outside within a specified time frame: the philosophy was that such an earning would be a measure of its acceptance and credibility and also of a change in work culture;
- b) there should be decoupling of the Headquarters from normal operation of the laboratories and an autonomy in the laboratories down the line to group level scientists;
- c) introduction of a system by which the career development of scientists was looked after and also distinguished between good scientists and indifferent scientists;
- d) introduction of a fixed term for Directors after which they return to science.

The Committee while making specific recommendation for the renaming of the RRLs took into account the discussions it had with the scientists, Directors and others of these laboratories and said that it would be more meaningful if RRLs were "recognized to reflect the direction and orientation of the expertise and excellence developed by them." Dr. Rama Rao said the following in this regard: "One of my main concerns since I took over as Director was to focus our activities towards the major areas of this Laboratory, i.e., chemistry and chemical technology. As there was nothing regional about science I felt the need to change the name of our institute, particularly because the Laboratory has grown into one of the major institutes under the CSIR. I suggested to the Abid Hussain Committee that we rename it as the National Institute of Chemical Technology as we could not have another National Chemical Laboratory within CSIR. This was one way to focus our efforts on activities more relevant to chemical technology. Accordingly the Institute was rechristened as the Indian Institute of Chemical Technology (IICT) effective from 1st April 1989. This has given a clear identity and direction to the Institute and enabled me to place emphasis on basic research in chemical sciences leading to innovative processes for a variety of projects important to human welfare such as food, health and energy."

**Indian Institute of  
Chemical Technology**

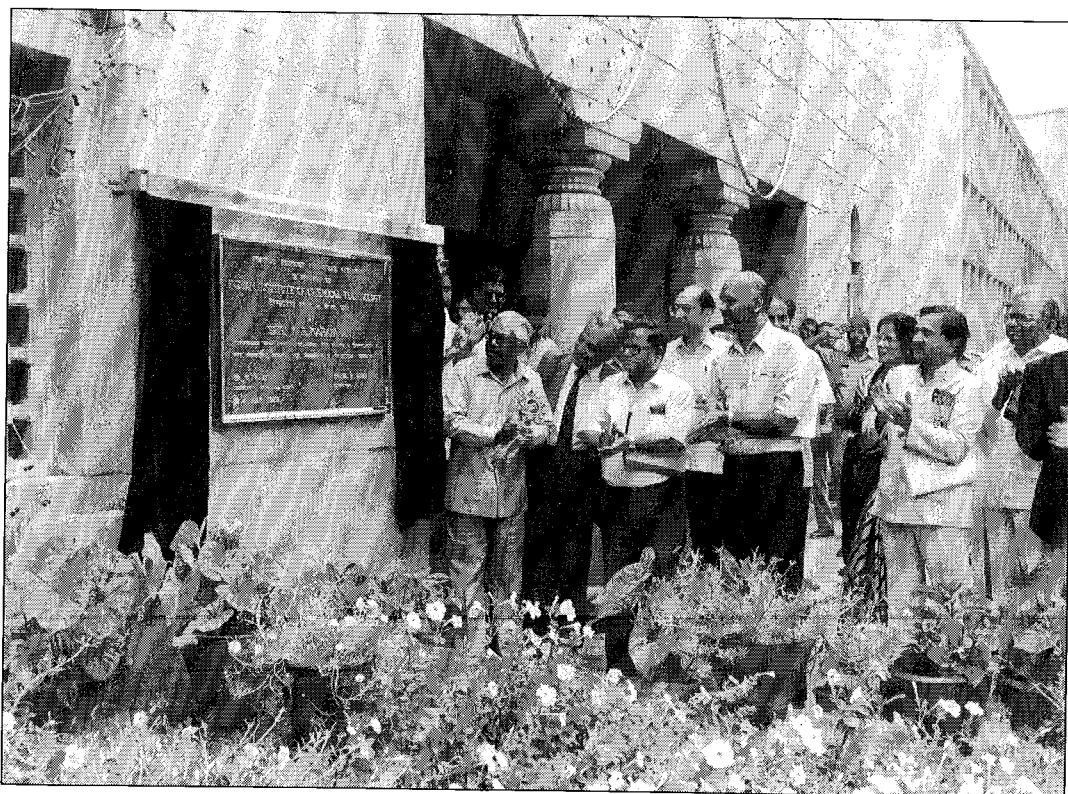




# INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY

Following a suggestion by the CSIR Review Committee, the Regional Research Laboratory *nee* Central Laboratories for Scientific and Industrial Research, Hyderabad was renamed as the Indian Institute of Chemical Technology (IICT) effective from April 1, 1989, in recognition of expertise and excellence developed at the Laboratory in the area of chemistry and chemical technology. Though all names sound as sweet, IICT is more appropriate since it goes with the nature and character of the activities at the Laboratory. Interestingly, an overview entitled "Basic and Applied Research in Chemical Sciences - CSIR Contribution" published by the CSIR in 1989 did not include the RRLH among the institutions reviewed.

The formal rechristening of the Laboratory took place on July 12, 1989, at a function attended by eminent persons representing science and industry.



Vice-President, Shri K.R. Narayanan formally rechristened the Laboratory as Indian Institute of Chemical Technology

Speaking at the function as the chief guest, Shri K.R.Narayanan, Union Minister of State for Science and Technology, said that a close alliance between science and social scientists was necessary if science were to be recognized and applied to socially useful tasks. Shri Narayanan called for closer relationship between the research laboratories and industry for a better utilization of indigenous know-how. He complimented that the renaming of RRLH as IICT was in recognition of a good role played by it in contributing to the history of scientific research.

Dr. A.P.Mitra, Director-General, Council of Scientific and Industrial Research (CSIR), presiding over the renaming ceremony, called for an increased investment in research and development. He said that in view of India's emergence as a major force in science and technology, the CSIR was planning to lay thrust on the sale of technology, not only within the country, but also abroad. He said that there had been a 'distinct jump' in the quality of science and technology in the country, but if India had to be successful in selling technology abroad, then the products should be world-class. He said technology could be sold in the areas of petrochemicals, drugs, pesticides and micro-electronics, and the need of the hour was to increase the manpower manifold, especially on research and development side.

