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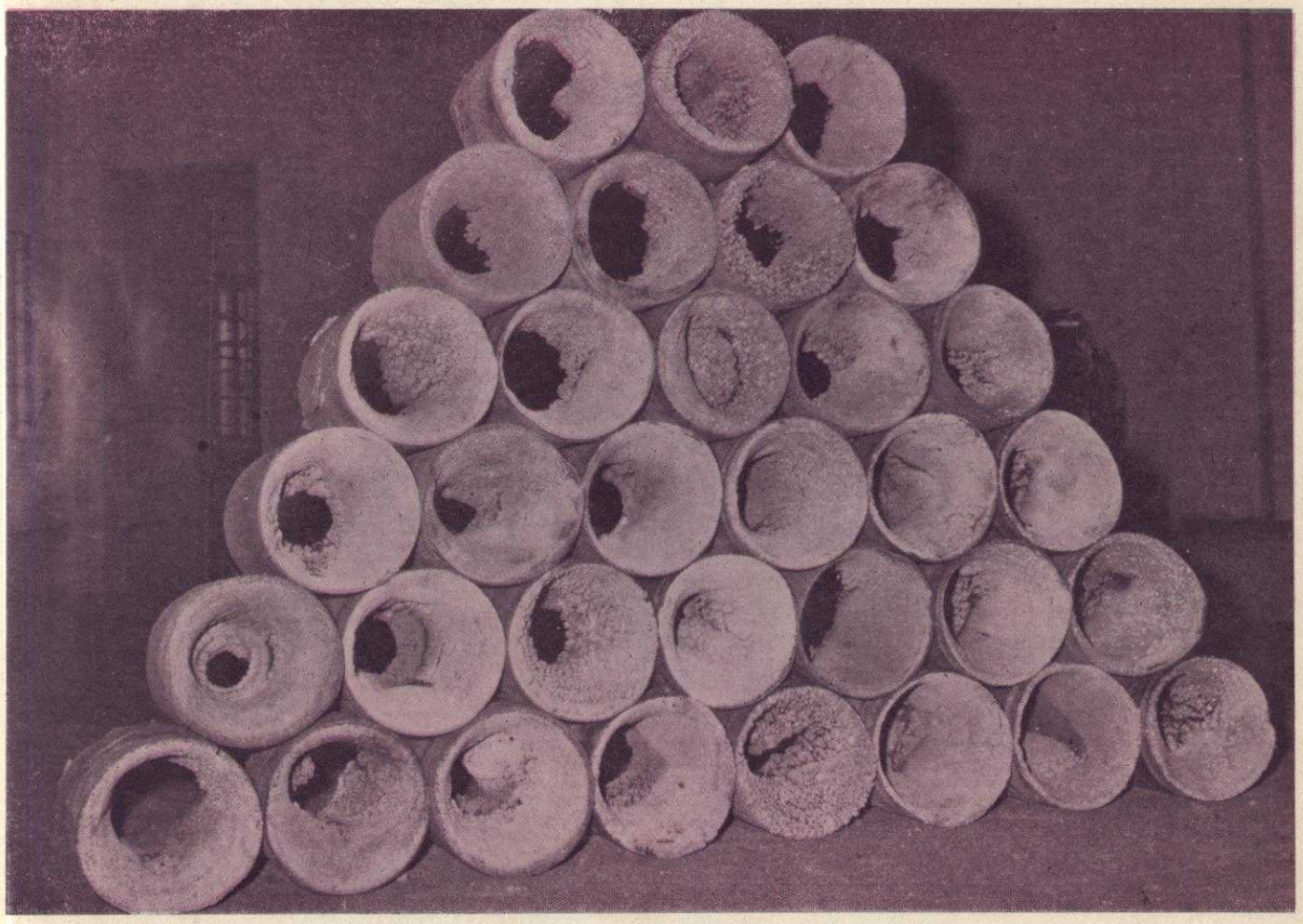

Magnesium Metal Crowns Produced at the NML's Magnesium Plant

IN THIS ISSUE

FAREWELL MAGNESIUM PLANT . . .

Development of process technology for the production of magnesium metal and the transfer of the plant equipment and the technology to the Andhra Pradesh Industrial Development Corporation, is a significant achievement of the Council of Scientific and Industrial Research and the National Metallurgical Laboratory. NML's experience in all this is rather unique.

The efforts in the development and transfer of magnesium technology were spread over a period of 32 years. The report on the development and sale of NML's magnesium technology printed in this newsletter, gives all facts related to the development and the transfer. It is hoped that the facts outlined in the report would benefit the others concerned with the development and transfer of indigenous technology.

Mr. M. P. Menon until recently the Acting Project Manager of the Magnesium Project has opted for voluntary retirement since 15th April, 1988. Out of his 29 years long service career at NML, Mr. Menon spent 22 years in the design, construction, installation, test trials, production trials, and standardization, negotiation and sale of NML's magnesium technology and plant. The success of the Magnesium Project owes to the dedicated, sincere painstaking work of Mr. M. P. Menon who worked as the Plant Manager and leader of Magnesium Project for 16 years.

This issue in addition, reports the standard items, such as Seminar Announcement, Staff News, Social and Cultural Activities.

—EDITOR

DEVELOPMENT AND SALE OF MAGNESIUM TECHNOLOGY—NML's EXPERIENCE

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1. WHY THIS REPORT ?

NML's efforts in the development of magnesium technology and its subsequent selling spanned a period of 32 years. During this period, the sale and the development of the technology required intense interaction with a large number of organisations — both in the public and private sectors. We thought NML's unique learning experience in all this effort could benefit others concerned with the development and sale of indigenous technology. NML's experience is, therefore, meticulously recorded in this report. However, this report also has other purpose as discussed below.

The magnesium plant is one of the few instances where a Technology Demonstration Plant was set up — based on a CSIR technology developed earlier on a pilot plant scale. Since technology demonstration is currently a very significant impediment to the transfer and use of all indigenously developed technology, NML's experience is very relevant to all laboratories concerned with the development and transfer of technology.

CSIR-NML's failure to sell the plant and technology over the last decade and a half attracted adverse comments on the working of the magnesium project from the Comptroller and Auditor General of India almost every year and these were systematically highlighted in the editorial columns of major national newspapers causing much embarrassment to CSIR-NML. On the other hand, CSIR-NML has always felt and stated that the facts and the events concerning the Magnesium Project merits an alternative appraisal. To permit such an alternative appraisal, these facts and events are faithfully documented. Though not always appreciated by the scientists and the government policy makers, a slight change in the government's perception and policy can facilitate the transfer and sale of an indigenous technology. This report clearly illustrates the same.

