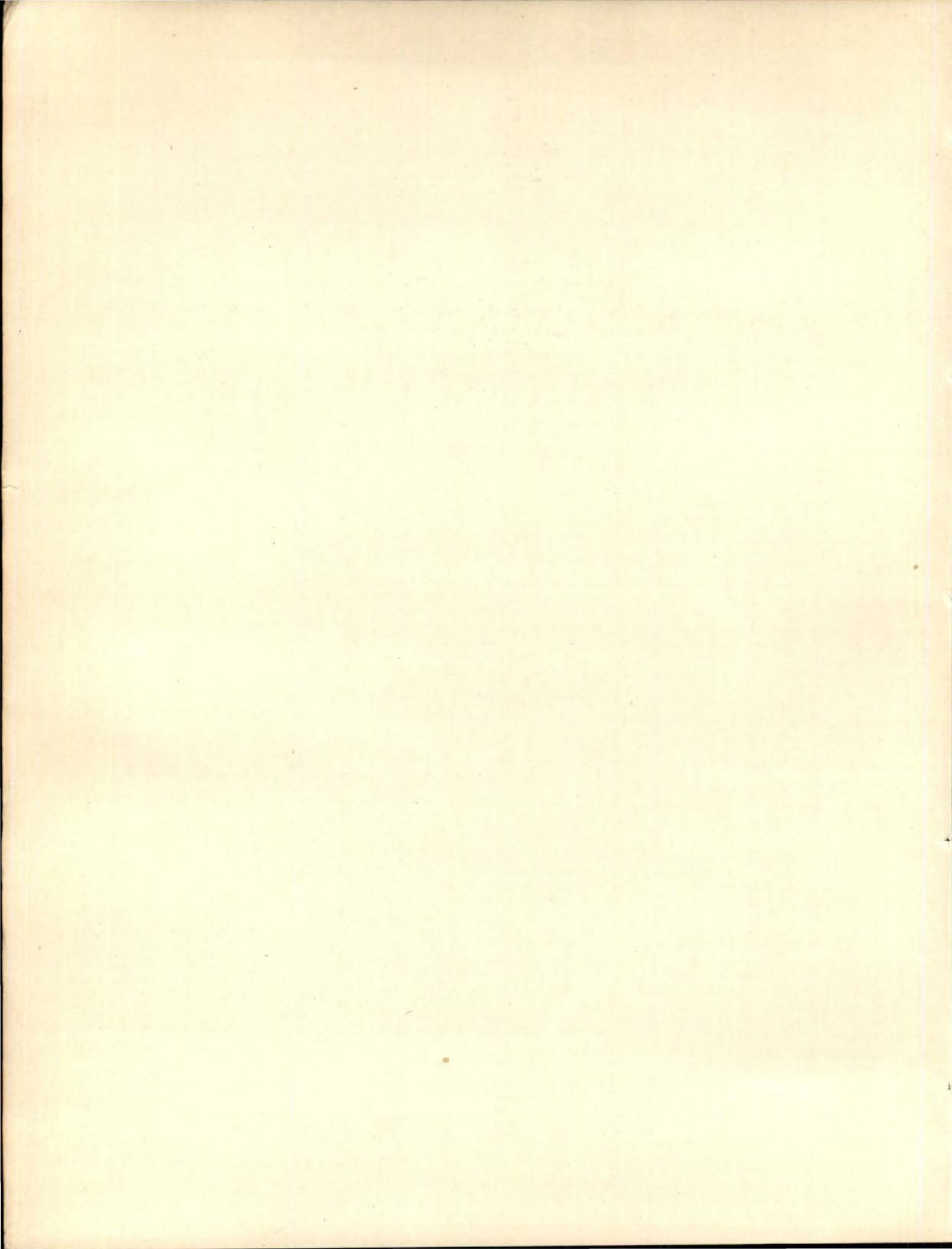




**REPORT OF THE
COMPTROLLER AND AUDITOR GENERAL
OF INDIA**

UNION GOVERNMENT
NO. 7 (COMMERCIAL) OF 1991

HINDUSTAN ZINC LIMITED





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PREFACE

The report on Hindustan Zinc Limited was prepared by an Audit Board consisting of the following members :

1. Sri K. Tyagarajan Chairman, Audit Board & Ex-officio Additional Deputy Comptroller & Auditor General (Commercial) upto 31st December 1989.

Deputy Comptroller and Auditor General (Commercial)-cum-Chairman, Audit Board from 1st January 1990 to 30th April 1990.
2. Sri A.C. Tiwari Chairman, Audit Board & Ex-officio Additional Deputy Comptroller and Auditor General (Commercial) from 1st May 1990 to 24th May 1990.

Deputy Comptroller and Auditor General (Commercial)-cum-Chairman, Audit Board from 25th May 1990 to 7th June 1991.
3. Sri P.K. Sarkar Chairman, Audit Board & Ex-officio Additional Deputy Comptroller & Auditor General (Commercial) from 8th June 1991 to 3rd July 1991.

Deputy Comptroller and Auditor General (Commercial)-cum-Chairman, Audit Board from 4th July 1991 till date.
4. Sri Kanwal Nath Principal Director of Commercial Audit & Ex-officio Member, Audit Board-III, New Delhi from 19th March 1990 till date.
5. Sri R. Hariharan Principal Director of Commercial Audit & Ex-officio Member, Audit Board, Hyderabad from 24th April 1991 till date.

6. Sri K.S. Menon Principal Director
(Commercial) and Member
Secretary, Audit Board from
2nd July 1990 till date.
7. Sri I.M. Aga Retd. Mining Advisor,
Government of India, Deptt.
of Mines, Part-time Member.
8. Sri M.V.N.R. Seshagiri Rao Retd. Chairman-cum-Managing
Director, Hindustan Copper
Limited, Part-time Member.

2. The report was finalised by the Audit Board after taking into consideration the discussions held with the Ministry of Steel & Mines, Department of Mines, on 20th August 1991 and further clarifications furnished by the Ministry.

3. The Comptroller and Auditor General of India wishes to place on record his appreciation of the work done by the Audit Board and the contribution made by the part-time Members.

OVERVIEW

I Hindustan Zinc Limited was incorporated on 10th January 1966 as a wholly owned Government Company on taking over the activities of the Metal Corporation of India Limited, with a view to exploiting the zinc-lead deposits to the fullest extent. The main products of the Company are zinc and lead and by-products are sulphuric acid, cadmium and silver. From sulphuric acid, single super phosphate and phosphoric acid are also manufactured. The identified zinc-lead resources in 1989 stood at 383 million tonnes containing 1.47 per cent lead and 4.78 per cent zinc equivalent to 5.63 million tonnes and 18.30 million tonnes of in situ lead and zinc metal respectively. The Company is at present operating six mines (including one of rock phosphate) and three smelters and is contributing 80 per cent of production of zinc and 100 per cent production of primary lead in the country. The Company's production during 1990-91 was 72,362 tonnes of zinc and 24,919 tonnes of lead which represented 44 per cent and 28 per cent respectively of the total requirement of the country. In order to reduce the likely demand supply gap, the Company has plans to raise the output of zinc to 1,49,000 tonnes and lead to 65,000 tonnes during the next decade by raising the smelting capacity by 1,05,000 tonnes i.e. 70,000 TPA of zinc and 35,000 TPA of lead.

(Paras 1.1 to 1.2.4)

II The micro objectives of the Company sent to the Department of Mines in March 1981 and again in December 1983 have not been approved so far.

(Paras 2.1 to 2.3)

III The authorised and paid up capital of the Company was Rs. 500 crores and Rs. 372.91 crores respectively as on 31st March 1991. The amount of Government loans and public deposits raised and outstanding as on 31st March 1991 were Rs. 0.14 lakh and Rs. 441.96 lakhs respectively.

(Paras 4.1 to 4.4)

IV There were time and cost overruns in the execution of various projects undertaken by the company from time to time. The delay in completion of the projects necessitated revision in the estimated costs from time to time. The cost of Balaria mine project increased from Rs. 1161 lakhs in September 1973 to Rs. 2167 lakhs in October 1977 and there was a time overrun of 10 months. The Rajpura-Dariba mine project was executed by the Company without proper engineering study and the various activities were not synchronised properly; the cost of the project increased from Rs. 4425 lakhs in February 1977 to Rs. 7830 lakhs in 1984 mainly on account of omissions of items in

the detailed project report, modification in the scope of work and under-estimation of quantities etc. Besides there was time overrun of 18 months.

(Paras 5.1 to 5.2.2)

The cost of Sargipalli Lead Mine project escalated from Rs. 1188 lakhs in January 1979 to Rs. 2092 lakhs in July 1987. The actual cost of the project was, however, Rs. 2061 lakhs and the time overrun was one year.

(Para 5.2.3)

The cost estimates of the Maton rock phosphate mine increased from Rs. 234 lakhs to Rs. 661 lakhs, inter-alia, due to inclusion of slurry pipeline, escalation, etc. The single super phosphate plant which uses rock phosphate virtually remained closed from 1988-89 since this plant was being operated only when the smelter had problems of disposal of sulphuric acid or of operation of phosphoric acid plant. The production of phosphoric acid plant which also uses rock phosphate was negligible and the Company, therefore, sold rock phosphate at a loss which amounted to Rs. 1.73 crores during nine years ending 31st March 1991. The purpose of operating Rock Phosphate Mine was, therefore, defeated. A Phosphoric Acid Plant estimated to cost Rs. 302 lakhs was completed at a cost of Rs. 447 lakhs with a time overrun of one year. In order to avoid problems in transportation of fine powder from Maton, to Debari for use in the Phosphoric Acid Plant, a slurry pipeline for transportation of rock phosphate in slurry form was commissioned in March 1983 at a cost of Rs. 267.30 lakhs. Even after commissioning of slurry pipeline, the Company continued to transport rock phosphate in dry form by road. Since 1987-88, the slurry pipeline was not in operation continuously as the phosphoric acid plant was not working due to water shortage. As the capacity utilisation of the phosphoric acid plant was very low, installing slurry pipeline for the purpose of transporting rock phosphate slurry lacked justification.

(Paras 5.2.4 to 5.2.7)

With a view to recover zinc locked in leached residue and improve zinc recovery in Debari Smelter, the Company installed in April 1985 residue treatment facilities at a cost of Rs. 1891.18 lakhs (with a cost overrun of Rs. 849.68 lakhs) and time overrun of 22 months but the guaranteed recovery had not been achieved.

(Para 5.2.8)

The cost of Vizag Zinc Smelter project increased from Rs. 2124.19 lakhs to Rs. 4689.00 lakhs and that of Vizag Lead Smelter Expansion from Rs. 620 lakhs to Rs. 862 lakhs.

(Para 5.2.9)

V. The Company had a total estimated ore reserve of 151.28 million tonnes in 1982-83 whereas the estimated ore reserve stood at 149 million tonnes in 1990-91. The decline was due to incorrect estimation in the case of West Mochia Mine and restricted extent of ore shoots as disclosed by subsequent stoping in case of Zawarmala Mine. The capacity of Zawar Group of Mines was derated from 4400 tonnes per day to 4000 tonnes per day.