The INSA President and Director, UDCT, Bombay, Professor M.M.Sharma who was a member of the CSIR Review Committee which recommended the change in the Laboratory's name, wondered why it took so many years for the nomenclature to change. He did not find anything regional about the activities of the Laboratory. Dr. S.Varadarajan, Chairman, Research Council of the IICT, referred to the pioneering work of the Laboratory in areas like oils and fats, coal, and adhesives which was begun long before the need for such technologies arose and when the need came, the Laboratory was ready to fulfil the obligation. Hyderabad was the key headquarters of medium fine chemical industries. The change in the name was recognition of realities and was not an imposed one, he added. Dr. G.S.Sidhu said that the "miniature CSIR" established by the Nizam's Government always received support from the academic institutions which helped her grow to the present level of intellectual calibre and research activity. The President of the Pesticides Formulators Association of India, Mr. Pradeep P. Dave recalled the long relationship of the pesticides industry with IICT and said that prior to 1975 almost all technical grade pesticides were imported. It was largely due to the development work of IICT and such institutions that the import had been reduced to mere five per cent. Speaking in the same vein, CIPLA's Mr. M.K.Hamied added that IICT had played a significant role in the development of drug technology and hoped that this enduring example of productive association between research and industry would continue.

Earlier, welcoming the gathering, Dr. A.V.Rama Rao, Director, IICT, Hyderabad, highlighted the achievements of the Institute. He said that IICT would lay emphasis on agrochemicals, basic drugs and polymers technologies. A programme for increasing crop yield, crop protection, by developing plant growth promoters and conventional pesticides was also being planned. During the last five years IICT had transferred technologies to various Indian entrepreneurs for a variety of pesticides. He concluded by saying "It is the most fitting tribute to the late Pandit Jawaharlal Nehru, the first Prime Minister of India and the President of the CSIR who inaugurated the present building of RRL in 1954, and a matter of pride to have the new name of the Laboratory in the year when we are celebrating his birth centenary. To mark this special occasion, we are instituting a special lecture named after the late Pandit Jawaharlal Nehru, which will be delivered by an eminent scientist or a technologist."

Thus the IICT became the inheritor of the legacies of CLSIR-RRLH — its traditions, its ethos and its legends. Being a growing and vibrant organization, it had been changing, moving forward and progressing or else it would have stagnated. Some changes were caused by external forces like government directives and policies, pressures from industry or international events. The foreshadow of the new economic policy of the Government was quickly perceived by industry which in turn demanded a working relationship of the national laboratories like IICT with their “production programmes both in the content of absorption and adaptation of imported technologies as well as introduction of indigenous technologies.” Having been accepted by industry since long, the IICT felt this pressure much more. This in turn led to changes within the Institute. Group discussions of work which was the hallmark of the Institute earlier were replaced by secretive work to protect the sponsor. To stimulate intellectual interaction, a programme of seminars, symposia, workshops and similar activity was encouraged. Being a firm believer in good science producing good technology, Dr. Rama Rao took steps to strengthen fundamental research by way of providing laboratory space, equipment and appropriate manpower. This he felt was necessary to take lead over others in developing new technologies by using innovative approaches in industrial research. It was with this objective that several bright youngsters were inducted and some sophisticated instruments and equipments were procured.

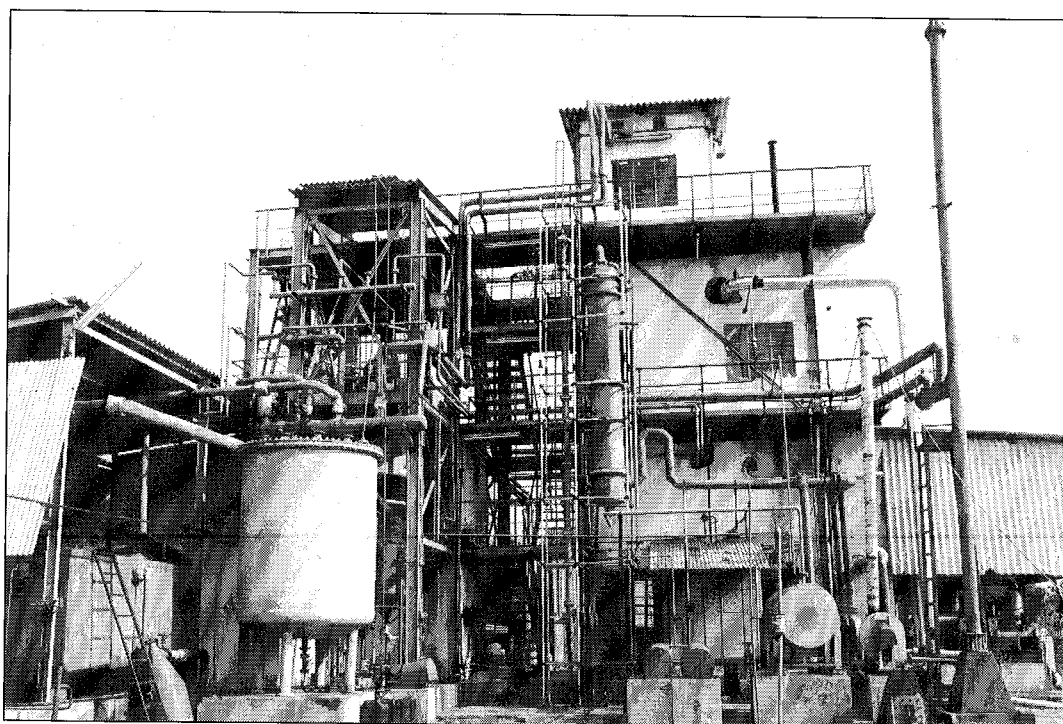
### **IICT FORGES AHEAD**

The IICT's R&D output, using the conventional indicators, has been phenomenal during the last decade. The sponsored work, a measure of industry's confidence in the Institute's capacity and capability to deliver the goods was marked by an increase both in terms of contracted value and cash flow. The contracted value of the assignments rose from Rs. 6 million in 1985-86 to Rs. 45 million in 1989-90 and Rs. 65 million in 1994-95. Likewise, the cash flow/earnings were mere Rs. 2.4 million which leapt to Rs.20 million in 1989-90 and further to Rs. 43.3 million in 1994-95. Each year increasing number of completed processes were demonstrated and released to industry. Depending upon the demand, a few processes were commercialized by several parties. The number of research papers published by the IICT scientists also rose significantly from 56 in 1985 to a peak of 201 in 1990, falling gradually to 155 in 1994. A total of 1343 papers were published during the last ten years. The number of patents filed had been fluctuating. It averaged five during 1985-88 but rose to 15 in 1994, totalling 89 in ten years. During the same period, 139 researchers submitted their theses for the award of Ph.D. degree.