And finally, since the closure and the sale of the Magnesium Project required the redeployment and reabsorption of the project employees, the closure became a contentious issue wherein the central and state governments, parliamentarians, legislators, unions and union leaders — all participated. And as a fallout of this, a segment of the press, of late, has started reporting a distorted and a truncated version of the fact related to the development, sale and transfer of the plant and technology. It is hoped that by putting the facts straight, this document will reduce the scope for such misrepresentation.

2. HISTORICAL BACKGROUND WITH IMPORTANT MILESTONES

Magnesium is a strategic metal since it has critical applications in the areas of defence, aeronautics, missiles, atomic energy, ammunition, armaments and space. Even though India possesses extensive deposits of magnesium minerals, magnesium metal is not commercially produced in the country. Accordingly in the late fifties National Metallurgical Laboratory initiated studies on the production of magnesium metal from indigenous raw materials by silicothermic reduction of dolomite. The laboratory successfully developed the knowhow for the production of magnesium both on laboratory and on pilot plant scales. Table 1 gives the important milestones in the development and sale of CSIR–NML's magnesium technology.

The scarcity of magnesium during the 1962 border war impelled the Government of India to set-up indigenous facility for the production of magnesium in the public sector. CSIR-NML offered its services to furnish the process knowhow for the establishment of commercial scale unit. A plant with a capacity of 1500 to 2000 tonnes per annum was proposed in the early sixties and approved by the Department of Commerce and Industry. However, the experts advised that a technology demonstration plant be set-up before investing resources in a commercial plant. Consequently, it was decided that CSIR should initiate action to set-up a Technology Demonstration Plant with a capacity of 100 TPA with the following objectives : to develop the process on a semi-commercial scale, to train personnel, to generate process technology data and to develop expertise for setting up a commercial plant.

In 1964, at the suggestion of Homi J. Bhabha, the Board of Scientific and Industrial Research while approving the proposal decided to increase the capacity of the proposed plant from 100 to 250 TPA, so that the immediate magnesium requirement of the country could be met by the proposed demonstration plant.

A revised project report was finalised by an expert committee in May 1968 recommending that M/S M. N. Dastur be appointed as consultants for the engineering of the project. The consultants were appointed and the work at the site commenced in 1969. The test trials commenced in 1971 and the plant was commissioned in

1972, with an installed capacity of 200 TPA. Thereafter, till 1985, NML continued to negotiate to sell the technology and plant without success.

In 1986, NML made a critical appraisal of the technology and the plant to identify the modifications required to make the plant saleable. It is this exercise which led to the successful transfer of the plant and the technology in 1988.

Table 1

SIGNIFICANT MILESTONES IN THE DEVELOPMENT AND SALE OF MAGNESIUM TECHNOLOGY

1956-60	R. N. Mishra, V. S. Sampath and P. P. Bhatnagar, under the guidance of B. R. Nijhawan develops technology on bench scale at NML.
1960-62	R. N. Mishra, V. S. Sampath, M. P. Menon and P. P. Bhatnagar under the guidance of B. R. Nijhawan, develops technology on pilot plant scale at NML.
1962	Government of India approves setting up a commercial 1500-2000 TPA in the public sector based on CSIR-NML technology.
1964	Board of Scientific & Industrial Research decides to set-up a 250 TPA Technology Demonstration Plant.
1968	Expert Committee approves revised project report and appoints M/s. M. N. Dastur as engineering consultants.
1969	Construction work commences at the site.
1971	Magnesium Project team led by M. P. Menon of NML installs, test trials and also produces first magnesium ingot.
1972	Magnesium Project team led by M. P. Menon of NML commissions the full capacity 200 TPA demonstration plant.
1972	Late Sri Mohan Kumaramangalam, Union Minister for Steel and Mines, dedicates the Magnesium Plant to the nation.
1975	V. A. Altekar, Director, NML initiates action to transfer the technology together with the plant.
1977	Magnesium Project team demonstrates to BALCO and attains more than 90% installed capacity during six months continuous trial operation.
1975-85	V. A. Altekar, Director, NML negotiates with various organizations for the sale of magnesium technology and plant.
1985	CSIR decides to stop all production activities and to keep the plant in suspended animation.
1986	NML makes a critical assessment of the magnesium technology and the plant—with a view to make them saleable.
1986-87	NML negotiates with various organizations and also obtains approval from the government and CSIR—of the new conditions for sale and issue of tender notice.
1987	CSIR-NML signs agreement for the transfer of technology and for the sale of a part of the plant equipment to Andhra Pradesh Industrial Development Corporation.
1987	NML obtains permission of Bihar Government and declares the formal closure of the project (December).
1988	NML-Magneisum Project organizes and arranges transfer of all the equipment sold—from Jamshedpur to Rajahmundry (accomplished on May 31).

3. DESCRIPTION OF PROCESS TECHNOLOGY

Magnesium metal is produced by the silicothermic reduction of calcined dolomite at high temperature under vacuum. The process flowsheet is given in Figure 1. Main raw-materials are dolomite and ferrosilicon. Dolomite is calcined, ground and briquetted after mixing with ground ferrosilicon as reducing agent and fluorspar as catalyst. The briquettes are reduced in special alloy steels retorts, heated in a suitable furnace at high temperature. The retorts are evacuated by high vacuum pumping sets and are kept under vacuum during the period of reduction. Magnesium is liberated as per the following reaction :

$$2\,(MgO.CaO) + Si\,(Fe) =$$

$$2Mg + Ca_2SiO_4 + (Fe)$$

The magnesium is collected in special condensers, placed inside the water cooled zones of the retorts. After reaction is over, vacuum is broken and crystalline magnesium is removed. After cleaning the residue, the retorts are again charged with fresh briquettes and the cycle repeated.

The crystalline magnesium is melted under suitable flux and thereafter cast into ingots.

The specifications of the major raw materials used are given below :

Material	Specification	Source
Dolomite	Microcrystalline structure with a minimum of 20% magnesium oxide and the maximums of 0.1% alkalies and 3% acid insolubles	Bengal (Jainti Hills), A.P., M.P., U.P. and Karnataka
Ferrosilicon	75-80% grade	Orissa, A.P. and Karnataka
Fluorspar	Acid grade with a minimum of 93% CaF_2	Gujarat

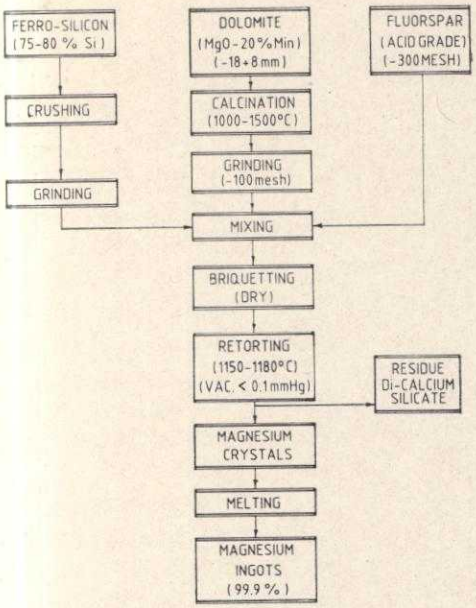


FIG. 1 PROCESS FLOWSHEET FOR PRODUCTION OF MAGNESIUM BY SILICOTHERMAL PROCESS.