(Paras 6.2 & 6.3)

At the beginning of the year 1982-83, the Company had an ore raising capacity of 12.72 lakh tonnes per annum (4240 tonnes per day) with matching milling and beneficiation facilities. With the commissioning of two more mines viz. Rajpura-Dariba and Sargipalli in 1984-85, the ore raising capacity with matching milling and beneficiation facilities was raised to 23.22 lakh tonnes per annum (7740 tonnes per day).

(Para 6.4.1)

In most of the mines as well as smelters the targets fixed were below the installed capacity and the production was even less as compared to the targets.

(Paras 6.4.2 to 6.7)

VI. The percentage of losses in transit of lead and zinc concentrates from mines to smelters as well as in inter-smelters transfers differed widely in different years and in different units. The total loss in transit during the five years ending 1990-91 was Rs. 350.03 lakhs.

(Para 6.8)

VII In many years the targets of sales could not be achieved except in the case of zinc ingots (1986-87), lead ingots (1987-88) and sulphuric acid (1986-87, 1988-89 and 1990-91). Non-achievement of sales targets resulted in carry over of huge inventories of finished goods.

(Para 7.2)

VIII The Company has not introduced integrated system of cost and financial accounts and standard costing so far despite assurances given to the Committee on Public Undertakings in November 1976. The Company attempted introduction of an integrated system of cost and financial accounts on a trial basis but did not find the benefits to be commensurate with the efforts put in.

(Para 8.1)

While in the Debari zinc smelter the cost of sales of zinc was less than the average sales realisation, in the Vizag zinc smelter the cost of sales was more than the average sales realisation in 1987-88. The cost of sales in Vizag was generally more than the cost of sales in Debari except in 1986-87. The average sales realisation of lead ingots at Tundoo smelter was more than the cost of sales except in 1986-87. At Vizag Smelter, the average sales realisation was less than the cost of sales in all the three years except in 1987-88 and 1989-90. The cost of sales at Tundoo and Vizag differed widely. The cost of sales of super phosphate was always more than its average sales realisation.

(Para 8.2)

IX Norms for consumption of stores and chemicals varied from year to year and unit to unit. The actual consumption also varied widely as compared to the norms fixed for respective years. The Committee on Public Undertakings, while observing that the Company had fixed certain norms for consumption of materials like explosives, chemicals, drill rods, etc. which were based on project reports and actual experience gained during operation of the plant, had recommended that norms for consumption of materials should be scientifically fixed based on appropriate data and got approved. This, however, was not done.

(Para 8.2.5)

Yearly norms for consumption of power in each process unit and per unit of main product and by-product were fixed by the Company. Power valued at Rs. 635.39 lakhs was consumed in excess compared to norms during the years 1982-83 to 1988-89.

(Para 8.2.6)

X The profit of the Company increased from Rs. 358.25 lakhs in 1987-88 to Rs. 8,645.03 lakhs in 1990-91. The substantial increase in the profits during these years was mainly due to increase in the selling price of zinc and lead fixed by MMTC in line with the international price of these metals.

(Para 9.2)

XI The overall stock of stores and spares which was equivalent to 7.68 months consumption in 1986-87 had come down to 6.52 months consumption in 1990-91. The non-moving/slow moving stores and spares at mines increased from Rs. 320.98 lakhs (17234 Nos.) in 1986-87 to Rs. 432.19 lakhs (19376 Nos.) in 1990-91. The Company was carrying non-moving/slow moving inventories to the extent of Rs. 629.22 lakhs (27923 Nos.) as on 31st March 1991. The Company had surplus stores and spares to the extent of Rs. 125.28 lakhs as on 31st March 1991.

(Para 10.1)

No physical verification was conducted in Vizag unit in respect of zinc and lead concentrate till 1984-85 and in respect of lead concentrate during 1986-87. In Maton mine, physical verification was not conducted during the five years upto 1987-88 even though heavy shortages were found in physical verification conducted in the years 1981-82 and 1982-83. In Sargipalli mine, physical verification of lead and copper concentrate was not conducted from 1984-85 to 1988-89.

(Para 10.2.1)

The shortages in handling and storage loss of zinc concentrates as compared to norms in the case of Debari amounted to Rs. 56.94 lakhs during 1982-83 to 1985-86 and in case of rock phosphate concentrate to Rs. 11.20 lakhs during 1982-83 to 1984-85.

(Para 10.2.2)

Moore cake worth Rs. 352.59 lakhs and neutral sand worth Rs. 300.20 lakhs were lying unmoved for the last five years (upto 31st March 1988).

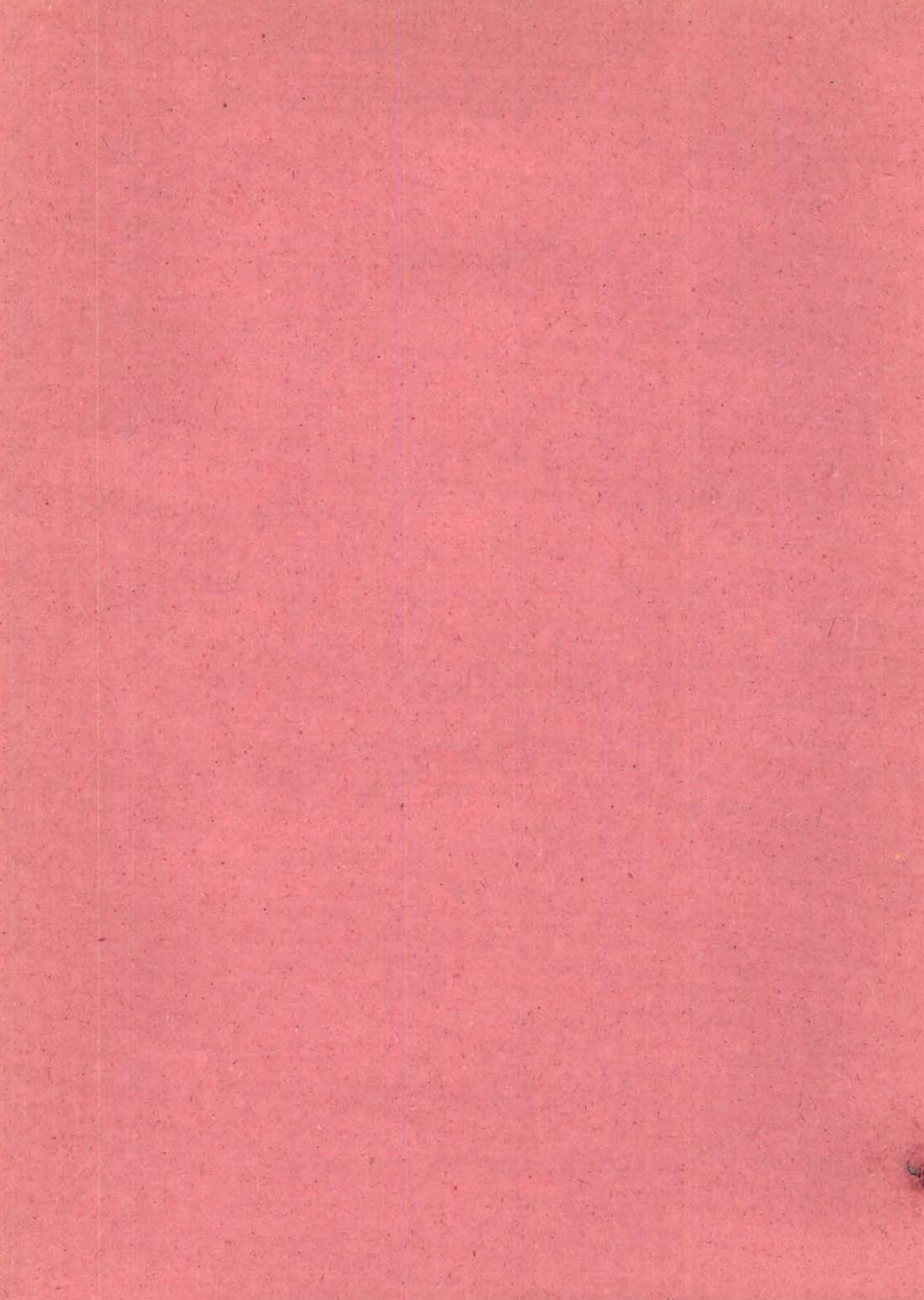
(Para 10.1.2.4)

XII There was wide variation in the overall output per manshift (OMS) at different mines. While the overall OMS was the lowest at Sargipalli being 0.65 tonne (1986-87), it was highest at Zawarmala being 3.06 tonnes (1986-87). The overall OMS was much less than DPR/consultants norms in respect of Mochia, Balaria, Rajpura-Dariba and Sargipalli mines (except in 1990-91).

(Para 11.1.2)

XIII The existing Internal Audit was not commensurate with the size and nature of the Company's business. The scope of work covered by Internal Audit was inadequate considering the rapid increase in Company's financial involvements.

(Para 12.3)



1. INTRODUCTION

1.1 Historical background

1.1.1 Zinc and lead are amongst the important non-ferrous metals for the national industrial growth. The mining of zinc and lead ores in Rajasthan was undertaken by the Metal Corporation of India Limited (MCI), a public limited company. MCI had also taken up the construction of a zinc smelter of 18,000 tonnes per annum capacity in Rajasthan. As MCI was experiencing certain difficulties, Government of India acquired (October 1965) this undertaking with a view to exploiting the zinc-lead deposits to the fullest extent and expedite the completion of the zinc smelter. The undertaking was managed by an Administrator appointed by Government till the incorporation of Hindustan Zinc Limited (Company) as a wholly owned Government Company on 10th January 1966. On the formation of Hindustan Zinc Limited, all the properties, assets, liabilities and obligations of MCI acquired by Government of India stood transferred to the Company from the date of acquisition of the undertaking.

1.1.2 The main products of the Company are zinc and lead and by-products are sulphuric acid, cadmium and silver. From sulphuric acid, single super-phosphate and phosphoric acid are also manufactured.