The remarkable progress made at the IICT found recognition in the form of many awards given to its Director and the Scientists. Dr. Rama Rao was awarded Padmashri (1990). The IICT scientists won the CSIR Technology Award in four successive years since its institution in 1990, the S.S.Bhatnagar Award (1990 and 1991), the CSIR Young Scientist Award (1987 to 1994 except 1993), Dr. S.Husain Zaheer Young Scientist Award (1990), Dr. S.Husain Zaheer Memorial Award (four successive years from 1989); FICCI Award (1991-92), Om Prakash Bhasin Award (1994), G.S.Nevatia Memorial Award (1989, 1990 and 1991). R.B.G.V. Swaika Memorial Award (1990 and 1991), Ranbaxy Research Award (1991), B.M.Birla National Science Award for Young Scientist (1990), Vishwakarma Medal (1991) and the CSIR Prize for Business Development and Technology Marketing Achievement (1994). Dr. J.S.Yadav was elected Fellow of the National Academy of Sciences (1993) and Dr. A.A.Khan as Fellow of the National Academy of Engineering.

## R&D STRATEGY AND ACTIVITIES

Several thrust areas such as drugs, agrochemicals, oils and fats, coal, organic coatings and polymers, process development and design, mechanical engineering design and development, simulation, optimization and control were identified. The divisional heads and project leaders were given a free hand and some new area leaders were also identified so that the objectives were not only kept in sharp focus but also they were quickly realized. Some younger scientists were encouraged 'to build scientific capabilities in specialized and frontier areas' like homogeneous catalysis, photochemistry, enzymatic reactions, carbohydrate chemistry, zeolites in organic chemistry and bio-organic chemistry. Additional inputs were provided to promote and strengthen crystallography, computer modelling, hazard and risk analysis and computer-aided design of chemical plants since they play important role in R&D. Another aspect of the R&D strategy was the induction of younger researchers, especially the research fellows, which not only provided the needed accent to basic research but also helped in the development of process know-how on a laboratory scale. Commenting on this strategy Dr. Rama Rao said: "My personal group consisting mostly of research fellows working at NCL were brought to RRL-H in 1986 and this group became a nucleus in the growth of the laboratory. We have initiated in major way programmes concerning synthesis of antitumour antibiotics, macrolides, immunosuppressants, carbohydrates, hydroxy fatty acids and synthetic vaccines. In addition, we built a strong photochemistry group to carry out various photochemical transformations, heterocyclic chemistry and a new group of enzymatic reactions. Consequently, the number of research fellows joining the three organic



Cyanuric Chloride Pilot Plant (capacity 10 kg/hr)

chemistry divisions went up year after year. In 1986 we had only 10 research fellows, and the number went up to 102 (CSIR qualified research fellows) by 1992. Of these, 80% are organic chemists from various parts of our country. This is an indication of our strength in this area. This has resulted not only in an intensification of our Ph.D. programme but also in producing some of the best papers published in various national and international journals. Today, IICT enjoys an international reputation as one of the strong schools of organic chemistry."

Referring to the deployment of the research fellows in the development of technologies for basic drugs and drug intermediates, he continued: "This is a new area which I initiated and kept under my own supervision. Most of the work was carried out by research fellows who joined my group for their Ph.D. programmes. This is being done by way of asking them to accomplish the process optimization of basic drugs on bench scale. All these projects have been sponsored by the Indian pharmaceutical industry."

Some major researches undertaken at the IICT in the recent years are described in the following pages. An important factor contributing to the success story is the traditional approach of the Institute to associate industry with the project right from its conceptual stage to the preparation of the project report including the design and engineering inputs and commercial production. The response from industry was also overwhelming.

Several drugs which are not manufactured in the country are imported. Their exorbitant price keeps them beyond the reach of a common patient. A few of such drugs also have too small a demand to attract their development by the private sector. In view of the societal need, the IICT launched a process development programme to cover the gap. One such drug is an anticancer agent, called etoposide, which is semi-synthetic drug, produced from an Indian plant, *Podophyllum emodi*. Its manufacture involves the isolation of podophyllotoxin from the plant resin and the conversion of the isolate into etoposide through highly chemistry-oriented steps requiring stereo selective control. The completed process was released to industry and the drug is now in commercial production. The IICT has also developed the process know-how for another anticancer drug, mitoxantrone, which has been released for commercial exploitation. There are several anti-cancer agents, notably Fredericamycin A and Taxol, both obtained from natural plant materials, which are under investigation.

The IICT undertook and successfully completed the development of process know-how for the production of two B-blockers, metoprolol and nadolol, by using innovative approach which made the two processes not only technologically superior but also more economical than the existing ones. Another sponsored research programme on cardiovascular drugs, which was successfully executed, related to the development of know-how for the manufacture of gemfibrozil used for the management of arteriosclerosis by lowering the blood cholesterol levels. The developed process did not employ the hazardous butyl lithium and was cheaper.

The Institute also initiated the synthesis of the drugs starting from the naturally available chiral intermediates. Timolol, which is widely used for the treatment of glaucoma, has one asymmetric centre in its structure framework and only one *viz.*, 'S-enantiomer, has the desired antiglaucoma activity. IICT scientists successfully developed and demonstrated a process for its manufacture starting with D-mannitol. The Institute is also developing a synthetic route to S-propranolol, a  $\beta$ -blocker.



Effective antimicrobial therapy is limited by a large reservoir of antibiotic-resistant microorganisms. Recently, more selective antibacterial agents have been introduced to cope up with the situation. Some quinolones have been shown to possess broad spectrum activity and oral efficiency. Two fluorinated molecules, norfloxacin and ciprofloxacin, which show marked antibacterial activity against both gram-positive and gram-negative bacteria, were taken up for development on a contract programme. The two drugs are now in production. The same client sponsored work on the development of process know-how for the manufacture of AZT, a drug recommended for the treatment of AIDS which is on the rise in India. AZT is one of the most expensive drugs since its production is monopolized by only one firm abroad.

An improved process for the production of Omeprazole - a substituted benzimidazole and an anti-ulcer drug, was developed under sponsorship. The drug is now in commercial production. Astemizole, recently introduced in clinical practice is a non-sedating antihistamine drug with a slow onset and long-duration action. The development of its process know-how was undertaken on a sponsorship basis. The multi-step process was worked out, starting from indigenous raw materials. The innovative approach dispensed with the customary use of sodium metal and employed milder conditions for the preparation of key piperidone.

Synthesis of vitamins A and E and some biologically active fatty acids, all using new and innovative approaches, are at various stages of completion. Studies in the emerging areas of organic chemistry included design and synthesis of supramolecular structures utilizing the concept of biomimetic modelling of chemical reactions, use of enzymes and artificial enzymes as biocatalysts in organic synthesis, synthesis of immunosuppressive agents and synthetic vaccines.