Fig. 2 A view of Magnesium Plant

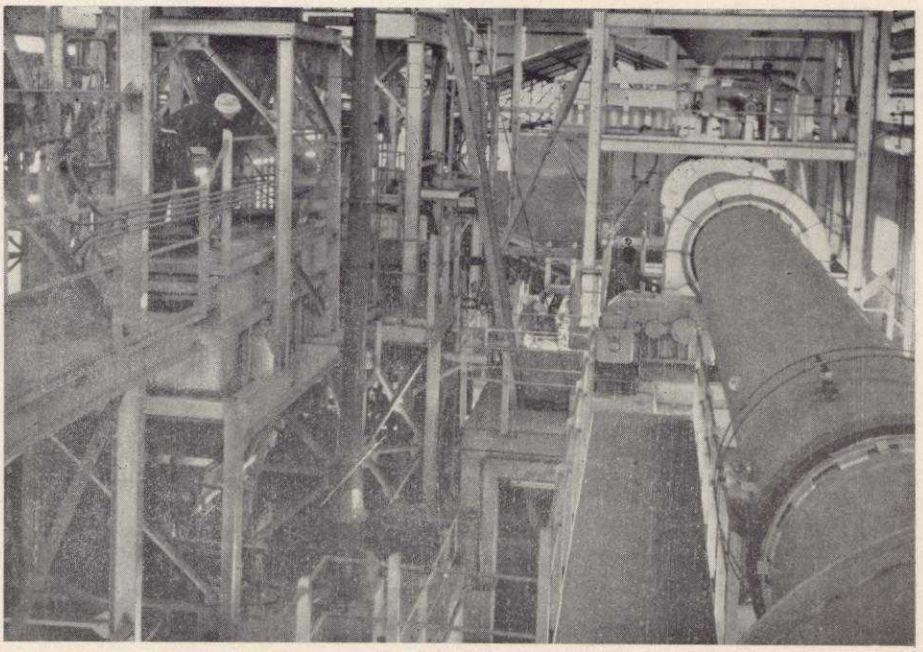


Fig. 3 Raw Material Preparation Unit

Depending on the analysis of the materials, approximately 10 to 14 tonnes of dolomite, 1 to 1.6 tonnes of ferrosilicon and 50 to 150 kgs of fluorspar are required per tonne of magnesium metal produced. The energy requirement is about 16 to 20 kWH and 2 to 2.5 litres of furnace oil per kg of magnesium metal, in case electrical energy is used for the reduction. If oil firing is used for reduction, the energy requirement is about 6 to 10 kWH per kg of magnesium and 6 to 8 litres of furnace oil per kg of magnesium. Producer gas from coal or natural gas can also be used as an alternative energy source.

4. DESCRIPTION OF THE PLANT

The plant (see Figure 2) consists of raw material preparation unit (RMPU), reduction unit (RU) and melting unit (MU) together with ancillary facilities like maintenance shops, sub-station, stores etc.

Raw Material Preparation Unit

The RMPU (see Figure 3) consists of : the equipment for crushing, calcining and grinding of dolomite, the crushing and grinding of ferrosilicon and the mixing and briquetting of the charge. The calcination unit consisted of oil fired rotary kiln (1.1 m dia × 22 m long) and cooler (1.2 m and 12 m long). The grinding unit is a Hardinge conical ball mill (6 ft × 2 ft). Briquetting unit is of double roll type with positive feeder to produce almond shaped dry briquettes at maximum pressure of 60 tonnes/cm. This unit has an installed capacity to treat raw material sufficient for the production of 500 tonnes magnesium/annum.

Reduction Unit

The reduction unit (see Figure 4) is equipped with two electrically heated furnaces with 4 retorts each and one oil fired furnace with 12 retorts for reduction of charge. Centrifugally cast heat resistant alloy steel retorts are used for reduction. About 10 tonnes of magnesium is produced per retort during its average life of three hundred days. A common high vacuum system evacuates the retorts during reduction. The installed capacity of the reduction furnace is 200 TPA while vacuum system has additional capacity of 500 TPA.

Melting Unit

The melting unit consists of mains frequency coreless induction furnace having steel crucible with melting capacity of 150 kg/batch with hydraulic tilting device. A roller pig-casting stand and fume extraction system are also available. The melting unit has an installed capacity of 300 TPA of magnesium.

Ancillary Facilities

Mechanical and electrical workshop facilities are available to undertake the day-to-day maintenance and repair work of the plant equipment. The control laboratory is equipped to carry out the analysis of raw materials and products. The substation has two step down transformers of 1000 kVA each with an input power supply of 6.6 kV. A spray pond and water tank has been provided for the cooling water recirculation system. Furnace oil storage in two tanks of 70 kL each, and a distribution system are also available. Facilities for supply and distribution of compressed air to various units are also provided.

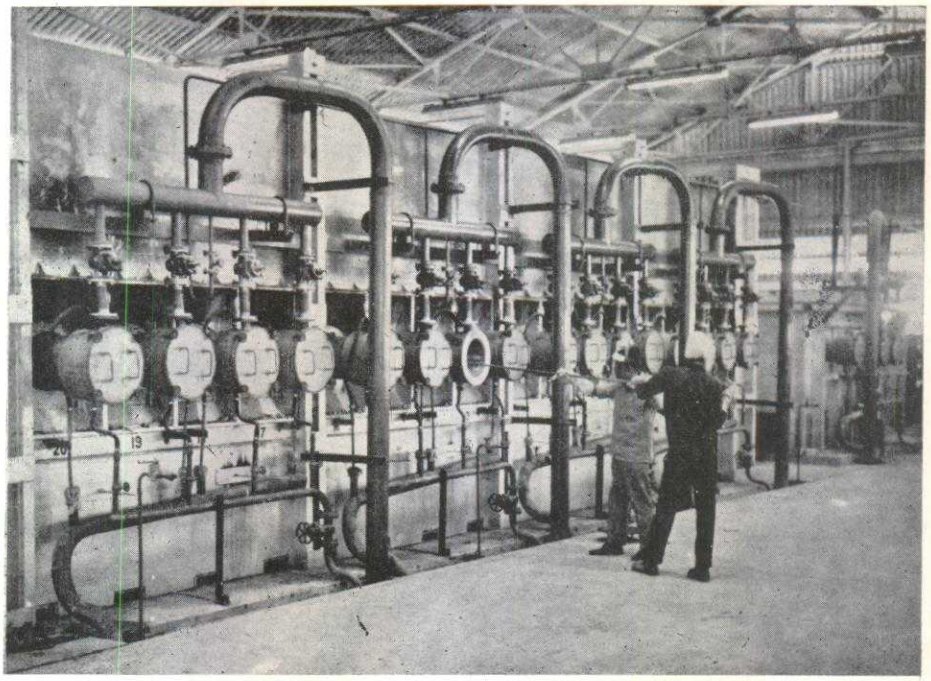


Fig. 4 Reduction Unit Showing Retorts

5. DEVELOPMENT OF TECHNICAL KNOWHOW

The plant was commissioned in February 1972 and subsequently the necessary modifications in the equipment and the processes were carried out. High purity magnesium 99.9% was successfully produced in tonnage quantities. Magnesium produced was cast into ingots of size specified by the Indian Standard.