1.2 Demand-supply scenario

1.2.1 Ore reserves

1.2.1.1 At the time of formulation of the Seventh Five Year Plan in 1984, the country's lead-zinc resources were estimated at 360 million tonnes with 1.62 per cent lead and 4.99 per cent zinc representing equivalent in situ contents of 5.83 million tonnes of lead and 17.96 million tonnes of zinc. In the early 1980's the estimates were increased by 60 million tonnes ore due to the discovery and detailed exploration of Rampura-Agucha deposit. This deposit is of great importance to the national economy because of its rich metal content (1.93 per cent lead, 13.48 per cent zinc) and amenability to open pit mining. During this period, the Company also completed detailed exploration of Baroi deposit. Thereafter, the Geological Survey of India, Mineral Exploration Corporation Limited and the Company continued exploration in the various metallogenic belts and also initiated regional exploration of some other potential locales. As a result of this, the identified zinc-lead resources in 1989 stood at 383 million tonnes containing 1.47 per cent lead and 4.78 per cent zinc equivalent to 5.63 million tonnes and 18.30 million tonnes of in situ lead and zinc metal respectively, as per details given below :

Identified resources

	Reserves (in million tonnes)			In situ grade (Per cent)	
	Demonstrated	Possible	Total	Lead	Zinc
A. <u>Ore reserves</u> (Economically viable)					
1. Producing mines	54.40	20.76	75.16	2.27	4.95
2. Developing mines	59.36	11.87	71.23	2.13	12.68
3. Deposits under detailed exploration	13.42	7.25	20.67	1.93	4.28
Total (1 + 2 + 3)	127.18	39.88	167.06	2.17	8.16
B. <u>Conditional resources</u>					
4. Paramarginal	152.42	32.74	185.16	0.88	2.23
5. Submarginal	10.84	19.73	30.57	1.25	1.82
Total (4 + 5)	163.26	52.47	215.73	0.93	2.17
Grand total	290.44	92.35	382.79	1.47	4.78

Unidentified resources

1. Prospective	150
2. Prognostic	350

1.2.2 Demand

According to World Bank Report (1986), zinc demand is expected to rise with the growth rate of zinc consumption for the world as a whole which is estimated at 1.3 per cent per annum between 1985 and 2000 AD. While the industrialised countries are likely to show 0.5 per cent growth rate, higher increase in consumption of zinc (2.9 per cent) is expected in the developing economic regions because of accelerated growth in construction and manufacturing activities. Past trends in the consumption of zinc and lead metals in India during the period 1975-76 to 1985-86 are given in the table below :

Year	Zinc		Lead	
	Consumption (thousand tonnes)	Percentage annually compounded growth upto 1985-86	Consumption (thousand tonnes)	Percentage annually compounded growth upto 1985-86
1975-76	67	7.0	31	7.6
1979-80	106	3.4	41	8.0
1980-81	94	6.7	46	6.0
1981-82	113	3.6	52	5.7
1982-83	100	9.3	57	4.5
1983-84	120	4.1	58	5.9
1984-85	125	4.0	61	6.6
1985-86	130	-	65	-

1.2.3 Production

1.2.3.1 The Company is at present operating six mines (including one of rock phosphate) and three smelters. The table below indicates the present status of zinc/lead mines and smelters in the country :

Mine (Owner)	Type	Capacity (TPD)	Smelter (Owner)	Capacity (TPA)	
				Zinc	Lead
<u>Operating</u>					
Zawar (HZL)	UG	4,000	Debari (HZL)	49,000	-
Rajpura-Dariba (HZL)	UG	3,000	Vizag (HZL)	30,000	22,000
Sargipalli (HZL)	UG	500	Binanipuram (CBZ)	20,000	-
Agnigundala (HZL)	UG	240	Tundoo (HZL)	-	8,000
Rangpo (SMC)	UG	100			
Rampura-Agucha (HZL)	OP	3,000			
Sub-total		10,840		99,000	30,000
<u>Under implementation</u>					
			Chanderiya (HZL)	70,000	35,000

Under consideration

Ambamata (GMDC) OP	1,200		
Deri (RSMDC) UG	100		
Sub-total	<u>1,300</u>	<u>70,000</u>	<u>35,000</u>
Total	12,140	1,69,000	65,000

Indian Lead Private Limited operates a 24,000 TPA Lead Smelter based on secondary source.

Note :

SMC Sikkim Mining Corporation.

GMDC Gujarat Mineral Development Corporation.

RSMDC Rajasthan State Mineral Development Corporation.

CBZ Cominco Binnani Zinc Limited.

The Company's production during 1990-91 was 72,362 tonnes of zinc and 24,919 tonnes of lead which represented 44 per cent and 28 per cent respectively of the total requirement of the country.

1.2.3.2 The consumption of zinc and lead in India rose from 67,000 tonnes and 31,000 tonnes during 1975-76 to 1,30,000 tonnes and 65,000 tonnes respectively during 1985-86. The consumption levels of about 1,30,000 tonnes of zinc metal and about 65,000 tonnes of primary lead metal in India during 1985-86 correspond to a per capita consumption of about 0.17 Kg. for zinc and about 0.08 Kg. for primary lead metal. The per capita consumption for the world as a whole is estimated to be about 1.5 Kg. for zinc and about 1.3 Kg. for lead metal. The per capita consumption for each of these metals in developed countries is substantially higher ranging between 4 Kg. to 7 Kg. The demand of these metals in developing countries like India is expected to rise at much faster rates than in developed countries.

1.2.3.3 Indigenous supply of lead and zinc metals has been increased in the past by expansion of existing mine and smelter capacities and by creation of new facilities. But because of innumerable constraints, the demand-supply

gap could never be completely bridged. The table below gives the projections for demand and supply of Zinc and Lead from 1991-92 to 1999-2000 :

Year	Zinc (Tonnes)				Lead (Tonnes)			
	Demand	Supply	Deficit	Percentage satisfaction	Demand	Supply	Deficit	Percentage satisfaction
1991-92	1,73,000	1,44,450	28,550	83.5	94,000	72,820	21,180	77.5
1992-93	1,82,000	1,52,100	29,900	83.6	1,00,000	77,500	22,500	77.5
1993-94	1,92,000	1,52,100	39,900	79.2	1,07,000	77,500	29,500	72.0
1994-95	2,03,000	1,52,100	50,900	74.9	1,15,000	77,500	37,500	67.4
1995-96	2,13,000	1,52,100	60,900	71.4	1,22,000	77,500	44,500	63.5
1996-97	2,23,000	1,52,100	70,900	68.2	1,29,000	77,500	51,500	60.0
1997-98	2,35,000	1,52,100	82,900	64.7	1,37,000	77,500	59,500	56.6
1998-99	2,46,000	1,52,100	93,900	61.8	1,45,000	77,500	67,500	53.4
1999-2000	2,59,000	1,52,100	1,06,900	58.7	1,54,000	77,500	76,500	49.7

1.2.4 Bridging the gap

1.2.4.1 In order to overcome the deficit, the working group on non-ferrous metals recommended (1989) the following action plan :

- i) The expansion of one of the existing smelters of the Company by setting up of a separate unit with a capacity of 30,000 TPA zinc metal based on techno-economic study.
- ii) Expansion of CBZ smelter capacity from 20,000 to 30,000 TPA.
- iii) Expansion of secondary lead capacity of Indian Lead Private Limited from the existing 24,000 tonnes to their licenced capacity of 31,500 TPA.
- iv) Expansion of Agucha mine from the present level of 3,000 TPD to 4,500 TPD.
- v) Development of Ambamata, Deri and Bamnia Kalan mines to meet the shortage of lead concentrates.
- vi) Participative mining abroad for lead concentrates.

1.2.4.2 The Company stated (September 1991) as under :

To bridge the gap between demand and indigenous production, the Company's proposal for Rampura-Agucha Mine (capacity 3,000 tonnes per day) and Chanderiya Lead Zinc Smelter (70,000 tonnes of zinc and 35,000 tonnes of lead metal per annum) was approved by the Government of India in October 1988 for pre-investment activities at a cost of Rs. 21 crores for completion of engineering, preparation of firm cost estimates and commencement of construction work of Gosunda Dam. Firm cost estimates of the integrated project were prepared and submitted to Government of India in April 1988. The Government of India approved (November 1988) implementation of the integrated project at an estimated cost of Rs. 617.20 crores with a completion schedule of 30 months from the date of approval. Rampura-Agucha mining complex of the integrated project of the Company comprising the mine and beneficiation plant went on stream in March 1991 (within the projected time and cost barring statutory increase and exchange parity variation). Chanderiya Lead Zinc Smelter, which would be the largest smelter in the country, was mechanically completed on schedule. Some of the major plants had been commissioned whereas the Imperial Smelting Furnace will start producing metals in September 1991.

1.2.5 Scope of the appraisal

1.2.5.1 The working of the Company was last reviewed by the Audit Board and its results included in the Report of the Comptroller and Auditor General of India, Union Government (Commercial) 1974 - Part-III. The Audit Report was considered by the Committee on Public Undertakings and their recommendations are contained in the 88th Report (Fifth Lok Sabha) 1975-76 and Action Taken thereon is contained in the 27th Report (Sixth Lok Sabha) 1978-79.

The present appraisal covers the working of the Company for the five years ending 31st March 1991.

2. OBJECTIVES

2.1 The main objects of Hindustan Zinc Limited are :

- i) to own and manage the undertaking of the MCI acquired by the Central Government by special legislation in 1966;
- ii) to carry on trade or business of metallurgists and miners including beneficiation of minerals, mineral dressing, concentration, smelting, refining, extraction, manufacture and fabrication, purchase and sale of ores, concentrates and metals of zinc and lead in particular and their by-products of all kinds;
- iii) to explore, exploit and beneficiate minerals; and
- iv) to undertake research in fields of mining, metallurgy and engineering aspects of the lead, zinc and allied activities of the Company.

2.2 The Bureau of Public Enterprises (BPE) directed (May 1979) all the public sector enterprises to spell out their micro-objectives to facilitate realistic and meaningful evaluation by Parliamentary Committees. The Board of Directors approved (February 1981) the following basic objectives of the Company :

- i) To develop mines and smelting capacities to meet substantially the growing needs of the country for zinc and lead.
- ii) To efficiently manage all resources and ensure adequate return, to declare and maintain reasonable dividends on equity and to achieve self-sufficiency for growth.
- iii) To make efforts to locate, in cooperation with appropriate agencies, additional non-ferrous deposits keeping a 20 year perspective of the country's needs for zinc and lead.

2.3 Consistent with the above basic objectives, the Board also approved (1981) inter-alia, the following objectives of the company :

- i) To develop technological competence for efficient plant and mine operation to international norms and improved ecological standards.
- ii) To improve profitability by means of :
 - a) constant endeavour towards achieving higher productivity of financial, physical and human resources; and
 - b) adopting and improving appropriate technology and developing in-house technology by R&D; 0.5 per cent of the turn-over to be ear-marked for R&D activity.
- iii) To complete projects within specified time and cost and to achieve full capacity utilisation within two years of project commissioning.

2.4 These micro objectives were sent to the Department of Mines in March 1981 and again in December 1983 but they have not been approved so far.

3. ORGANISATIONAL STRUCTURE

3.1 The Company is under the administrative control of the Ministry of Steel and Mines (Department of Mines). Its affairs are managed by a Board of Directors headed by a Chairman-cum-Managing Director vested with the executive and administrative functions of the Company. The Chairman-cum-Managing Director is assisted by four full time functional Directors viz; Director (Finance), Director (Mining Operations), Director (Smelting Operations) and Director (Projects), three Executive Directors, seven Group General Managers and a Secretary.