The scope of developing technologies for synthetic pesticides which had been on the research programme of the Institute for some years, was extended to include plant-based pesticides, synthetic pyrethroids, pheromones and plant growth regulators. The industry which has been utilizing these technologies, came forward to sponsor the know-how development of several pesticides like glyphosine, chlorsulphuron, thiophanate, pirimiphos methyl, flucythrinate, glyphosate, chlorothalonil, pendimethalin and thiadiazuron.

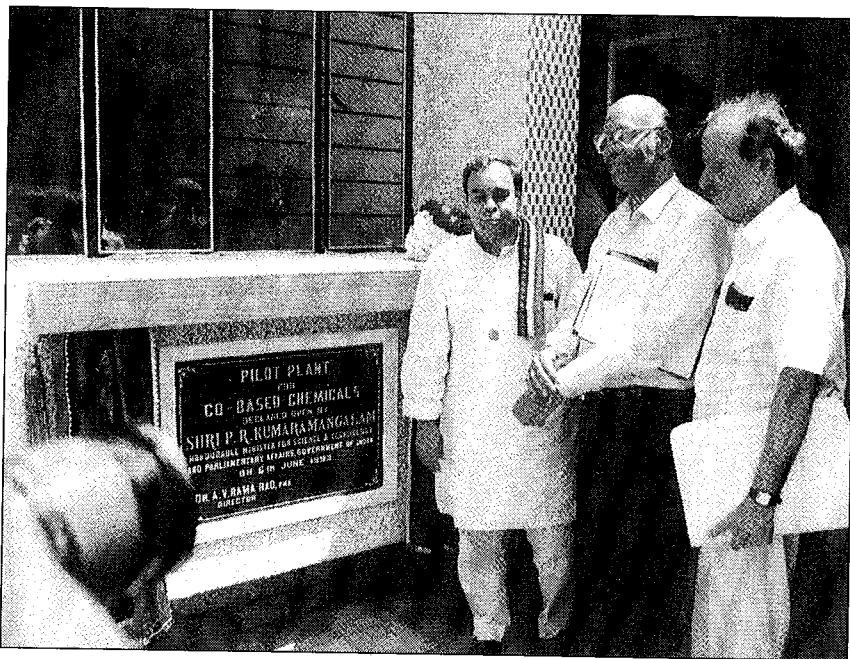
Pheromones are non-toxic chemical substances secreted by one insect and received by other insects of the same species and widely used as a communication system and sex attractants. This property has been used to trap insects and facilitate their destruction. Cotton crop is highly pesticide-intensive, requiring an average of ten applications. The use of sex pheromones to control the insects of this crop is well-established. The IICT, therefore, chose to develop processes for the manufacture of pheromones under sponsorship.

Reference has already been made to the isolation of active fraction, 'Vapacide', from neem kernals, which was further tested against more pests. Its toxic action was to prevent the pest from eating the crop. The insect would die out of starvation. Its technical formulation was also standardized. The process is under commercial production. The by-products of processing are edible oil and non-bitter meal of high protein content.

Custard apple seed oil, which was investigated by the laboratory in the early fifties had shown insecticidal properties. Efforts to isolate the active principle, however did not succeed. In a revived interest, 'the seed' is being given a fresh look. Another new area of work which has been taken up is the screening of marine products for biologically active ingredients.

Tricontanol, a plant growth regulator, occurs naturally in alpha-alpha and some other plants. The IICT has developed a synthetic route to produce tricontanol. The process has been suitably up-scaled.

The importance of rational use of coal received the much-needed emphasis during the energy crisis of the early seventies. The pilot-plant of the laboratory was erected and experimentation on gasification of the low-grade coals got under way to generate appropriate methodologies to this end. In this context,



Shri P.R. Kumaramangalam, Minister of State for Science & Technology & Parliamentary Affairs inaugurating the pilot plant for CO-based chemicals. Dr. A.V. Rama Rao and Dr. S.K. Joshi are also seen

power generation by integrated gasification combined cycle (IGCC) concept, generation of synthesis gas for fertilizers, production of methanol and acetylene, production of value-added chemicals from the by-products of coal carbonization, use of low-grade coal as a blending component for the production of coke in steel industry and coal washing on a very large scale were assessed to establish the economic feasibility of the right process. The catalyst for conversion of benzene to cyclohexane, developed earlier by the laboratory, is in commercial use. The sponsor periodically gets the catalyst batches evaluated at the IICT. Several catalysts are being developed on sponsorship basis. These include oxychlorination catalyst required in vinyl chloride monomer production, an ammoxidation catalyst needed in the production of pyrazinamide — an anti-TB drug, an active carbon catalyst for the production of phosgene, a zeolite catalyst for the production of pyridine and picoline and a fuel cell catalyst.

Significant contributions were made in the area of homogeneous catalysis. Innovative preparation of truly anchored inter-related catalysts were prepared for the first time using Pd complexes of phosphine, pyridine, bipyridine and amine moieties, covalently bound in the inter-layers of montmorillonite. The arrangement prevents the leaching of noble metal which usually occurs in the anchored catalysts using polymers or metal oxides as supports.

Cyanoacrylate adhesives developed by the IICT found ready acceptance both by the industry and the consumer. Several types of surgical adhesives were developed and tested in the hospitals all over the country for applications in ophthalmic, dental, oral and facial and general surgery.

A rotadisc heater was developed for the stabilization of rice bran and in-plant demonstrated to rice millers in different parts of the country. The process permits a shelf-life of 30 days during which enzymatic hydrolysis would not take place. Consequently, there would be no increase in free fatty acid content.

A process for the production of undecenoic acid and heptaldehyde by continuous pyrolysis of castor oil was released to industry for exploitation. As part of an inter-laboratory projects, polymer-based door panels, replacing wood, were successfully developed. In another inter-laboratory project suitable impervious media were developed for storage of natural water in arid areas.

Following the Bio-organic and Fine Chemicals Laboratories, the construction of Natural Products and Catalysis Laboratories was started. The Pilot Plant complex for CO-based chemicals was inaugurated by Shri P.R.Kumaramangalam, Minister for Science and Technology and Parliamentary Affairs on April 2, 1992.

An event which gave great joy and relief to the scientific community and others was when Dr. Rama Rao and Professor Balasubramanian had a miraculous escape when the plane carrying them crash-landed at the Indira Gandhi Airport at New Delhi on January 9, 1993.