The magnesium metal produced during the development period was supplied to users such as: Aluminium Company, Ordnance Factories, Hindustan Aeronautics Limited, Government Mint, Bharat Aluminium Company Limited, Heavy Engineering Corporation, Vikram Sarabhai Space Centre, Defence Research Laboratories, Nuclear Fuel Complex, Glaxo Laboratory, Kothari Electronics and Industries Limited (Water Activated Batteries Plant) etc. These organizations confirmed that the magnesium supplied could replace the imported magnesium used by them. By 1975, the knowhow was ready for transfer to a suitable organization, preferably in the public sector, so that magnesium metal could be produced in commercial scale. Thus by 1975, the main objective of setting up the plant — that is to demonstrate indigenous technology for the production of this strategic metal without any foreign collaboration — had been fulfilled.

Together with the knowhow, the development - cum - demonstration plant with an installed capacity of 200 TPA and with a set of well trained personnel were also available for transfer to meet the magnesium need of the country at that time. The capacity of this plant could be readily and inexpensively expanded to 500 TPA by installing nominal matching facilities to meet the increasing demand for magnesium in the country.

6. THE NEED FOR THE TRANSFER OF THE MAGNESIUM PLANT TO AN ENTREPRENEUR

At present, almost the entire requirement of magnesium of the country is imported. The estimated annual demand of magnesium in our country is more than 700 tonnes. With the commissioning of NALCO, this requirement should increase further and a demand of 1000 TPA is envisaged by the end of this decade.

At present, there is no commercial unit producing magnesium in the country. The Tamilnadu Industrial Development Corporation (TIDCO) is setting up a 600 TPA plant to produce magnesium by the electrolytic process developed by Central Electrochemical Research Institute in Tamilnadu. It will be sometime, before the production starts and magnesium is made available to the consumers. A prototype plant has been commissioned by Defence Metallurgical Research Laboratory at Hyderabad based on the same process. This is a captive unit which recirculates the magnesium used in DMRL's Titanium Plant. The magnesium from this plant will therefore not be available to other consumers.

Even after the TIDCO plant is commissioned, there will be a gap of about 500 TPA between the demand and production of magnesium in the country.

Therefore, to meet this gap in demand a commercial unit must immediately be set up to produce magnesium. NML's magnesium technology and plant could provide a part of the magnesium that the country currently imports. An obvious question arises as to why CSIR should not undertake the production and sale of magnesium to meet the current needs?

CSIR — NML cannot engage itself in regular production and sale of magnesium for the following reasons:

CSIR is an R & D organisation and its charter does not provide for it to engage in commercial production. Neither is CSIR organizationally or managerially designed to undertake manufacturing operations of three shifts a day, 365 days a year. The rules of employment by CSIR create difficulties in involving its employees in such regular shift duty and expose them regularly to conditions of safety hazards under industrial production. Consequently, the labour productivity is bound to be low. The demonstration of technology in the scale of operation required, reluctantly compelled NML—CSIR to get involved in the production and sale of magnesium. CSIR — NML's Magnesium Plant, therefore, had to be registered under the Factories Act 1948 as well as under the Industries (Development and Regulation) Act 1951. All these created innumerable difficulties in conducting developmental work in the plant within the ambit of CSIR's standard employment policy and rules. Besides all these, the most important point is that the cost of magnesium production in the plant by CSIR was very high and therefore quite rightly, the production was completely stopped in 1985.

CSIR's main aim and objective is to develop appropriate technology for commercial use. In the case of the Magnesium Project, this objective was fulfilled in 1975. Therefore, attempts have been made to transfer the technology together with the plant to a suitable entrepreneur since 1975.

7. A RECORD OF OUR EXPERIENCE IN TRANSFER OF TECHNOLOGY & PLANT

A chronological account of the organizations with whom extended negotiations and/or joint plant demonstrations were carried out for the transfer of the magnesium technology and plant, is given in Table 2.

TABLE-2

ORGANISATIONS WITH WHOM NML NEGOTIATED THE SALE OF THE PLANT

1975	Indian Aluminium
1975	Bharat Aluminium
1976	Defence Production
1977	Bharat Aluminium
1977	Sandur Manganese and Iron Ores
1978	Tata Yodogawa Limited (TAYO)
1979	Bharat Aluminium Company
1980	Mishra Dhatu Nigam
1980	Hindustan Aeronautics
1980	Director-General of Ordnance Factories
1981	Bihar State Industrial Development Corporation
1981	Hindustan Zinc
1983	Nirlon Synthetic Fibres & Chemical Limited
1985	Defence Production

The offer of Indian Aluminium Company in 1975 to take over the technology and the plant and to expand the capacity to 1000 TPA was not accepted by the Government, since the firm was a foreign equity company in the private sector. Bharat Aluminium Company a public sector organization was then contacted. BALCO conveyed their inability to take over the plant after evaluation of the plant. In 1977, BALCO together with Magnesium project employees operated the plant for a period of six months on a trial basis. Even though the technological viability of the process and the plant was established, BALCO declined to take over the plant.

M/s. Sandur Manganese and Iron Ores Limited and the Tata Yodogawa Limited, a private sector unit, showed interest during 1977 and 1978. While Sandurs declined to take over the plant after review, the offer of TAYO was not accepted by CSIR in 1979. On the other hand, the committee appointed by DGSIR recommended that the plant and technology be transferred to a public sector Organisation such as BALCO.

In 1979, BALCO reconsidered the proposal and again conveyed their inability to take over the plant.

Other organizations in the public sector like Department of Defence Production, Hindustan Aeronautics Limited, Mishra Dhatu Nigam Limited and Hindustan Zinc Limited were also contacted. All the organizations evaluated the technology and the plant and regretted their inability to take it over. Bihar Industrial Development Corporation also showed interest. After a review, they too did not take over the plant apparently because the commitment of the Government of India for raising the selling price of magnesium could not be obtained.