3.2 The Board approved in May 1982 creation of a divisional office at Hyderabad for co-ordination and control of activities of Eastern Region, based on the recommendations of a sub-committee of the Board. The divisional system introduced from December 1982, however, did not work well as the composite divisional concept (comprising both mining and smelting units) was not considered to be conducive to efficiency. The matter was again considered by the Board in January 1986 and it was decided to revive the earlier system of functional operations. Accordingly, from May 1986, the units were put under respective Directors, i.e., Director (Mining Operations) and Director (Smelting Operations). However, the Divisional Office at Hyderabad was functioning as Liaison Office from May 1986 with a skeleton staff. The latest organisational chart is given in Annexure-1.

4. CAPITAL STRUCTURE

4.1 Authorised and paid-up capital

4.1.1 The Company was incorporated on 10th January 1966 with an authorised capital of Rs. 10 crores divided into 1,00,000 shares of Rs. 1,000 each. As on 31st March 1991 the authorised capital of the Company was Rs. 500 crores and paid-up capital was Rs. 372.91 crores.

4.2 Unsecured loans

4.2.1 The Company had obtained long term unsecured loans from Government of India. The long term loans granted by the Government carry, in addition to the normal interest, liability for penal compound interest of $2\frac{1}{2}$ per cent on all overdue instalments of principal and/or interest.

4.2.2 The Company defaulted in repayment of instalments of principal and interest in some years. As the Company faced continued acute power shortage, particularly in Rajasthan based units affecting its production and profitability since 1979-80, the Government waived in 1981-82, 1982-83 and 1984-85 Rs. 265.05 lakhs representing defaulted payment of principal, interest and penal interest.

4.2.3 In February 1986, the Company approached the Government of India for waiver of payment of interest on loan for the year 1985-86, 1986-87 and 1987-88 (about Rs. 13 crores per annum) on the grounds of additional levies imposed by Central Government/State Governments, imposition of rent of mineral land and increase in power tariff, DA neutralisation rate and maximum limit of bonus payment. The Government of India, however, sanctioned (March 1986) holiday on interest accruals and dues on Government loans amounting to Rs. 11.12 crores only for the year 1985-86.

4.2.4 All the overdue instalments of principal and interest had been paid by the Company in 1987-88. As on 31st March 1991, the outstanding loans amounted to Rs. 0.14 lakh and the interest accrued and due on loans was Rs. 274.17 lakhs.

4.3 Debt-equity-ratio

The debt equity ratio of the Company was 0.23 : 1 in 1988-89 and 1989-90 and 0.50 : 1 in 1990-91.

4.4

Public deposits

In 1979-80 the Company was permitted by Government of India to raise deposits from the public under the Companies (Acceptance of Deposits) Rules, 1975. As on 31st March 1991, the amount of public deposits stood at Rs. 441.96 lakhs.

5. PROJECT IMPLEMENTATION

5.1 There were time and cost over runs in the execution of various projects undertaken by the Company from time to time as indicated in the following table :

Name of the Project	Instal- led Capa- city (Tonnes)	Date of <u>commissioning</u> Sche- duled		Time over run (mon- ths)	Original estimated sanct- ioned cost	First revised estimated cost	Second revised estimated cost	Actual cost	Cost over run with reference to origin estimates
		Actual	Actual						
Balaria Mine	2000 TPD	Dec., 1976	Oct., 1977	10	1161.00	2074.19	2202.91	2166.95	1005.95
Rajpura Dariba Mine	3000 TPD	Sep., 1982	March 1983 Mar. 1984 (Stoping)	6 18	4425.00	7284.00	7830.00	7830.00	3405.00
Sargi- palli Lead Mine	500 TPD	1982- 83	April 1984	12	1188.00	1789.08	2092.00	2061.00	873.00
Maton Rock Phosphate	600 TPD	May 1974	Jan., 1974 (Mine) Jan. 1976 (Mill)	Nil 19	234.37	488.00	612.00	661.00	426.63
Debari Zinc Smelter Expansion	27000 TPA (Zinc)	March 1975	Sept., 1976 to April, 1977	18 25	1049.00	2992.94	-	2990.00	1941.00
Phos- phoric Acid Plant	26000 TPA	Aug., 1977	Aug., 1978	12	301.60	354.64	-	446.82	145.22
Leach Residue Treatment Plant	-	June 1983	April 1985	22	1041.50	1874.60	-	1891.18	849.68
Vizag Zinc Lead Smelter	30000 TPA(Zinc) 10000 TPA(Lead)	Dec., 1976	March 1977 Jan., 1978	2 12	2124.19	4725.00	-	4689.80	2565.61

(Rs. in lakhs)

Lead Smelter Expansion (Vizag)	10000 TPA	June 1983	June 1983	-	620.00	848.00	-	862.00	242.00
Mercury Removal Plant	-	March 1985	March 1986	12	225.00	225.00	-	154.17	-

- i) Leach Residue Treatment Plant.
As per Ministry, the Plant was installed mechanically in time but guarantee tests were delayed till April 1985.
- ii) Mercury Removal Plant.
Mechanically completed in February 1985 but guarantee tests were conducted in March 1986

The delay in completion of the projects necessitated revision in the estimated cost from time to time mainly on account of cost escalation, change in the scope of work and increase in statutory levies, etc.

5.2 The time and cost overruns in each project are discussed in the succeeding paragraphs.

5.2.1 Balaria Mine

5.2.1.1 The scheduled date of completion of the project was December 1976. It was, however, completed in October 1977. The time overrun of 10 months was attributed (May 1989) by the Management to late receipt of Government sanction. The increase in project cost by Rs. 92.76 lakhs over the revised estimated cost of Rs. 2,074.19 lakhs was mainly in plant and machinery (Rs. 64.78 lakhs), mine development, pre-production interest and expenses (Rs. 42.82 lakhs) and land and civil works, etc. (Rs. 28.94 lakhs) and decrease in expenditure on utilities and services, etc. (Rs. 43.78 lakhs). The cost overrun was attributed (May 1989) by the Management to escalation, change in scope after detailed engineering and fiscal changes.

5.2.1.2 The Ministry stated (April 1991) as under :

"The completion schedule of December 1976 was based on assuming Government sanction of the project by February 1973. The actual sanction was issued in September 1973. Reckoned from this date, the project was completed in four years' time as per schedule."

5.2.1.3 In this connection, it may be mentioned that in October 1970, the Government had approved an expenditure of Rs. 232.85 lakhs to be incurred during 1970-71 and 1971-72 for the completion of the essential items of work like sinking of auxiliary shaft and development of two horizons at Balaria Mine and for the exploratory mining at Mochia. The contract for Balaria shaft sinking and Mochia Balaria interconnecting drivage work was also awarded in June 1972. In view of this there was no justification for the time overrun.

5.2.2 Rajpura Dariba Mine

5.2.2.1 The time overrun was due to late completion of some of the key component activities.

5.2.2.2 The cost overrun of Rs. 3,403 lakhs compared to the original estimate was due to the following reasons :

	Amount (Rs. in lakhs)
i) Omission of items	338.00
ii) Changes/modifications in the scope of work	215.00
iii) Under-estimation of quantity	85.00
iv) Price escalation	2003.00
v) Financial charges	125.00
vi) Due to time overrun	637.00
Total :	<u>3403.00</u>

The Management stated (June 1989) that changes in the scope of work were, inter-alia, due to delineation of ancient workings as approved by DGMS (Rs. 18.50 lakhs), development of trial stopes to conduct studies of rock mechanics, determination of dimension of stopes, etc. (Rs. 25.37 lakhs) establishment of primary underground crusher (Rs. 49.62 lakhs) and advancement of north lode development (Rs. 63.56 lakhs).

5.2.2.3 As the Company was having an underground crusher at Zawar mines and was aware of its advantages, the crusher could have been provided for in the original estimate.

5.2.2.4 Certain deficiencies were also noticed in the execution of this project. These are discussed in the succeeding paragraphs.

5.2.2.4.1 M/s Rio Tinto Zinc consultants (RTZ) of U.K. were engaged (November 1971) to undertake techno-economic and conceptual engineering study for the development of the mine. Based on the report submitted by the consultants in August 1972 the Company submitted (March 1973) a proposal to the Government for the development of the mine with a capacity of 3,000 TPD with a matching beneficiation plant. In the report submitted by the consultants it was clearly mentioned that it was in no way a definite feasibility study. Government approved the Company's proposal, in principle, and accorded sanction (October 1973) for incurring an estimated expenditure of Rs. 198 lakhs on essential items of preliminary works subject to the following conditions :

- (i) The Company should submit firm estimates for consideration of PIB; and
- (ii) Necessary further tests should be carried out and additional data collected as early as possible.

5.2.2.4.2 The Company, however, informed (November 1973) the Government that the report prepared by the consultants and further elaborated by the Company was more than a feasibility report and no further data were needed. Government approved (March 1974) an estimate for Rs. 1953 lakhs based on the techno-economic study of the consultants. Further, revised estimates for Rs. 4,425 lakhs in February 1977 and Rs. 7,284 lakhs and Rs. 7,830 lakhs in 1980 and 1984 respectively were also sanctioned by Government inspite of the BPE pointing out (August 1976) the Company's failure to (a) carry out essential items of preliminary work including shaft sinking for the first two years and (b) submit firm proposals regarding the shape of the project.

5.2.2.4.3 The failure of the Company to prepare a detailed feasibility report and firm cost estimates in the beginning resulted not only in repeated revision of project cost estimates but the project had also to be executed without proper engineering study. One of the deficiencies pointed out by the consultants viz. bad ground conditions due to hanging wall mica schist was also not taken into account with the result that the Company suffered shortfall in production of 1.88 lakh tonnes, 1.40 lakh tonnes and 0.68 lakh tonnes respectively during the years 1986-87 to 1988-89 (vide para 6.4.2 and Annexure II). It was also realised by the Management in January 1987 that with better input of geotechnical data for design of mine opening and stoping, considerable problems currently being faced at the mines could perhaps have been minimised.

5.2.4.4 With a view to overcoming the bad ground conditions and achieving the installed capacity of mine production, the Company decided to introduce "vertical crater retreat" mining and accordingly entered into an agreement with M/s INCOTECH of Canada in November 1987. Certain recommendations were made in the consultant's report of March 1989 regarding mining methods.

The Management stated (September 1991) that the Company had successfully introduced this new technique of bulk mining. The blasting of first slice of ore by spherical charge ushered in an era of new bulk mining technology, not only in the Company but in the country as well. This has resulted in achievement of new peaks in the mine output during the year 1990-91 and thereby the Company gained considerable confidence in the successful adoption of the new mining technique which will ensure higher production and safety of men.