### **GOLDEN JUBILEE OF THE CSIR**

The CSIR was created on September 26, 1941. It was the foresight of Sir A.Ramaswamy Mudaliar, the then Commerce Minister and the dynamism of Dr. S.S. Bhatnagar whom he appointed as the Director of Scientific and Industrial Research, which placed the Indian R&D on its path of progress. After Independence, the vision of Nehru and the support of Homi J. Bhabha, M.N. Saha, K.S. Krishnan, P.C. Mahalanobis and others, helped the CSIR to establish a network of national laboratories and other institutions which have since contributed significantly in India's efforts towards industrialization and self-reliance.

While the CSIR celebrated its fifty years of fruitful activity, there were major changes in India's economic policies which naturally had an impact on the national R&D strategies and programmes.

The year-long CSIR golden jubilee programme included conferences, lectures, publications, films and awards. The lead conference topics were; Management of Change; Science: Looking Ahead; Technology and Industry; Science and Society; Research - University-Industry Interface; Science Communication and International Science and Technology. There were

nine scientific conferences including one on 'Advances in Chiral Synthesis' which was held at the IICT during April 2-3, 1992 and four international or co-sponsored symposia or workshops relating to high-pressure science and technology, toxicology, ceramics and concrete structural failures. The CSIR Saga Vol.I was also released. The Ministry of Communications issued a special stamp on September 26, 1992 to commemorate the occasion.

## **TECHNOLOGY POLICY**

A decade after the Technology Policy Statement (TPS) was laid before the Parliament, the Government enunciated a new policy. The TPS-93 had following thrust areas:

- social concern for the spread of technology, especially among the disadvantaged,
- emphasis on infrastructural, environment and on human capital,
- critical technologies and technology upgradation,
- emphasis on engineering,
- incentives to stimulate contributions from industry,
- increasing self-reliance in the government laboratories,
- more reliance on private initiative, and greater concern for economic forces such as competition, markets, incentives and efficiency.

The policy document did not state as to how far the goals of the TPS-83 were achieved nor did it identify the shortcomings which led to the revised statement. The INSA felt that unless the TPS explicitly defined the implementation channels, the structures and modalities, it would remain a statement of wishes. It urged the Government to create a culture and climate which would encourage and enable increasing use of technology in agriculture, industry and service sectors.

## **FIFTY YEARS OF STRUGGLE AND PROGRESS**

The IICT has the distinction of being the first constituent laboratory of the CSIR to celebrate its Golden Jubilee. All these years it has also been a leader and pathfinder —it has treaded along the paths not visited by others before. It had its ups and downs too, as all pioneers do, and it had to struggle but eventually came 'tops'.

The year-long Golden Jubilee programme included ten symposia, seminars and a workshop, cultural events, sports competitions and a quiz programme. The topics of discussions were: Clean Coal Technology; Biotechnology of Oils and Fats; Eco-friendly Organic Coatings and Polymers; Advances in Chemical Engineering; Mathematical and Scientific Computing; Biological Diversity and its Impact on Environment; Computer-aided Engineering of Process Plants; Recent Advances in Asymmetric Synthesis; Catalysis in Energy and the Environment; New Horizons in Analytical Chemistry; and an international symposium on "Chemistry and Chemical Technology."

Started in 1944 as the Central Laboratories by the Nizam in the pre-Independence era, its main object was to carry out scientific and industrial research and thereby help the industrial development of the erstwhile princely State of Hyderabad-Deccan. Dr. Zaheer who took over

as its Director in 1948, revised it charter and gave it its industrial research orientation with emphasis on pilot plants which were necessary to prove the process in those days. With an uncanny eye to spot the talent, he collected a band of young people to help him in his endeavours. The laboratory soon grew in stature and expertise to become a member of the CSIR family in 1956 as the first RRL. During this period, it had to ward off many a greedy eye intent on its dismemberment. Despite these and other odds, the laboratory made steady progress and as Dr. Rama Rao put it, "succeeded in utilization of natural resources while simultaneously endeavouring to acquire expertise in chemical sciences and technology, towards fulfilling CSIR's goals of technological self-reliance." The reach of the technologies developed by the laboratory was far beyond the regional boundaries. The laboratory had also acquired strength in chemistry and chemical

technology and in design and engineering of projects. Recognizing these factors, the Abid Hussain Committee recommended a change in RRLH' nomenclature in 1986. The formal change, however, came in 1989 when IICT was born.

Reviewing the achievements of the IICT during the last five decades Dr. Rama Rao observed, "the R&D thrust of the laboratory all through its existence has been on applied research backed by strong base in fundamental sciences." The late forties saw institution interest accompanied by in-house pilot plant production for demonstration, techno-economic data collection and for proving of technology. This, the then non-conventional approach to win the confidence of industry, was considered helpful in the utilization of low-grade coals, processing of cottonseed and distillation of fatty acids. The approach was extended to providing in-house assistance to industry. Methaqualone, a non-barbiturate sedative and hypnotic, was discovered during this period. Operational research techniques as a tool for research management were also developed.



Prof C.N.R. Rao delivering the IICT Golden Jubilee Lecture

The early sixties witnessed changes at the CSIR-HQ after Dr. Zaheer took over as the new DG. Instead of functioning merely as an administrative office, specialists were appointed to provide technical advice on research planning, technology utilization, manpower development and project engineering. The laboratories were given more freedom to function. At RRLH, Dr. Sidhu was appointed Director. Many senior scientists also left to take over as Directors of other national laboratories — Datar at CSMCRI, Bhavnagar; Krishna at IIP, Dehra Dun and Chowdhury at CMERI, Durgapur. Chari and Baldev Singh moved to the CSIR-HQ to head Design Cell and Technology Utilization respectively. Two other former scientists of RRLH were also appointed, Rahman, as Head of Planning at the HQ and Iyengar, as Director, RRL, Jorhat. Seeing the sweep of the new appointments, a senior scientist jokingly remarked that it was known that RRLH had pilot plants but that there was one to produce Directors was not known. And indeed, the RRLH had long second-line of leadership.

The concepts of multidisciplinary approach were extended when the project-oriented programmes with time targets and project teams drawn from several disciplines were introduced. With restrictions on RRLH removed, it became possible to acquire simple analytical instruments denied earlier. The changes were, however, too good to last for long. A concerted effort was made to dismantle the technical secretariat at the HQ. The RRLH once again became a special target. Its EC and SSC were again packed with people who specialized outside the disciplines of the laboratory. Attempt was made to hold up the payment of the salaries of the staff and the DG himself encouraged some disgruntled elements to harass the management and help in a witch-hunt.