In 1982, CSIR advertised the disposal by sale of the working plant and technology. The two offers received were considered by CSIR, and negotiations were held in 1983 with M/s. Nirlon Synthetic Fibres and Chemicals Limited and M/s. Dev Raj Capur. However, these offers did not materialise.

In 1985, the Ministry of Defence Production was approached and they too declined to take over the plant.

BRIEF SKETCH OF MR. M. P. MENON

Mr. M. P. Menon, a Bachelor of Engineering (Mechanical), started his career with M/s. Sepulchre Brothers, Calcutta as the Sales and Service Engineer in February, 1953. M/s. Sepulchre Brothers promoted him to the position of Site Engineer at Low Shaft Furnace Project in November, 1957.

Mr. M. P. Menon, joined the National Metallurgical Laboratory on 1st August, 1959 as Senior Scientific Officer and was promoted to the position of Chief Engineer on 1st August 1966. During this period he was engaged in the engineering and installation of pilot plant for recovery of Vanadium-pentoxide and supervision of installation of 500 KVA submerged arc furnace for the production of ferro-alloys. He was responsible for the preparation of revised Project Report and for assisting M/s. M. N. Dastur in the detailed engineering of the Magnesium Project. He took over the charge of Magnesium Project as Acting Project Manager in March, 1972 and further rose to the position of Scientist E-II and later as Officiating Scientist 'F'.

Mr. Menon supervised, coordinated and managed with great diligence, dedication and distinction various activities-design, construction, fabrication, installation, commissioning, test trial, standardization and productionization — all related to NML's Magnesium technology and plant. As the leader of the Magnesium Project, Mr. Menon inspired his colleagues to work under very difficult circumstances to achieve excellent results. Apart from his engineering and managerial skill, Mr. Menon's personal commitment and devotion to the cause of the magnesium project has been examplary and the single most important factor in the successful development and transfer of NML's magnesium technology and the plant.

Mr. M. P. Menon, Acting Project Manager, Magnesium Plant, retires. We record our heart felt appreciation

He opted for voluntary retirement with effect from April 15, 1988 after serving the NML for 29 years. We wish Mr. M. P. Menon, Mrs. Renuka Menon and his sons Pravin, Pramod and daughter Shailaja the very best on the occasion of his retirement.

8. WHY WAS THE TRANSFER DIFFICULT ?

In early 1986 a detailed analysis and examination was carried out to determine why the magnesium technology and plant could not be sold during 1975-85. As a result of this analysis, the following three reasons arranged in order of increasing importance were identified :

(a) The government's reluctance to sell the plant only to a private sector company.

(b) NML's condition that the magnesium plant employees be re-employed by the buyer of the plant.

(c) High cost of production of magnesuim.

An examination of the chorono-logical account as reported in Table 2 shows that the Govern-ment's avowed policy to set up the facility for commercial produc-tion of magnesium only in the public sector, prevented the trans-fer of the plant to competent private sector entrepreneurs such as Indian Aluminium Company or Tata Yodogawa even though these companies were keen to take over the plant earlier. Accordingly, the government was approached in 1986 to permit CSIR-NML to sell the plant to the highest bidder irrespective of whether the buyer belongs to public or private sector. This subtle change permitted serious negotiations and discus-sion for sale of the plant with a different group of potential buyers. Such discussions provided NML with very important insight into the commerce of magnesium metal and technology. This insight later helped us to formulate the strategy for the sale and transfer of the plant.

NML had earlier suggested that the buyer of the Magnesium Plant and technology should absorb the 147 employees of the magnesium plant. On the other hand, most of the potential buyers felt that the plant was overmanned, if routine production work was to be carried out; and, the absorption issue always became an irritant in negotiation with them. There-fore, it was decided and accord-ingly the CSIR's clearance was obtained to delink the reabsorp-tion and redeployment of the employees from the sale of the technology and plant. As a result, a more flexible arrangement to sell the technology and the plant could be explored.

As regards the cost of production, a detailed sensitivity analysis was carried out and this revealed that the cost of production was a very sensitive function of the following:

* Scale of Production
* Capacity Utilization
* Cost of Energy
* Cost of Ferrosilicon
* Obsolesence Level of the Equipment & Plant
* Retort Productivity.

The 200 TPA scale of operation is quite appropriate for techno-logy demonstration and semi-commercial operation. But at such low levels of production, the cost of production would be very high compared to the production cost in large plants abroad with capa-cities of 5,000 to 1,25,000 TPA.

The production capacity of the magnesium plant was 200 TPA. On the other hand, the more ex-pensive units of the plant such as: raw material preparation unit, re-duction unit and melting unit had additional built-in capacities so that the production could be readily scaled upto 500 TPA level with small investment. However, the higher investment in the already built-in additional plant capacities became a liability in terms of the higher cost of production, wastage of energy, higher cost of mainten-ance, apart from the larger depre-ciation and interest.

Whereas one expects CSIR technology to compete with tech-nology imported from abroad in terms of the cost of production, the major input costs such as : the indigenous cost of ferrosilicon and the cost of energy which toge-ther account for 60% of the cost of magnesium production in the plant, was 2 to 3 times higher than their cost abroad. Under the cir-cumstance a comparison of the cost of production in NML's mag-nesium plant with those abroad, becomes quite unfair. CSIR-NML, therefore, approached the Govern-ment of India to permit a producer of magnesium to import the required quantity of ferrosilicon without duty at the international price and/or treat the ferrosilicon used as 'deemed export'.

The plant and equipment in-stalled in 1971, were based on concepts, technology and opera-tion which were considered quite efficient at that time. Since then, the combustion and furnace tech-nologies had undergone radical im-provement. Over the years, the combustion system and the fur-naces of the magnesium plant had become obsolete, consuming ex-cessive energy with poor plant availability and productivity. NML therefore planned to undertake modification in design and con-struction of the furnace and the combustion system to improve productivity.

The retort productivity was observed to be the most im-portant factor in reducing the cost of production. Accordingly, the

following recommendations were made :

(a) Increase diameter of the retort from 25.5 cm to 28 cm to increase the retort volume and production by 21%.

(b) Improve the reaction kinetics through the use of suitable additives and catalytic agents.

(c) Use retort of large diameters (greater than 60 cm) with partial vacuum outside.

(d) Decrease heating time and the time for loading and unloading operation through appropriate innovation.

Finally, market survey revealed that the downstream integration through the production of the magnesium alloy castings and master alloys for aerospace application and the production of import substitute items such as magnesium powder and magnesium alloy slugs for defence applications, could significantly improve the profitability of the semi-commercial plant.