The production at the mines increased subsequently as detailed below :

<u>Year</u>	<u>Production (MTs)</u>
1988-89	3,82,195
1989-90	3,85,013
1990-91	5,11,641

5.2.2.4.5 It was seen that the Ore Beneficiation Plant (the activity which follows ore raising) was completed much ahead of the mine development and stoping with the result that the investment made on the Plant remained blocked till the completion of mine development. The Management attributed (January 1987) delay in mine development to delay in stoping permission by DGMS. It was, however, seen that out of 26 permissions sought for various mining activities by the Management there was delay in granting permission only in five cases and the delay ranged between 7 to 23 months. The main delay in completion of the project was, however, in commissioning of cage and skip by MAMC. It is of interest to note that the COPU had also commented upon lack of synchronisation of different activities taken up by the Company in connection with the implementation of an integrated scheme (vide 99th COPU Report 1975-76 [Fifth Lok Sabha]). Accepting the above recommendation, the Ministry of Steel and Mines directed (August 1976) that for additional capacities of Zinc-Lead production adequate steps may be taken well in time by the Company to ensure optimum synchronisation of different activities of the project in future.

5.2.3 Sargipalli Lead Mine

5.2.3.1 The Government of India accorded (January 1979) sanction to the development of Sargipalli lead ore deposits at an estimated cost of Rs. 1,188 lakhs (including foreign exchange component of Rs. 84.02 lakhs). The estimates were revised to Rs. 1,789.08 lakhs (including foreign exchange component of Rs. 71.46 lakhs) which were approved by the Government of India in November 1981.

5.2.3.2 The increase in cost was attributed by the Management mainly to escalation (Rs. 535.68 lakhs), inadequate provision and omissions (Rs. 48.08 lakhs) and change in scope (Rs. 16.01 lakhs).

5.2.3.3 The cost estimates were again revised (August 1984) to Rs. 2,092 lakhs which were approved by Government in July 1987. The further increase in cost by Rs. 303 lakhs was mainly due to escalation (Rs. 241.92 lakhs) and cost of time overrun (Rs. 58.66 lakhs), etc.

5.2.3.4 Production incline

The work of production incline at an estimated cost of Rs. 90.07 lakhs was awarded to Bharat Gold Mines Limited (BGML) in December 1979 and was to be completed by 24th April 1982. The work, however, was completed only in March 1986 at a cost of Rs. 93.21 lakhs. Owing to delay in completion of production incline and lack of development, the Company could not raise a ventilation shaft as originally proposed and had to sink the same at a cost of Rs. 24.10 lakhs approximately which could have been avoided had the work been completed in scheduled time. Apart from this avoidable expenditure, the Company suffered loss in production of ore in 1984-85 and 1985-86.

5.2.3.5 The Management stated (May 1989) that the main reasons for delay in completion of production incline were relatively higher depth of alluvium than anticipated and weak ground conditions exposed during excavation necessitating major design change resulting in substantial increase in quantity of concreting for support thereby affecting the time schedule.

5.2.3.6 The delay in completion of the work, according to BGML, was, however, due to non-compliance by the Company in the matter of production of drawings, shortage of power, supply of winding machine, provision of accommodation and a host of other technical reasons. Claims for Rs. 11.79 lakhs (approximately) were also raised against the Company by BGML on various grounds and these were awaiting settlement. No claim, however, was made by the Company against BGML for the extra expenditure of Rs. 24.10 lakhs incurred by the Company in sinking ventilation shaft.

5.2.4 Maton Rock Phosphate Mine

5.2.4.1 This mine was developed for production of 600 MTD of run-of-ore mine and 300 MTD of beneficiated rock phosphate to meet the requirement of rock phosphate for Single Super Phosphate and Phosphoric Acid Plants which were installed to consume the surplus quantity of sulphuric acid (a by-product). While the mine went into production in January 1974, ore dressing plant could be commissioned only in January 1976 as against the scheduled date of commissioning of May 1974 due to inordinate delay by the contractor.

5.2.4.2 The cost estimates were revised thrice from Rs. 234.37 lakhs to Rs. 488 lakhs in 1976-77, Rs. 612 lakhs in 1977-78 and Rs. 661 lakhs in 1982-83. The increase of Rs. 426.63 lakhs in the project cost compared to the original estimate was mainly due to inclusion of slurry pipeline (Rs. 148.50 lakhs), escalation (Rs. 104.70 lakhs) and desliming section (Rs. 32.00 lakhs).

5.2.4.3 Although the rock phosphate mine started operations in January 1974 as per schedule and the ore dressing plant was also commissioned in January 1976 the rock phosphate produced could not be used for the production of single super phosphate and phosphoric acid as the single super phosphate plant virtually remained closed from 1988-89. Moreover the production of phosphoric acid plant was negligible. The Company had, therefore, to sell rock phosphate and suffer a loss of Rs. 172.61 lakhs during the nine years upto 1990-91. The purpose of operating rock phosphate mine by the Company was, therefore, defeated.

As regards stoppage of production of single super phosphate from 1988-89 the Management stated (May 1989) that this plant was being operated only when the smelter had problems of disposal of sulphuric acid or of the operation of phosphoric acid plant (vide para 6.6.1.7).

5.2.5 The predominant feature that was observed in the projects of the Company was absence of dependable estimates of costs of projects and time of completion. These deficiencies resulted in cost and time overruns in each case.

5.2.6 Phosphoric Acid Plant

5.2.6.1 The Phosphoric Acid Plant at Debari was set up as a part of Debari Zinc Smelter Expansion Scheme. The original estimated cost of Rs. 301.60 lakhs for the Phosphoric Acid Plant approved by Government was revised to Rs. 354.64 lakhs in November 1977. The increase of Rs. 53.04 lakhs was due to increase in quantities after detailed engineering (Rs. 27 lakhs), price escalation (Rs. 13.50 lakhs) and pre-production interest and general overheads (Rs. 12.54 lakhs). The plant was mechanically completed in August 1978 against the schedule of August 1977 at a cost of Rs. 446.82 lakhs.

5.2.6.2 The time overrun of one year was attributed (December 1977) by the Management to delay in supply of indigenous equipment due to strike at suppliers work, delay in supply of rubber lining and late receipt of imported materials.

5.2.6.3 Non-achievement of guaranteed recovery efficiency

The contract for supply, erection and commissioning of phosphoric acid plant was awarded to M/s Krebs & Cie, Paris and Krebs & Cie (India) Private Limited, Calcutta in April 1975 on turnkey basis. The principals at Paris were to supply technical know-how and the Indian firm was to execute the contract.

5.2.6.4 In addition to the delay of one year in the mechanical completion of the plant, the commissioning of the plant was further delayed since trial runs conducted in January 1979 and June 1979 could not establish the recovery efficiency of 98 per cent guaranteed by the contractor. It was, therefore, mutually agreed between the contractor and the Company in June 1980 :

- i) to extend the warranty period for the phosphoric acid plant till 2nd June 1980;
- ii) to conduct demonstration tests before 31st March 1981, subject to certain conditions, and to establish recovery efficiency of 98 per cent;
- iii) to levy penalty or to pay bonus, as the case may be, in the event of decrease/increase in the recovery efficiency over the efficiency achieved in the trial runs conducted in June 1979; and
- iv) to carry out certain modifications.

5.2.6.5 While the modifications envisaged were carried out in December 1983 at a cost of Rs. 5.12 lakhs, the demonstration tests were further delayed and were conducted during the period 13th January 1985 to 17th January 1985. Even these protracted demonstration tests could establish recovery efficiency between 73.167 per cent and 96.049 per cent against the guaranteed efficiency of 98 per cent. The lower efficiency achieved during the tests conducted in June 1979 attracted a penalty of Rs. 2.85 lakhs and FF 1,36,294.86 and FF 10,570 (payable in equivalent Indian Rupees) since the efficiency achieved at that time was 95.67 per cent. The penalty payable was reduced to Rs. 2.34 lakhs and FF 1,11,859.79 plus FF 8,675

based on 96.049 per cent efficiency achieved in the tests conducted in January 1985. The test results of January 1985 were accepted in view of certain operational abnormalities in the plant pointed out by the contractor. The Company, however, withheld the amount of penalty recoverable as per the test results of June 1979.

5.2.6.6 Although the General Manager, Debari Smelter recommended in February 1985 that the contractors should be asked to take up corrective measures to set right the operational abnormalities pointed out by them, no corrective action was taken so far. The Ministry stated (April 1991) that the deficiencies would be investigated and remedial action, if required, taken after commissioning of the Chanderiya Smelter and the production of sulphuric acid.

5.2.7 Slurry pipeline scheme

5.2.7.1 In order to avoid problems in transportation of fine powder from Maton to Debari for use in the phosphoric acid plant, the Board approved (September 1979) a scheme of construction of slurry pipeline for transportation of rock phosphate in slurry form. The slurry pipeline was commissioned in March 1983 at a cost of Rs. 267.30 lakhs. M/s Krebs (Paris), the foreign contractor, who had constructed the phosphoric acid plant, indicated that rock phosphate in the form of slurry could be used as feed material in the phosphoric acid plant. The second guarantee test run, therefore, was carried out with wet feed system and the recovery achieved with wet feed guarantee test was higher than the recovery achieved in the first guarantee test with dry system.

5.2.7.2 However, the high recovery claimed to have been achieved in the second guarantee test with the wet feed system is to be viewed in the light of the fact that the results of only two samples as against the average of seven samples were taken during the second guarantee test. The quantity of rock phosphate transported in dry form and through the slurry pipeline for use in the phosphoric acid plant during 1983-84 to 1990-91 is given in the table below :-

Year	Dry form	Slurry (through pipeline)
-----	----- (in tonnes)	
1983-84	34682	14671
1984-85	19812	9098
1985-86	7407	14449

1986-87	-	14389
1987-88	-	584
1988-89	-	792
1989-90	-	3374
1990-91	83.309	-

5.2.7.3 Even after commissioning of slurry pipeline in 1983-84 the Company continued to transport rock phosphate in dry form by road. Since 1987-88 the slurry pipeline was not in operation continuously as the phosphoric acid plant was not working due to water shortage. The Management stated (May 1989) that with the coming up of Chanderiya plant, the phosphoric acid plant and slurry pipeline might be used.

5.2.7.4 The capacity utilisation of the phosphoric acid plant was as low as 19 per cent in 1983-84, 0.80 per cent in 1984-85, 0.80 per cent in 1988-89, 3.24 per cent in 1989-90 and 0.30 per cent in 1990-91. The investment in the phosphoric acid plant and slurry pipeline for the purpose of transporting rock phosphate slurry lacked justification as is evident from the poor utilisation of capacity in phosphoric acid plant and slurry pipeline.

5.2.8 Leach residue treatment plant

5.2.8.1 In the 45,000 TPA capacity Debari Zinc Smelter, the indicative overall recovery of zinc was about 84 per cent and about 12.5 per cent of zinc in the blend was tied up in leached residue ever since the commissioning of plant in 1968. In order to recover the zinc locked up in leached residue and to improve zinc recovery in Debari Smelter (so as to match the recovery with international norm), the Company decided to instal residue treatment facilities for treatment of leached residue. It was expected that losses of zinc in leached residue would come down from 12.5 per cent to 3.5 per cent, besides increase in recovery/production of other metals like cadmium and silver. The rated capacity of zinc was expected to go up to 49,000 TPA (93 per cent recovery), silver 8.5 TPA and gold 10 Kg. per annum. While the rated capacity of zinc and silver has been established as envisaged, that of gold could not be established so far as the process was still at laboratory stage.