Despite these impediments, the RRLH continued on its path of progress. Since the processes developed by the laboratory lacked the back-up of design and engineering, a design group was set up and quickly expanded. Thus it became possible to provide extended basic designs for a large project like LTC of coal. Design and engineering is now offered as part of the process know-how when released for commercial exploitation.

Another area of thrust was the development of technologies for agrochemicals. Soon the laboratory became the nodal agency to coordinate the development of technologies for known pesticides and other agrochemicals but also to discover new molecules having bioactivity. According to Dr. Rama Rao, nearly 60 percent of the total production of agrochemicals was attributable to the IICT technologies. The commercial success was virtually assured by transfer of viable technology alongwith design and engineering and associated commissioning assistance.

The Biochemistry group, which had been a source of controversy, graduated to become a full-fledged laboratory, the CCMB.

Dr. Thyagarajan, who headed the programme on agrochemicals at the RRLH, moved to the RRL at Jorhat as its Director in 1974 but returned to the RRLH in 1982 when Dr. Sidhu took over as DG. A multi-laboratory consultancy programme to assist ONGC was initiated involving collaboration with foreign agencies. The laboratory also served as a nodal point in determining the sequence of events leading to Bhopal gas-leak tragedy. As a sequel, project on hazard study and risk analysis was formulated.

Dr. Thyagarajan was moved to CLRI, Madras as its Director. Dr. Rama Rao took over as

Director, RRLH. He gave a critical look to the ongoing programmes and commended a science-intensive innovative approach. Thus, the mid-eighties saw a new thrust given to the programme of developing cost-effective and commercially viable technologies for the production of drugs. The programme had the following characteristics : (i) it was almost wholly sponsored by industry, and (ii) it was made an integral part of human resource development effort when young researchers registered for Ph.D. degree were required to provide an innovative solution to a selected part of a drug synthesis. The drugs included antibacterials, anti-virals, anti-emetic, analgesics and anti-inflammatory agents or those for cardiovascular ailment or cancer treatment. Many of the processes have been completed and have been demonstrated/released to industry.

The IICT's capability in developing technologies for biologically active organic compounds requiring considerable scientific inputs has also been recognized abroad and several leading pharmaceutical companies have R&D collaborative arrangements. The WHO has also entrusted process development for a few drugs to the IICT.

The IICT was designated as a nodal agency 'to develop CFC alternatives and associated equipment.' Other participating laboratories are NCL, ITRC and IIP. India is a signatory to Montreal Protocol which calls for the phasing out the ozone-depleting substances. Using an in-house catalyst, the IICT has already developed a suitable substitute for CFC. The development of 'green technologies' and eco-friendly products, which have sponsorship of industry, include CO-based chemicals, synthetic pyrethroids, pheromones and neem-based pesticides.

Dr. Rama Rao said, "Looking back, the gradual and steady progress this laboratory has had in building up the type of expertise in fulfilling the demands on S&T from time to time, is indeed amazing." He expressed his confidence that the IICT was well-equipped to face any challenges posed to Indian R&D.

## THE FUTURE

The new economic policies of the Government announced in 1991 had been on the anvil for sometime. The outdated control structure was dismantled. The industrial licensing was abolished, the MRTP restrictions removed and strict boundaries between private and public sector were erased. The access to new technology and funding became easier and foreign investment in selected sectors was allowed up to 51 per cent and facilitated in other sectors. In short, it was a switch from regulated economy to market economy. The stated aims of the economic reforms are: to maximize production; to minimize costs; to improve quality and to create surpluses which would trickle down to increase income, eradicate poverty and improve quality of life.

The liberalization, as the new economic policy is called, has competition at its base. With liberalized imports and reduction in customs and excise duties, Indian products have to compete with imported ones in terms of price and quality. Technology, like other commodities, is governed by laws of demand and supply. Technology application, and not its mere development, is what enters the economic system. With greater role assigned to direct foreign investment (capital, technology, management and marketing expertise), the Indian R&D has to act with speed not only in technology development but the road leading to its entry in production should also be short. According to the Centre for Technology Studies, the

investment on R&D by companies has fallen from 1.1% of turnover in 1980 to 0.8% after economic liberalization. The companies spent more on advertisement and less on product improvement and sought technologies assistance, when required, from foreign collaborators. It is the familiar game of 'short time profits versus the long-term gains.' The in-house R&D units have done reasonably well in technology absorption but precious little towards innovative technology development.

With ratification of the Uruguay Round agreement, India has become a founder-member of the World Trade Organization (WTO). The country has shown strong inclination to adopt product patenting in conformity with the norms of the Paris Convention and accept the rationale of Trade-related Intellectual Property Rights (TRIPS). The vital areas of agricultural chemicals and pharmaceuticals, which are the forte of IICT's thrust areas, had hitherto remained outside the sphere of product patenting and will now be open to multinationals from abroad by 2005 when the new patent regime comes into full effect.

The concepts of import substitution and self-reliance, adopted in the fifties, were safe but negative in contrast to the Japanese drive for export promotion, a positive approach for economic growth during the same period. The Indian R&D institutions which were asked to develop technologies based on indigenous resources to reduce imports, have now to develop strategies which are compatible with the new demands of industry and the people in the WTO era. The Indian Science Congress Association at its recent session at Calcutta has demanded a new science and technology policy statement. The Prime Minister announced the creation of Technology Development Fund by introducing a cess on imported technology. The MNC's are also active. Some have announced plans to set up production in India taking advantage of lax environmental controls and cheap labour. They are also sponsoring research in Indian laboratories so that they could pay more attention to pursuits of long-term gain.

The IICT has, of late, done some rethinking. Hitherto, it was possible to develop alternative processes involving innovative approach for synthesizing molecules whose efficacy had already been established abroad. The IICT, for instance, found cheaper way for the AIDS drug, AZT, by using less expensive sugar as the starting material. It may still be possible to obtain a product and process patent on a molecule closely related to a known drug or its metabolites. The new economic policies and globalization of trade, however, expose our traditional system of medicine and household recipes for pest control to new dangers of product patenting.

Big profits and opportunities lie in discovering new drugs which can be sold worldwide. Dr. Rama Rao has proposed a consortium approach to the development of new bioactive molecules, including drugs and agrochemicals. He visualizes the involvement of the Government, the CSIR and the industry to make a beginning with an investment of Rs. 100 million to establish a 'Discovery Lab'. The IICT is well-equipped to face the challenge posed to Indian R&D and embark on the discovery of new molecules, especially for use as drugs and agrochemicals, the two areas having high potential for innovative processes and products, and thereby the most affected by the GATT consequences. Even for off-patent drugs, it will be necessary to upgrade technology in order to remain competitive in the world market.