9. OUR EFFORTS IN THE REVIVAL AND SALE OF THE MAGNESIUM PLANT DURING 1986-87

Based on the analysis outlined in the previous section NML initiated several moves to revive the plant. Towards this end, the Scientific Adviser to the Defence Minister had been approached to provide funds so that the plant could be revived and some of the modifications as discussed above could be incorporated in the plant to develop the magnesium technology further. The response from the Ministry of Defence as also the others who were informally approached for this was not positive.

Therefore, NML contacted several organizations and in some cases initiated negotiations with some of them during 1986-87 for the sale of the plant. These are : Indian Aluminium Company, Thapar Group of Industries, Tata Yodogawa, Bengal Limestone Company, IPICOL, Indian Rayon and Industries, Madhya Pradesh Industrial Development Corporation, BALCO, Department of Mines, Hindustan Zinc Limited, NALCO. The response from all these for the purchase of plant was also not favourable.

As per the CSIR decision, the plant had been kept in suspended animation since April 1985. Therefore, since April 1985, 147 workers of the plant were reporting for duty, six days a week in three shifts round the year, without any worthwhile productive work. This had a demoralising effect not only on the plant employees but also on the other 1100 employees (approximately) of National Metallurgical Laboratory, the parent organization of the magnesium plant at Jamshedpur. Further, the adverse comments of the Comptroller and Auditor General of India, on the working of the Magnesium Project were highlighted by almost all the national newspapers in their editorial columns. This produced alround embarrassment to CSIR in general and NML in particular. At this stage, NML approached CSIR for approval and clearance to issue Notice Inviting Tender for transfer of technology and the plant.

10. SIGNING OF AGREEMENT WITH APIDC AND THE SUBSEQUENT DIFFICULTIES IN TRANSFER OF PLANT AND TECHNOLOGY

In carrying out the decisions to sell the NML's Magnesium Technology and the CSIR's Magnesium Plant, several impediments were encountered and these can be judged from a brief outline of the significant events which preceded the transfer of the plant. These are given in Table 3.

Fresh tenders were floated and limited response was received from two entrepreneurs. One of them was a joint sector organization — consisting of Andhra Pradesh Industrial Development Corporation–Southern Magnesium. Extended negotiations on the details of transfer of technology and the plant were carried out with APIDC during April-July 1987 to obtain best terms of payment for the transfer of technology. After the Executive Committee approved the sale of the plant and technology to APIDC in July 1987, the clearance and approval of the draft agreement and permission to sale was obtained from the CSIR Headquarters.

The Agreement between NML/CSIR and APIDC was signed on 12th August, 1987. According to the agreement, APIDC had to dismantle the equipment and machinery and reinstall the same in Andhra Pradesh.

The transfer of the plant involved shifting of 185 tons of machinery and equipment numbering 40 major items over a distance of 1000 kms. Some of the equipment was sensitive like the vacuum pumps and the others as cumbersome as a 22 m long rotary kiln. All the piping and installation joints had to be carefully cut and dismantled to permit quick reinstallation in their new site. The logistics involved were indeed quite difficult. These difficulties in the physical transfer of the plant were further aggravated by the need to immediately resolve the contentious issue on the reabsorption and redeployment of the plant employees. The important milestones in the physical transfer of the plant are outlined in Table 3.

Table 3

MILESTONES IN TRANSFER OF CSIR's MAGNESIUM PLANT DURING 1987-88

April 1987
NML issues NIT

June 1987
Executive Committee of NML ratified the action to issue Notice Inviting Tenders (NIT)

July 1987
NML Executive Committee decides to sell the plant to APIDC

July 1987
CSIR's Governing Body is informed about the decision to sell the plant and the technology

August 1987
NML/CSIR signs agreement with APIDC to transfer the plant

August 1987
NML informs the Magnesium Project employees about the agreement and offers them three options for redeployment and voluntary retirement

August 1987
Government of India directs CSIR to re-examine NML's decision to sell the plant as a follow up of a question raised in the Rajya Sabha

September 1987
A High Power Committee appointed by CSIR recommends that the plant and technology be sold to APIDC as agreed by CSIR-NML in August 1987

September 1987
NML files applications to Bihar Government for closure of the Plant

September 1987
Magnesium Project Employees Congress (MPEC) contests application to close the plant

December 1987
Bihar Government issues permission for closure.

January 1988
APIDC begins transfer of equipment

January 1988
The Union Leaders of MPEC stage demonstration and prevents transfer of equipment and submits writ petition at Patna High Court

February 1988
Patna High Court (Ranchi Bench) rejects writ petition and advises the union to file review petition with Bihar Government

May 1988
APIDC completes the transfer of equipment

Since the magnesium plant was registered under the Factories Act 1948 as also under the Industries (Development and Regulation) Act 1951, we had to obtain formal permission for closure of the magnesium plant from the Bihar Government. The Bihar Government's permission was delayed due to interventions from the parliamentarians, legislators and union leaders. Thus it was only on May 31, 1988 that the representatives of Southern Magnesium could transfer the last item of equipment, four months ahead of the schedule. With the physical transfer of the equipment having been accomplished, the closure of the Magnesium Plant has now entered the fourth or the last phase, namely, the redeployment of the employees. At present out of the 119 regular employees, 3 have applied for voluntary retirement and 30 employees have already been redeployed to the other CSIR laboratories. The arrangement for the redeployment of the balance 86 employees is in progress. The 27 casual labour could be given alternative positions in the CSIR laboratories as and when appropriate vacancies are available.

11. FUTURE OF NML's MAGNESIUM TECHNOLOGY

NML looks forward to the utilization of its magnesium technology with great deal of anticipation. The magnesium plant being set up by APIDC-Southern Magnesium near Rajahmundry in Andhra Pradesh would use natural gas of Godavari Basin. The use of gas would enable Southern Magnesium, in turn, to permit use the latest technology and concepts in their combustion system and in the furnace design and construction. Accordingly, they would achieve much better thermal efficiency, higher retort productivity and consequently a lower cost of production. Also, the dolomite available in the nearby area in Andhra Pradesh is found suitable for magnesium production. NML has recommended that Southern Magnesium should set up their own captive ferrosilicon plant to obtain the ferrosilicon at a relatively low cost.

The proposed APIDC-Southern Magnesium plant has a capacity of 600 TPA. Higher plant capacity, higher retort productivity together with the use of natural gas which, in turn enables the induction of the latest innovations in the combustion system and furnace design and a large and growing market for magnesium — all these make the APIDC-Southern Magnesium Plant a highly attractive proposition. The plant is expected to go into production by June 1989.

After NML signed the agreement with APIDC, the following organizations both public/private, have again approached NML to make available to them the technology for the production of magnesium and for setting up commercial production units :

M/s. Bengal Limestone & Company Limited
IPICO Limited, Orissa
M/s. Indian Rayon & Industries
Madhya Pradesh Industrial Development Corpn.