5.2.8.2 In January 1980, the Government approved the project at a total cost of Rs. 1,041.50 lakhs and desired submission of firmed up cost estimates. The firm estimates for Rs. 1,874.60 lakhs were submitted in July 1982 against which an expenditure of Rs. 1,891.18 lakhs was incurred.

The Management, while attributing (March 1987) increase in project cost to escalation, under-estimations and omissions, stated that the latter were due to changes in process parameters which were essential for successful implementation.

5.2.8.3 The project was due for completion in three years from the effective date of contract, i.e., by June 1983. The guarantee tests for residue treatment plant were, however, conducted in April 1985 and of silver recovery in October 1985. The Management attributed (March 1987) the delay of 22 months in the case of Leach Residue Treatment Plant and 27 months in the case of silver recovery plant to poor and erratic power supply (leach residue treatment) and change from indigenous to imported filter cloth (silver recovery plant).

5.2.8.4 The leach residue treatment plant and silver recovery plant were accepted after guarantee tests in April 1985 and October 1985 respectively. The guaranteed zinc recovery was 96.2 per cent against which average recovery of four days was 95.91 per cent, entailing a penalty of 2 per cent of contract price (viz. Rs. 1.60 lakhs) which was not levied for the following reasons :

i) non-maintenance of ratio of stock-pile and due to tailing door limitation and low consumption of neutral overflow in the down stream facilities;

ii) excess addition of lime in Mitsubishi Metal Corporation, Japan (MMC) process which increased solid content to be filtered; and

iii) thickness of jerosite cake being more than 10 mm, water soluble zinc was higher requiring better filter cloth, hence cake thickness below 10 mm could not be achieved.

5.2.8.5 The Management stated (May 1989) that for some months in 1985-86 and 1986-87 the recovery efficiency was over 91 per cent and in 1987-88 over 92 per cent. Recovery efficiency achieved in 1988-89 was, however, 86.63 per cent. Thus, it may be seen that the guaranteed recovery of 96.2 per cent had not been achieved.

The Ministry stated (April 1991) as under :

"The anticipated overall recovery of 93 per cent for zinc was based on the guaranteed recovery figure 96.2 per cent from zinc calcine to neutral over-flow, against which the recovery efficiency achieved was 90 per cent in 1985-86 and 1986-87; although in some months the recovery efficiency was 91/92 per cent. The lower recovery efficiency in subsequent years has been mainly due to inadequate availability of water, especially because of drought conditions prevailing in Rajasthan. Besides non-availability of required power also contributed to non-operation/partial operation of the plant."

5.2.8.6 The Ministry's reply is to be viewed in the light of the following :

i) The Company purchased 60.55 lakh cum. of water costing Rs. 390.56 lakhs during the years 1986-87 to 1989-90 to operate Zinc Smelter, Debari.

ii) According to the Company (September 1991) as a result of good monsoon in 1988 followed by very good monsoon in 1989 and 1990, the water position in Rajasthan based units of the Company was quite comfortable.

iii) In April 1986, the Board of Directors decided to place an order for 5 MW DG set on M/s Jyoti. In this connection, it may be mentioned that COPU in its 44th Report 1968-69 (Fourth Lok Sabha) had recommended that no project or expansion of a project should be undertaken in future unless power supply was assured with a guarantee where it was to be supplied by another authority to the project. This recommendation was accepted by the Government and follow up instructions issued in December 1969.

5.2.8.7 In the Audit Board meeting held in August 1991 with the representatives of the Ministry, the Chairman and Managing Director of the Company mentioned that the norm could not be achieved on account of increase in silicon content; water was also not available as the same was used for the production of zinc rather than for the Leach Residue Plant.

5.2.8.8 Since separate records for production of zinc from zinc concentrate and from leach residue plant were not maintained, the actual efficiency of the plant could not be assessed in Audit. The Management stated (May 1989) that it was technically not feasible to keep separate records for zinc production from calcine (roasted zinc concentrates) and residue generated from leaching plant. The Management further stated (May 1989) that the leach residue treatment plant operations were required to be closely integrated with the balance zinc hydro-metallurgical stream to derive the maximum benefit in terms of recovery efficiency, and that due to acute water and power scarcity, the available water and power had necessarily to be diverted to the main zinc plant resulting in non-operation/partial operation of the plant which in turn affected the overall zinc recovery efficiency.

5.2.9 Vizag Zinc Lead Smelter

5.2.9.1 The original capital cost of the Vizag Zinc Lead Smelter project was Rs. 2,124.19 lakhs against which the actual cost was Rs. 4,689.00 lakhs. The original cost of

lead smelter expansion was Rs. 620 lakhs against which the actual cost was Rs. 862 lakhs.

The Management stated (June 1989) that cost of Vizag zinc lead smelter increased due to (i) increase in roaster capacity from 170 TPD to 227 TPD, (ii) increase in lead smelter capacity from 2,000 MT to 10,000 MT, (iii) consequent increase in sulphuric acid capacity from 140 TPD to 220 TPD and (iv) provision of waste heat boiler for recovery of heat value as steam at roaster outlet.

5.2.9.2 Cobalt recovery plant

The Management stated (September 1991) that they had successfully commissioned the above plant for recovery of cobalt and copper from the residues generated during the zinc smelting process using solvent extraction techniques developed by in-house R&D in association with BARC. Further cobalt recovery plant, which was the first of its kind in the country, was put up in CRDL, Debari for production of around 18,000 kg. of cobalt metal per annum and that the plant had been taken on stream in March 1991. This had added a new dimension to the multimetal character of the Company.

6. PRODUCTION PERFORMANCE

6.1 The two main products produced by the Company are zinc ingots and lead ingots. Different by-products and joint products also arise in the course of production. Production involves different stages, the first stage being extraction of ore containing zinc and lead from the mines. Ore is then beneficiated by crushing, screening and milling to produce zinc and lead concentrates. The concentrates are then treated in zinc and lead smelters to produce zinc and lead as main products; sulphuric acid, cadmium, zinc sulphate, copper sulphate are produced as by-products in the zinc smelter and silver as a by-product in the lead smelter. Single super phosphate is produced as a down-stream product to utilise the sulphuric acid in the Zinc Smelter complex.

6.2 The mining activities of the Company comprise of proving ore by exploration, development of stopes, raising of ore, its beneficiation and preparation of concentrate. The Company has six mines with a total estimated ore reserve of 151.28 million tonnes in 1982-83. While the estimated reserves declined in some mines, the same increased in some mines and the total ore reserve stood at 149 million tonnes in 1990-91. There was steep decline in the estimation of ore reserves in the following mines :

- i) West Mochia Mine - from 11.19 million tonnes in 1982-83 to 6.49 million tonnes in 1990-91 due to incorrect estimation; and
- ii) Zawarmala Mine - from 17.78 million tonnes in 1982-83 to 8.93 million tonnes in 1990-91 due to restricted extent of ore shoots as disclosed by subsequent stoping.

The Management stated (May 1989) that the results of preliminary exploration indicated only the potential and the subsequent detailed exploration and mine development in Mochia as well as Zawarmala mines revealed the continuity of ore shoots as limited. This resulted in downward revision of reserves.

6.3 The Balaria and Mochia mines each have a capacity of 2,000 tonnes per day and Zawarmala mines 400 tonnes per day, i.e., 4,400 tonnes per day for the Zawar Group of Mines. However, the capacity was derated to 4,000 tonnes per day for which Government's approval was not obtained. The Ministry stated (April 1991) as follows:

"Mochia Mine is one of the mines of Zawar group and the combined capacity of Zawar group of mines is 4,000 tonnes per day. The mines get depleted over time and replacement mines are opened to maintain production level. Zawar group of mines will, therefore, continue to

have a capacity of 4,000 tonnes/day after making provision for opening or replacement of mines where required. In mining venture action for the replacement is a normal practice".

6.4 Installed capacity and production of mines

6.4.1 At the beginning of 1982-83 the Company had an ore raising capacity of 12.72 lakh tonnes per annum (4,240 tonnes per day) with matching milling and beneficiation facilities. With the commissioning of two more mines viz. Rajpura-Dariba and Sargipalli in 1984-85, the ore raising capacity with matching milling and beneficiation facilities was raised to 23.22 lakh tonnes per annum (7,740 tonnes per day).

6.4.2 The installed capacity, targets fixed for raising of ore viz-a-viz actual production in respect of each mine are given in Annexure II. It would be seen from the annexure that there was shortfall in ore production in all the mines in each of the five years 1986-87 to 1990-91. The shortfall in Rajpura Dariba, Agnigundala and Sargipalli Mines was considerable ranging between 5.25 per cent and 34.24 per cent in Rajpura-Dariba, 10.55 per cent and 19.29 per cent in Agnigundala and 7.08 per cent and 23.54 per cent in Sargipalli mines. The targets of production fixed were also considerably less than the installed capacities except in Agnigundala mines. In Rajpura Dariba mines, the utilisation of capacity was very low during the three years 1986-87 to 1988-89, the percentage of production to installed capacity being 40.19, 44.46 and 42.47 respectively. In Sargipalli mines the utilisation of capacity ranged between 57.60 per cent (1986-87) and 92.06 per cent (1990-91), in Agnigundala between 78.26 per cent (1988-89) and 100.80 per cent (1986-87) and in Zawar mines between 77.92 per cent (1987-88) and 87.09 per cent (1990-91). Fixation of targets consistently below the installed capacities in these cases virtually amounted to deration of capacity in these mines without the approval of Government.

6.4.3 The shortfall in production was attributed (May 1989) by the Management to the following reasons :

- i) Power restrictions, bad ground conditions and sudden caving in of strata (Zawar mines).
- ii) Restrictions imposed due to poor ground conditions for safety reasons (Rajpura-Dariba).

- iii) Though development of stopes at various levels were ready by March 1984, the production incline (second track) was handed over by the contractors only in March 1986 against the schedule of March 1984 (Sargipalli)
- iv) Power restrictions, equipment break-down, labour problems and other reasons (Agnigundala).

The Ministry stated (April 1991) :

"The annual targets of ore production were fixed based on anticipated ground conditions, area available for stoping and availability of power and water. The production from Rajpura-Dariba Mine was affected due to ground conditions being even poorer than anticipated. Intensity of support in the form of cable bolts had to be increased, with experience. The increase in the intensity of cable bolts used as support resulted in longer time cycle, affecting the ore production from the stopes. As a long term solution to the poor ground conditions of the Rajpura-Dariba Mine, Vertical Crater Retreat (VCR) mining has been introduced which ensured working conditions with higher productivity. With the adoption of the VCR method, the production has shown an increasing trend."