The future R&D plans of IICT include natural products as leads for drugs and pesticides, discovery of new chemical entities, chiral synthesis and technology, and fermentation



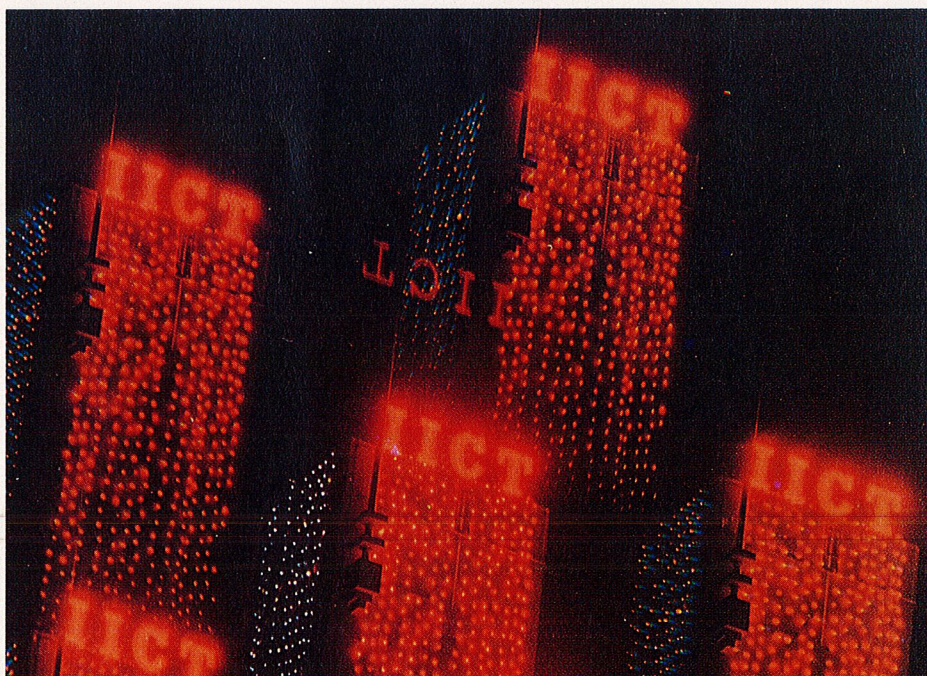
technologies, with emphasis on environment-friendly developments and also technologies for generic products with a view to capturing the world market.

Viewing the global perspective, one finds that MNCs are diversifying into various parts of the world with the help of new technology which enables them to re-locate factories and even labour. These global corporations exist on computer chips, fibre optic telephone lines and in previously unthought of locations. A new global situation has developed where the technologically superior are waging an economic war not only against the underdeveloped world but also among themselves for supremacy.

Since technology is the foundation on which economic strength and national security rest, there is no doubt that technology holds key to greater national strength. 'Arm India with technology' says Dr. Abdul Kalam.

The free market economy by itself does not raise the living standards of the people. It must have superior technological skills at its base to have an edge over the competitors. To this end, our technologies must have roots in our natural resources, the people's needs and social development and should aim not only at self-reliance but go beyond to successfully counter global competition. And these must be developed fast to avert the danger of Indian R&D becoming subservient to the needs of the global corporations.

The IICT has always come out with flying colours in its struggles and has played the role of a pathfinder. It is equipped to provide the lead in the future to make the Indian R&D globally competitive.



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# **IICT's Golden Jubilee Celebrations**

## IICT'S GOLDEN JUBILEE CELEBRATIONS

**F**ifty years is a long period. Memories grow dim. But the past must be recalled, not so much as to recount the struggles and progress made during this period but for the sake of future, expressly to rededicate the vibrant and pulsating IICT to the cause of science and technology.

The IICT Golden Jubilee Advisory Committee planned a year-long celebrations to commemorate the event. The Committee comprised Dr. A.V. Rama Rao (Chairman), Dr. U.T. Bhalerao (Co-Chairman), Shri R.N. Parlikar, Shri T.S.R. Anjaneyulu, Dr. A.A. Khan, Dr. M. Yaseen, Shri T. Krishna Reddy, Dr. Sajid Husain, Shri S.V. Samuel, Shri G. Narsing Rao/Shri M. Krishna (Members) and Shri M.M. Hasan (Member-Secretary). Several sub-committees were constituted to plan and execute the programmes covering scientific, cultural and social events.

As a part of the celebrations, several State-level and interlaboratory tournaments were organized which included carrom (August, 1994), bridge (December 1994), badminton



Prof M.M. Sharma delivering the Second Golden Jubilee Lecture

(December, 1994), chess (March, 1995) and table tennis (March, 1995). Special programmes were designed to draw maximum participation of women and children. Cultural evenings provided dance, drama and music. Interesting events were Science Quiz, pictorial photography competition and a magic show.

### SCIENTIFIC PROGRAMMES

**Lectures:** The delivery of the First Golden Jubilee Lecture by Professor C.N.R. Rao, FRS marked the launching of the IICT Golden Jubilee celebrations on April 1, 1994. The Golden Jubilee Popular Lecture on "Improving global health - Making motherhood safe in India" was delivered by Professor Sunne Bergstrom, NL on March 15, 1995. The Second Golden Jubilee Lecture was delivered by Professor M.M. Sharma, FRS on March 31, 1995. He chose an interesting topic — 'Orchestration of chemistry, chemical technology and chemical engineering for the manufacture of fine chemicals'.

**Seminars, Symposia, Workshops:** Over one dozen seminars, symposia and workshops were organized to discuss the recent advances in the areas of interest. Scientists from all over the country and in a few cases also from abroad participated. Seminar on 'Clean Coal Technology' was held during April 15-16, 1994. The discussions centred round beneficiation of coal, environmental pollution and control, coal combustion, coal gasification, coal carbonization and briquetting and environmental and analytical aspects.

A symposium on 'Biotechnology of Oils and Oilseeds' was organized during June 16-17, 1994. Various aspects of genetic engineering, microbial lipids, bioprocessing, biotechnology of



Dr. A.V. Rama Rao explaining the layout of Golden Jubilee Block to the Prime Minister

oilseed proteins and enzyme biotechnology were discussed. 'Eco-Friendly Organic Coatings and Polymers' was the topic of a seminar held during July 15-16, 1994. During presentation and discussions attention was paid to statutory regulations pertaining to organic coatings and polymers, development of coatings and high solid coatings and water based paints and coatings. Other issues discussed were structural adhesives, polymer membranes, biodegradable polymers, wood substitutes and other aspects of organic coatings and polymers.