NML looks forward to the further utilization of its magnesium production technology. In addition, it is currently engaged in the development of technology for the production of magnesium powders, extruded magnesium alloy product and magnesium-base alloys.

R & D ACTIVITIES

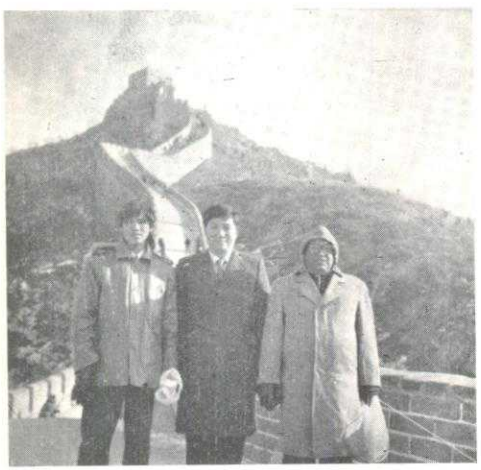
INTERNATIONAL CONFERENCE ON BASE METALS TECHNOLOGY

The National Metallurgical Laboratory, jointly with Indian Institute of Metals, will be organising an International Conference on Base Metals Technology at Jamshedpur during February, 1989. The objective of the Conference is to focus attention on various technologies in the areas of Base Metals, such as lead, copper, zinc and tin.

The conference will have panel discussions to evolve a suitable action plan for further development of all the available base metal technologies.

Large number of participants from India and abroad are expected to attend the conference. Further enquiries may be addressed to :

Conference Secretariate,
International Conference on
Base Metals Technology,
National Metallurgical
Laboratory,
Jamshedpur — 831 007 (India)



Shri K. N. Gupta, Deputy Director, alongwith Chinese Scientists, on the China Wall

VISITS ABROAD

1. Dr. O. N. Mohanty, Deputy Director, has left for West Germany for a period of $3\frac{1}{2}$ months from 1st March, 1988 under the Exchange Programme between CSIR and West Germany. He will be under training at University of Karlsruhe and Siemon's Laboratory at Karlsruhe during the above period.

2. Shri K. N. Gupta, Deputy Director visited China to attend a regional seminar on 'Chemical reaction engineering in extractive metallurgy' organised by Institute of Chemical Metallurgy, Academia Sinica, Beijing, under the auspices of UNIDO. He presented two papers on 'Modelling and simulation of vertical reactors by non-isothermal techniques' and 'Vertical retort direct reduction process of DRI for developing countries'.

During the visit from 4-17 December, 1987, Mr. Gupta had discussions with Prof. Mooson Kwak, Director Emiritus and Prof. Xu Zhihong, Institute of Chemical Metallurgy, Academia Sinica, Beijing ; and Prof. Hsiao Tse Chiang and Prof. Li Yin Tai, Department of Ferrous Metallurgy, North East University of Technology, Shenyang. He delivered 3 lectures at NEU of Technology Shenyang, on :

1) DRI production in India — VRDR Process of NML
2) Non-isothermal kinetics of iron ore reduction and
3) Production of high temperature, high reduction potential gases from non-coking coals in a molten metal reactor.

TECHNICAL LECTURES

Prof. Hsiao Tsechiang, North East University of Technology, Shenyang, China. 'Chinese Iron and Steel Industry and Smelting Reduction of Ores' on 12th February, 1988.

Prof. Neil Dirks, Pittsburg University, USA. 'Reoxidation of sponge iron' on 19th February, 1988.

Dr. P. K. Mukhopadhyay, Director, R & D, Indian Oil Corporation, Faridabad. 'R & D in oil sector' on 29th February, 1988.

The following lectures were jointly organised by NML and Indian Institute of Metals, Jamshedpur Chapter.

Dr. Rajib Kohli, Manager International Commercial Space Activities, USA. Microgravity material processing for space science metallurgy' on 22nd January, 1988.

Dr. S. C. Srivastava, Scientist, NML. 'Pit nucleation in steels' on 11th March, 1988.

Dr. N. B. Prasad, Chairman, Andhra Pradesh Industrial Development Corporation, Hyderabad. 'Energy options in India' on 25th March, 1988.

Mr. A. Kishi, Marketing Manager, ULVAC, Japan. 'Thermal conductivity measuring equipment and its applications to ceramics and heat resistant alloys' on 7th April, 1988.

The following lecture was jointly organised by NML and Indian Ceramic Society, Jamshedpur Chapter.

Dr. Jaidev Mukherjee, Deputy Director, Central Glass and Ceramic Research Institute, Calcutta. 'Silicon carbide refractories' on 5th February, 1988.

General Lecture

Shri Neel Ratan Banerjee, Income Tax Officer, Salary Ward, Jamshedpur. 'Income tax for salaried people' on 28th February, 1988.

The Welfare Committee of the Laboratory organised the above lecture to provide first hand information to the staff of the laboratory about their Income tax problems.

PUBLICATIONS

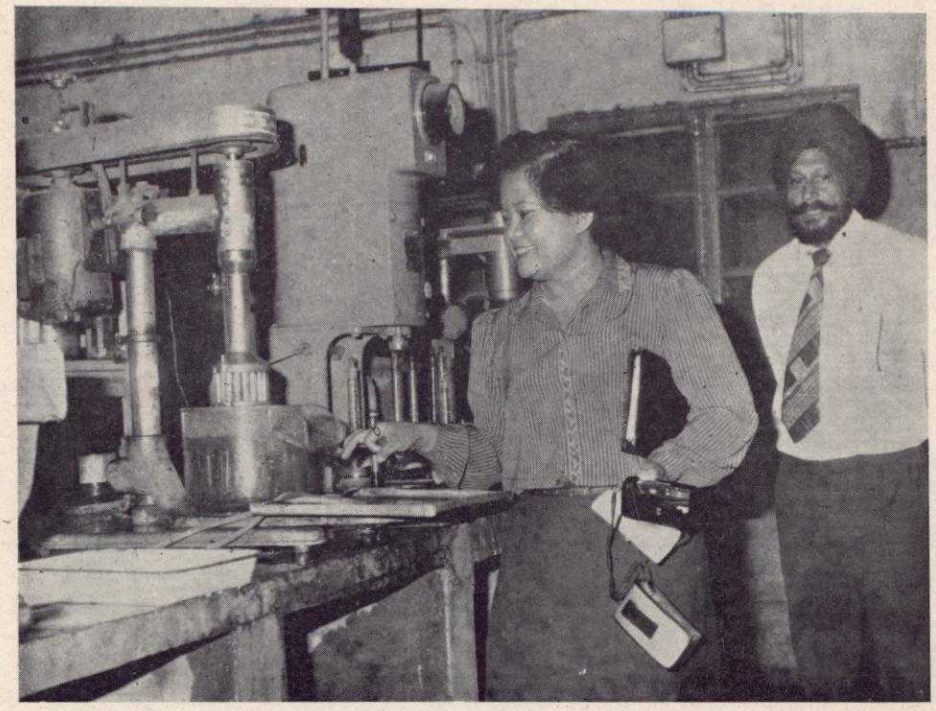
1. 'Use of the moving bed technique for the assessment of reducibility of iron ores and reactivity of solid reductants' —S. Prakash, H. S. Ray and K. N. Gupta. Reactivity of Solids, 4, 215-226, 1987.