6.5 Recovery efficiency at mines

6.5.1 The data regarding quantity of ore treated, metal contents, concentrates produced, percentage of recovery and norms of recovery as per DPR/Budget during the five years ending 31st March 1991 are given in Annexure III. It may be seen from the annexure that norms for recovery were not fixed for some mines. The actual recovery was less than the norms for zinc in the case of Zawar mines in 1986-87 and 1987-88 and in the case of Rajpura Dariba mines during 1986-87 to 1990-91. The recovery of lead in the case of Sargipalli mines was less than the norms during the years 1986-87, 1987-88 and 1988-89 and in Zawar mines during 1987-88, 1988-89 and 1990-91.

The low recovery efficiency was attributed (May 1989) by the Management to the following reasons :

Lead Concentrates

i) Zawar

The minerology and characteristics of ore produced from three mines, i.e., Mochia, Balaria and Zawarmala was different and so was the recovery. While Balaria and Zawarmala ore contained high pyrites and less

lead, the Mochia mines ore contained high lead and less pyrites and the microscopic examination of ore of the above mines showed that the Balaria mine ore was of finer grain than Mochia resulting in lower recovery thereby affecting the overall recovery. Increased proportion of pyrites in the feed required increased use of pyrite depressant which, while depressing the pyrite, also carried away with it a certain quantity of lead. The proportion of pyrite in the mill feed increased due to increased quantity of ore from Balaria and Zawarmala. The net result of increase in pyrite content and decrease in lead grade, therefore, affected the lead recovery of Zawar mine.

ii) Sargipalli

In the case of recovery efficiency of lead concentrate at Sargipalli, plant operation took time to stabilise and, thus, recovery efficiency was lower in the first year and the same improved in subsequent years. Further, the grade in the project report was average for the life of the mine and recovery of lead in concentrate had been affected due to lower lead in ore than envisaged in the detailed project report.

Zinc concentrate

i) Zawar

Since there was direct correlation between minerology and recovery, the zinc recovery was affected due to higher pyrite content, which when depressed carried away with it inter-locked zinc particles, thus affecting recovery.

ii) Rajpura Dariba

The recovery depended on minerology, steady power, quality of water, etc.

It is evident from Management's reply that the above factors were not taken into consideration while fixing realistic norms for recovery.

The Ministry stated (April 1991) as under :

"The recovery norms were fixed after giving due consideration to various factors which could be anticipated. There were certain factors which were difficult to anticipate in the beginning of the year itself. Besides, the norms were always fixed at a level which could be challenging and required considerable effort to achieve."

The Management further stated (September 1991) that instream analyser and computerised process control system was commissioned at the Balaria concentrator of Zawar Group of Mines in March 1989. With the stabilisation of the system, it had lead to significant improvements in the grade of concentrates, recovery of lead, zinc and silver metal values besides reduction in consumption of reagents, resulting in substantial savings during the years 1989-90 and 1990-91. With the experience gained with the successful operation of this system, the Company had already taken action to install similar system at Mochia and Rajpura-Dariba concentrators, as well.

6.6 Installed capacity and production of smelters

6.6.1 The installed capacity, targets fixed and actual production of various products and by-products of the Company for the five years ending 31st March 1991 are given in Annexure IV. From the data given in this annexure, the following position emerges :

6.6.1.1 Zinc ingots

6.6.1.1.1 The targets fixed at Debari and Vizag smelters ranged between 70.41 per cent (1986-87) and 83.67 per cent (1990-91) and 70 per cent (1988-89) and 90 per cent (1990-91) of the installed capacity. The actual production ranged between 63.94 per cent (1987-88) and 90.42 per cent (1990-91) in Debari smelter and 58.01 per cent (1987-88) and 93.51 per cent (1990-91) in Vizag smelter. There was shortfall in production to the extent of 15.32 per cent (1987-88) of targets in Debari smelter and 33.06 per cent (1987-88) and 0.5 per cent (1989-90) in Vizag smelter. The shortfall in Debari smelter in 1987-88 was attributed (April 1991) by the Ministry to shortage of water as a result of drought in Rajasthan and operation of the smelter by using purchased water. The Management stated (September 1991) that as a result of extensive efforts made by the Company to tide over the constraint of water, the Debari smelter could produce 96,368 tonnes of zinc metal valued at Rs. 334 crores (at the then prevailing price) till August 1989 thereby saving foreign exchange to the tune of Rs. 157 crores.

6.6.1.1.2 As regards shortfall in Vizag smelter, the Ministry stated (April 1991) that with more cordial labour relations and installation of diesel generator sets to augment power supply, the capacity utilisation showed considerable increase in 1989-90 and 1990-91.

6.6.1.2 Lead ingots

The targets fixed ranged between 70 per cent (1986-87) and 80 per cent (1990-91) of the installed capacity at Vizag smelter and between 90 per cent (1986-87) and 93.75 per cent (1990-91) at Tundoo smelter.

While there was shortfall in production in all the five years at Vizag smelter, the shortfall ranging between 3.07 per cent (1990-91) and 25.74 per cent (1988-89), there was shortfall in production (15.44 per cent) during one year only viz 1988-89 at Tundoo smelter. The Ministry stated (April 1991) that to sustain production at higher levels throughout the year, certain long term measures were taken at Vizag smelter resulting in increase of production by 25 per cent in 1989-90 and 40 per cent in 1990-91 over the production in previous years.

6.6.1.3 Cadmium

The targets fixed at Debari smelter ranged between 48 per cent (1986-87) and 68.40 per cent (1990-91) and at Vizag smelter between 46.35 per cent (1986-87) and 62.61 per cent (1987-88) of the installed capacity. While the shortfall in production at Debari was substantial (28.73 per cent) only during 1987-88, at Vizag there was very substantial shortfall of 49.70 per cent in 1986-87. The actual production at Vizag smelter was as low as 23.31 per cent of the installed capacity in 1986-87. The Management stated (May 1989) that production of cadmium at Debari and Vizag had been commensurate with zinc production.

It may be mentioned that the Management had not indicated the specific reasons for substantial shortfall at Vizag smelter.

6.6.1.4 Sulphuric acid

There was shortfall in production at Debari smelter during the year 1987-88 (21.41 per cent), 1988-89 (3.92 per cent) and 1989-90 (7.17 per cent) whereas at Vizag there was a shortfall of 5.38 per cent in 1986-87 and 36.03 per cent in 1987-88. The Management stated (May 1989) that sulphuric acid production was commensurate with zinc production and sulphur content in the concentrate.

6.6.1.5 Silver

6.6.1.5.1 The targets fixed at Vizag ranged between 51.67 per cent (1990-91) and 81.67 per cent (1987-88) and at Tundoo between 76.67 per cent (1988-89) and 90 per cent (1986-87) of the installed capacity. The shortfall at Vizag smelter occurred in all the five years ranging between 24.37 per cent (1988-89) and 36.31 per cent (1989-90). There was a marginal shortfall of 5.69 per cent at Tundoo smelter in only one year viz 1986-87. The Management stated (May 1989) that production of silver was not an independent activity and was based on lead production,

silver content in lead concentrate treated and was also governed by silver crust and silver in secondaries treated during that year.

6.6.1.5.2 However, the MIM Technology Marketing Limited in their modernisation report of November 1986 stated that "the liquidation process had never really operated satisfactorily since its introduction and had given problems of low kettle lives and poor metallurgical performance, the equipment in use was unsuitable in many aspects e.g. fabricated steel was unsuitable for the kettle construction, handling of materials was unsatisfactory, method of kettle firing was not conducive to uniform heating, working conditions were unsatisfactory and poor."

6.6.1.5.3 The Ministry stated (April 1991) as under :

"Modernisation report of MIM Technology Marketing Limited had analysed several steps in refining like copper removal, desilverisation etc. which required improvement. Liquidation to which reference has been made is only one of several such steps. Even though it improves the direct recovery of silver, overall silver recovery would not change much but for reduced recycle load. As the report indicated reduction in zinc consumption through vacuum dezincing, reduction in fuel oil consumption, reducing cycle time and affecting improvements in environmental pollution, these have been accepted. Presently, the scheme is under implementation."

6.6.1.6 Phosphoric acid

6.6.1.6.1 The targets fixed ranged between 13.85 per cent (1990-91) and 23.07 per cent (1986-87) of the installed capacity and the shortfall in production ranged between 30.85 per cent (1986-87) and 97.80 per cent (1990-91). The Management stated (May 1989) that production of phosphoric acid was governed by several factors like economics of the sale of sulphuric acid, phosphoric acid, availability of quality rock phosphate and corresponding economics of its direct sale vis-a-vis use for production of phosphoric acid, etc. Further, availability of power and water, if limited, would be delivered for zinc productin including leach residue treatment plant.

6.6.1.6.2 It may be stated that these factors were known to the Management even before installation of the phosphoric acid plant.

6.6.1.6.3 The Ministry stated (April 1991) that the phosphoric acid plant was to act as an insurance against stoppage of zinc production in the event of non-disposal of sulphuric acid either due to lack of demand or unremunerative prices. But the phosphoric acid plant operated intermittently during the years 1985-86, 1986-87 and 1988-89.

6.6.1.6.4 In this connection, the following remarks are offered :

i) Ministry's contention that the phosphoric acid plant was installed as an insurance plant was not corroborated by documentary evidence. The plant was designed to produce 87 TPD of phosphoric acid. The Board of Directors was informed in April 1974 that the plant was to run for 300 days in a year. Evidently, the economic viability of the plant was not kept in view by the Company.

ii) The country imported 61.93 lakh tonnes of phosphoric acid during 1982-83 to 1988-89, a part of which would have been avoided had the plant been fully utilised.

iii) No phosphoric acid plant was established in Vizag with an installed capacity of 75,000 tonnes of sulphuric acid, as against the Debari plant's capacity of 87,000 tonnes of sulphuric acid.

iv) The Board of Directors was informed in January 1990 that the demand for sulphuric acid in the areas near Vizag smelter was very limited, whereas Debari had locational advantages of big markets like Ahmedabad and Bombay in the vicinity. Therefore, the selling price of sulphuric acid at Vizag was lower as compared to that at Debari.

6.6.1.6.5 The Ministry, however, stated (April 1991) as under :

"No phosphoric acid plant was envisaged at the Vizag Smelter because :

- a) Vizag area was industrialised with fertilizer and alum industries, etc., providing a ready market for sulphuric acid;
- b) even areas like Rajahmundry and Nidadavole in Andhra Pradesh and extending upto Madras and Hyderabad, which are close to Vizag, provided a market; and
- c) that both single superphosphate and phosphoric acid plants were installed as insurance against stoppage of zinc production..... In view of the intermittent operation of these plants based on the premise on which they were set up capacity utilisation was bound to be low."

6.6.1.6.6 In fact now sale of sulphuric acid was being made at very high rate and the plant was almost lying idle. The expenditure incurred on the plant is substantially infructuous.