A symposium on 'Advances in Chemical Engineering' held during August 9-11, 1994 started by two Plenary Lectures delivered by eminent chemical engineers followed by several sessions to discuss reaction engineering and kinetics, process systems engineering, process development and design, separation operations and thermodynamics and hazard analysis and risk assessment.

'Scientific Computing and Mathematical Modelling in Chemical and Biological Sciences' was the subject of a workshop which discussed its various aspects during September 12-16, 1994. Important among these were IBMPC - software, numerical analysis and statistics, software for chemical analysis, biosciences and chemistry and regression models in environmental science. The discussions were followed by two invited lectures on 'Emerging trends in scientific computing software' and on 'Fuzzy systems, neural computing, AI & expert systems'. A seminar on 'Emerging Trends in Applied Biology' discussed the following during October 21-22, 1994: Biocontrol, biocontrol/IPM, biotechnology environmental biotechnology/bioremediation and biodiversity.



Prime Minister and other dignitaries being conducted by Dr. U.T. Bhalariao to IICT Golden Jubilee function

A seminar on 'Computer-Aided Engineering of Process Plants' organized during November 16-17, 1994 was successful in bringing together academic institutions, research institutions, consultancy organizations, software developers, hardware manufacturers and user industry to a common forum. The seminar constituted technical sessions in computer graphics, maintenance, safety and control, design analysis, artificial intelligence and expert systems. Demonstrations were held by AMI Sanag Micromation Ltd., Onward Technology, Integrated Data Systems Ltd and Autodesk Inc.

A seminar on 'Recent Advances in Asymmetric Synthesis' during December 19-20, 1994 started its proceedings with IICT-Abbott Lecture by Professor K.B. Sharpless. Asymmetric synthesis of biologically active controls and development of new methodologies in asymmetric synthesis were the themes of several invited lectures and oral presentations.

Indo-British seminar on 'Catalysis in Energy and Environment' was held during January 30-31, 1995. Presentations were made on industrial processing, environmental pollution control, energy and drugs and fine chemicals.

A two-day course on 'Stainless Steel and Nickel Alloys for Process Industry' was conducted during February 16-17, 1995. The course covered the following topics: Corrosion in process industry; The SS family; Ni alloys; Corrosion and heat-resistant casting; Materials for coolers and condensers and for major organic chemicals; Design aspects; Fabrication, testing and



Prime Minister was the Chief Guest at the IICT Golden Jubilee function. Seen in the picture (from left to right) are Dr. A.V. Rama Rao, Dr. S.K. Joshi, Shri Krishan Kant, Governor, A.P., Shri P.V. Narasimha Rao, PM and Shri N.T. Rama Rao, CM, A.P.



inspection; Cathodic and anodic protection; Fitness for service and integrity assessment; Special materials for petrochemical industry; and Case histories of service failures.

Seminar on 'New Horizons in Analytical Chemistry' held during February 23-24, 1995 was conducted through nine plenary lectures, three invited lectures, poster sessions and papers presentation.

The last activity in this group was an international symposium on 'Frontiers in Chemistry and Chemical Technology' held during March 28-31, 1995 which comprised 22 plenary lectures delivered by well-known scientists from India and abroad and a panel discussion.

### COMMEMORATIVE EVENTS

A monument erected to commemorate the IICT's 50 years of fruitful existence was unveiled by the Governor of A.P., Shri Krishan Kant on August 6, 1994. Among those who spoke on the occasion were R.C. Chairman, Dr. S.Varadarajan, UDCT Director, Professor M.M. Sharma, former Director and DGSIR, Dr. G.S. Sidhu, industrialists, Shri D.B. Gupta, Dr. A.V. Modi and Dr. K.R. Das. Dr. S.K. Joshi, DGSIR presided over the function. Earlier Dr. A.V. Rama Rao, Director, IICT welcomed the guests. The Golden Jubilee Monument is a three sided structure in concrete, lined by grey and black granite, depicting the three changes in nomenclature of the Institute which reflect the recognition of the strides made by it in research and development in the area of chemistry and chemical technology.

On April 1, 1995, Prime Minister, Shri P.V. Narsimha Rao inaugurated the Golden Jubilee Block comprising Discovery Laboratory, Natural Products Laboratory and Catalysis Laboratory. Among those present were A.P. Governor, Shri Krishan Kant, A.P. Chief Minister, Shri N.T. Rama Rao, Minister of State for Science and Technology, Shri Bhuvanesh Chaturvedi, R.C. Chairman, Dr. S. Varadarjan, DGSIR, Dr. S.K. Joshi and senior staff of the IICT. Dr. A.V. Rama Rao explained the nature and importance of work planned to be carried out in the various laboratories.

This was followed by the main Golden Jubilee Function presided over by Shri Krishan Kant. Dr. Rama Rao while welcoming the distinguished gathering, dwelt upon the history the Institute and its achievements. He laid emphasis on the new shift in the approach towards innovative research to meet the challenge of international competition. The Prime Minister drew attention to the need of research on traditional herbs and pesticidal plants like neem which have suddenly become objects of research the world over. Shri N.T. Rama Rao, Shri Bhunesh Chaturvedi, Dr. S. Varadarajan, Dr. S.K. Joshi and representatives of industry also spoke.

Earlier, Chief Minister, Andhra Pradesh released IICT Golden Jubilee Brochure and Minister of State for Science and Technology, Government of India, released a book entitled '50 Eventful Years' and handed over the first copy to Prime Minister.

Specially made mementoes were distributed to all members of IICT during March, 1995.



Dr. U.T. Bhalariao presenting a memento to Dr. U.V. Varlu during workshop on 'Scientific computing and mathematical modelling in chemical and biological sciences'



Dr. A.R. Kidwai, Governor of Bihar inaugurated seminar on 'New horizons in analytical chemistry'



Dr. C.R. Bhatia inaugurating symposium on 'Biotechnology of oils and oilseeds'



Dr. A. Gopalakrishnan being presented a memento during intensive course on 'Leakfree pumping for safer future'



Dr. G. Thyagarajan inaugurated seminar on 'Eco-friendly organic coatings and polymers'



Book on abstracts being released during seminar on 'Computer aided engineering of process plants'



Dr. A.V. Rama Rao inaugurated the Open Bridge Tournament on December 10, 1994



Inauguration of Golden Jubilee Carrom Tournament on August 12, 1994



A view of Kuchipudi Dance Recital on March 30, 1995



Panel judging entries during cooking competition