2. 'Pilot scale production of ferro-alloys and pig iron through electrothermal smelting at NML' — A. K. Vaish and D. D. Akerkar. Proceedings of the Symposium on Electrometallurgy, 1986. (Published by C.E.C.R.I./CSIR).

AWARD OF Ph.D. TO SHRI SWATANTRA PRAKASH

Shri Swatantra Prakash, based on his work on 'Non-isothermal kinetics of iron ore reduction' has been awarded Doctor of Philosophy (Engineering) by Indian Institute of Technology, Kharagpur during the 33rd Convocation held on 8th March, 1988.

We congratulate Dr. S. Prakash on this achievement.



Dr. (Mrs.) Ladawal Chotimongkol, Member, High Power Delegation from Thailand Institute of Scientific and Technological Research, is shown around NML by Major G. S. Minhas, Head (Technology Utilization)

VISITORS

1. Dr. (Mrs) Ladawal Chotimongkol, Member of the high power delegation from Thailand Institute of Scientific and Technological Research, on 9th February 1988.

2. Prof. Hsiao Tsechiang, North East University of Technology, Shenyang, China, on 12th February, 1988.

3. Prof. Neil Dirks, Pittsburg University, USA on 19th February, 1988.

4. Mr. A. Kishi, ULVAC, Japan, on 7th April, 1988.

5. Dr. Jaidev Mukherjee, Deputy Director, Central Glass and Ceramics Research Institute, Calcutta, on 5th February, 1988.

6. Dr. N. B. Prasad, Chairman, Andhra Pradesh Industrial Development Corporation, Hyderabad on 24th and 25th February, 1988.

7. Dr. P. K. Mukhopadhyay, Director, R/D, Indian Oil Ltd. Faridabad, on 29th February, 1988.

OBITUARY

We express our profound grief on the sad demise of the following staff members of the laboratory and pray for peace of the departed souls.

Shri D. Routh, Ex-Fine Mechanic, on 12th January, 1988.

Shri O. Subba Rao, Heavy Truck Driver, on 2nd April, 1988.

STAFF NEWS

WE WELCOME THEM AND WISH THEM A FRUITFUL STAY AT NML...

Shri Suchandan Kumar Das, Scientist C; Shri Purushottam Narayan Mishra, Scientist C; Shri Shiv Nandan Singh, Scientist B; Shri Shaik Ali Akbar, Scientist B; Dr. (Miss) Jyotilata Pandy, Scientist B; Dr. (Mrs) Kakali Chatterjee, Documentation Officer (B); Miss Swati Bhattacharyya, Library Officer (B); Shri Chheda Lal Jha, Foreman (B); Miss Anita Taneja, Library Assistant; and Shri Ashish Bhaduri, CSIR Fellow.

WE CONGRATULATE THEM ON THEIR PROMOTIONS...

Shri A. Papa Rao, Assistant; Shri A. K. Balakrishnan, Assistant; Shri S. K. Haldar, UDC; Sarvashri Viswanath, M. C. Mandal, A. P. Mishra, K. P. Bera, A. K. Panda and R. P. Maurya, as SPA (Gr. V).

WE WISH THEM A HAPPY RETIRED LIFE...
(Joining date in parenthesis)

Shri Sudhangsu Kumar Bose, Scientist A-1, (27-12-1948); Shri P. R. Mohanty, Fine Mechanic, Gr. II(3), (7-1-1948); Shri G. C. Mishra, Fine Mechanic Gr. II(4), (2-12-1946); Shri K. Simhachalam, Fine Mechanic Gr. II(3), (Voluntarily retired) (13-11-1954).

NML BAGS PRIZES AT THE FLOWER SHOW

NML participated in the flower show organised by the National Council of Women in India Jamshedpur Branch, on 12th February, 1988 in the following events:

Dahlia (Potted), Succulent and Cactus (Potted), Foliage Group (Potted), Cut flowers, Flori craft and Floral display (Art). We are proud to announce that like the past years, the laboratory once again bagged 18 prizes. The dedicated and hard work of the following staff members enabled us to achieve the laurels. S/Shri Sanchu, Bijoy Bahadur Singh, Mistry, Ram Khilawan Pandey, Garden Chowdhary and the supporting staff Smt. Charu, Smt. Bilasi, Smt. Sibbon, Smt. Suru, Smt. Soba, Smt. Junga, Smt. Parbati and Smt. Kailashi Bai, under the able supervision of Shri S. Sanyal and Shri M. L. Blaggan.

The NML News congratulates them and hopes that they will keep up their performance in the future also.

SOCIAL AND CULTURAL ACTIVITIES

Participants from NML, singing a song during the Cultural Festival, organised by the NML Staff Club

Prof. S. Banerjee, addressing the gathering at the Cultural Festival

NML Staff Club Activities

Staff of NML playing in Volley Ball Match, Organised by the NML Staff Club

NATIONAL YOGA COMPETITION AT RANCHI (7-10 Jan., 1988)

Dr. Ashok Kumar Vaish, Scientist, participated in the 12th National Yoga Championship as National referee, representing Bihar State. He has also been nominated as member of the Executive Committee of Yoga Federation of India.

GREAT FREEDOM RUN 1988

NML Staff Club jointly with a number of institutions, such as, Singhbhum District Amateur Atheletic Association, Tisco Welfare, C.D. & S.W. Tisco, Jamshedpur Physical Cultural Association, Adibasi Association, Mango Youth Club and Bengal Club Sakchi, organised the Great Freedom Run 1988 at Jamshedpur on 24th April, 1988 to commemorate 40 years of India's Independence. More than 12,000 persons from all parts of the city, participated in this event of national importance. The contingent of runners from Agrico Ground Centre was flagged off by Shri K. N. Gupta, Deputy Director, NML.

Shri S. K. Sharma, D. C. Singhbhum District, was the Chief Guest, during the closing ceremony at Keenan Stadium. Shri A. K. Matto, Chairman Organising Committee welcomed the gathering. Dr. A. K. Vaish, Chief Organising Secretary elaborated on the objectives of this event and Shri M. J. Shahani, Deputy Director presided over the function.

Participants in the Great Freedom Run. Shri K. N. Gupta, Deputy Director, Flagging Off the Participants at Agrico

Lighting of the Torch at the start of the Great Freedom Run, Organised by NML Staff Club

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