6.6.1.7 Single super-phosphate

The production was virtually stopped from 1988-89. According to Management (May 1989) the plant was envisaged to be phased out after commissioning of phosphoric acid plant. This plant was, therefore, being operated only when the smelter had problems of disposal of sulphuric acid or of operation of phosphoric acid plant.

6.7 Recovery efficiency at smelters

6.7.1 The recovery efficiency of zinc and lead at Debari and Vizag smelters is given in Annexure V from which the following position emerges :

6.7.2 Zinc ingots

6.7.2.1 Debari

The zinc concentrate with the zinc content of 55.5 per cent should give a recovery efficiency of 86 per cent. As per project report of leach residue treatment plant, the recovery efficiency of zinc should have further risen to 93 per cent after commissioning of the said plant in 1985-86. The actual recovery efficiency which rose to 90 per cent in 1985-86 after installation of leach residue treatment plant ranged between 86.63 per cent (1988-89) and 89.6 per cent (1986-87).

6.7.2.2 The Ministry stated (April 1991) that :

"The lower recovery efficiency has been mainly due to inadequate availability of water.... This is particularly relevant in 1988-89, with drought conditions prevailing in Rajasthan and the main source of water supply having totally dried up. Besides, reduced availability of power also contributed to non-operation/partial operation of the leach residue treatment plant, resulting in lower recovery efficiency."

6.7.2.3 Vizag smelter

The actual recovery efficiency was 86.8 per cent (1986-87) as against the norm of 88 per cent and ranged between 84.6 per cent (1987-88) and 86.25 per cent (1990-91) as against the norms of 87 per cent. The Management stated (May 1989) that the recovery efficiency at Vizag smelter depended on quality of imported concentrate and efficiency of moore filters on equipment not considered highly efficient and normally not used in

modern smelters. With the introduction of more efficient filtration unit and improved quality of zinc concentrate, recovery efficiency improved progressively to 86.8 per cent in 1986-87.

6.7.2.4 The contention of the Management is not borne out by the actual recovery efficiency of zinc which came down to 84.6 per cent and 84.7 per cent in 1987-88 and 1988-89 respectively.

6.7.2.5 The Ministry stated (April 1991) as under :

"Due to power cuts in 1987-88 and 1988-89 the available power was diverted to maintain zinc plant resulting in partial operation of Wartz Kilns (which were being used for treatment of leach residue) resulting in lower recovery efficiency."

6.7.2.6 It is pertinent to note that the objectives adopted by the Company in February 1991, inter-alia aimed at development of technological competence for efficient plant and mine operation to international norms. Even after the lapse of over ten years, the Company has not been able to achieve the recovery efficiency in smelting process to international norms (93 per cent).

6.7.3 Lead ingots

Vizag smelter

The recovery efficiency of lead during the years 1986-87 to 1990-91 varied between 85.29 per cent (1988-89) and 88.07 per cent (1990-91). However, the recovery efficiency of refined lead at Tundoo was close to the norm of 88 per cent in all the years upto 1990-91. The Management stated (May 1989) that recovery efficiency at Vizag was low due to lower lead content in concentrate, generation of extra sinter fines because of high graphitic content in concentrate and lock-up of lead in drosses and that action to modernise the plant had been initiated.

6.7.4 Cadmium

6.7.4.1 Debari

The agreement entered into with the supplier of equipment indicated recovery efficiency of cadmium of about 72 per cent of input against which the norm of 60 per cent was fixed by the Management in 1982-83. This could be achieved in the years 1988-89 to 1990-91. The Management stated (May 1989) that cadmium recovery efficiency of 72 per cent was only an indicative figure. The lower recovery efficient with respect to norms was mainly due to intermittent operation of leach residue treatment plant.

6.7.4.2 Vizag

The recovery efficiency ranged between 47.04 per cent (1986-87) and 56.29 per cent (1990-91) against the expected recovery of 55 per cent from 1987-88. The Management stated (May 1989) that low recovery efficiency at Vizag was due to lower cadmium content in concentrates.

6.7.5 Sulphuric acid

6.7.5.1 Debari zinc smelter

The recovery efficiency of sulphuric acid during the five years upto 1990-91 ranged between 80.7 per cent (1987-88) and 86.96 per cent (1990-91). The Management stated (May 1989) that due to shortage of power and water, the plant was operated intermittently resulting in faster corrosion of plant necessitating replacement of critical equipment and with the improvement of equipment the recovery efficiency had improved.

6.7.5.2 Vizag smelter

The Company had assessed that 98.4 per cent of sulphur input could be recovered in the shape of sulphuric acid. However, the recovery efficiency ranged between 86.13 per cent (1988-89) and 86.37 per cent (1989-90).

6.7.6 Silver

6.7.6.1 Tundoo and Vizag

The recovery efficiency of silver at Tundoo was slightly above 90 per cent during the five years upto 1990-91. At Vizag the recovery efficiency ranged between 86.63 per cent (1988-89 and 1989-90) and 88.2 per cent (1987-88). The Management stated (May 1989) that the silver content in lead concentrate had a major bearing on its recovery and the same had generally been commensurate with the silver content in the concentrate.

6.7.6.2 It was observed that no study had been made by an outside expert organisation to suggest feasible norms of output of these smelters. During the meeting with the Ministry, the latter stated that they would consider the desirability of commissioning such studies.

6.8 Transit losses

6.8.1 The smelter-wise position of losses in transit of lead and zinc concentrates from mines to smelters at Debari, Vizag and Tundoo as well as inter-smelter transfers of concentrates for the five years upto 1990-91 have been tabulated in Annexure VI from which the following position emerges :

- i) The percentage of loss in transit differed widely in different years and in different units.
- ii) The losses in zinc and lead concentrates received at Vizag were more than those at Debari.
- iii) The total loss in transit during the five years ending 1990-91 worked out to Rs. 350.03 lakhs.
- iv) As regards receipt of lead concentrates at Tundoo Smelter, the entire quantity despatched from Zawar mines has been shown as receipt of Tundoo (except 1986-87 for which information was not available) which apparently does not seem to be correct.

6.8.2 In this connection, it may be mentioned that the COPU in its 27th Action Taken Report - 1978-79 (Sixth Lok Sabha) had observed that the system of weighment of bags, quantity of bags, etc., should be kept under constant review so as to take suitable measures wherever discrepancies were noticed. However, continued transit shortages mentioned above deserved consideration.

6.8.3 The Ministry stated (April 1991) :

"Some loss in transit in case of fine powder material is unavoidable. To minimise the losses, a number of steps have been taken e.g. polythene gunny bags have been replaced with HPDE, stitching has also been improved, besides provision of ears to prevent use of hooks. Further, with a view to cut down the transit losses and to fix a realistic norms, two expert agencies were appointed whose recommendations have been received. These are being examined for further action."

7. PRICING POLICY AND SALES PERFORMANCE

7.1 Pricing policy

Prices of zinc and lead are fixed by MMTC. Prices of cadmium are fixed by the Company on the basis of import parity formula. Prices of silver are based on Bombay Stock Exchange market. Prices of sulphuric acid are fixed by the Company based on market conditions.

7.2 Sales performance

7.2.1 The targets and actuals of sales in comparison with the targets and actuals of production for the five years 1986-87 to 1990-91 are given in Annexure VII. It may be seen from the annexure that the actual sales of zinc ingots compared to sales targets ranged between 84.26 per cent (1987-88) and 108.49 per cent (1986-87); that of lead ranged between 65.72 per cent (1986-87) and 101.94 per cent (1987-88); cadmium between 66.19 per cent (1990-91) and 89 per cent (1989-90); silver between 78.69 per cent (1986-87) and 94.53 per cent (1987-88); and sulphuric acid between 72.91 per cent (1987-88) and 123.12 per cent (1986-87). In the case of single super phosphate and phosphoric acid, the targets of sales were fixed only in one year viz. 1986-87. There was no production of single super phosphate after 1987-88.

7.2.2 It was also observed that the actual sales in respect of zinc ingots, lead ingots, cadmium, silver, phosphoric acid and sulphuric acid were substantially less than the actual production in almost all the years inspite of the fact that the actual production itself was less than the targets of production. The percentage of actual sales to actual production in respect of cadmium was showing a downward trend. The substantial reduction in sales with reference to actual production and sales targets resulted in accumulation of finished stock and consequent inventory carrying costs.

7.2.3 The table below indicates the accumulation of finished stocks during the three years 1988-89 to 1990-91 :

(Quantity : In MT except silver which is in Kg.

Value : Rs. in lakhs).

	1988-89		1989-90		1990-91	
	Qty.	Value	Qty.	Value	Qty.	Value
Zinc Ingots	6497	1797.37	6758	2280.04	14591	5981.55
Lead Ingots	3144	720.18	6558	1547.15	7127	1977.94
Cadmium	81	260.28	129	446.35	229	596.29
Silver(Kg.)	3043	192.08	1464	98.27	3060	201.55

The Management stated (May 1989) that sales performance of the major products and by-products except zinc, lead and single super phosphate had been commensurate with the actual production and that variation with the targets was due to the fact that sales targets were based on targeted production.

7.2.4 In this connection, it may be stated that as early as in 1975-76 the COPU in its Eighty Eighth Report (1975-76 Fifth Lok Sabha) observed as under :

"The Committee regret to note that Hindustan Zinc Limited was not in a position to sell its entire production of zinc which itself was much less than the rated capacity of the smelter with the result, the closing stock gradually increased....."

The position with regard to sales and accumulation of stocks continues to be more or less the same even now.

8. COST ACCOUNTING SYSTEM AND COST OF PRODUCTION

8.1 Cost accounting system

8.1.1 The operations in mines and smelters are identified with various production and service cost centres such as ore raising and milling concentrate for mines, roasting, leaching and purification, electrolysis and casting for zinc and sintering, blast furnace and refining for lead. Direct expenses like explosives, raw materials, chemicals, stores and spares, power, etc., are collected directly for the relevant production and service cost centres. Indirect expenses are grouped into factory, sales, head office and social overheads and are then allocated to relevant production cost centres. Factory overheads and sales overheads are apportioned to various products on conversion cost basis and sales turnover basis respectively. Head office overheads are apportioned to various producing units in the ratio of the budgeted revenue expenses of each unit for that year.

8.1.2 The Administrative Staff College of India, Hyderabad in their report of September 1973 had suggested, inter-alia, introduction of integrated system of cost and financial accounts. COPU in its Eighty eighth Report (April 1976 Fifth Lok Sabha) had expressed regret at the delay in introduction of such an integrated system. The Government assured (November 1976) COPU that the Company had agreed to take necessary steps for introducing this system as early as possible after studying its actual working in one or two public sector undertakings and after getting an outline of the system prepared.

The Management stated (May 1989) that after development of effective communication system and extensive integrated application of computer network in all the units linked with Headquarters integrated system of accounts might be given trial at appropriate time.

The system has not been introduced so far (April 1990).

8.1.3 The Administrative Staff College of India and COPU in its 88th Report *ibid* suggested introduction of Standard Costing System. In spite of this and also Government's assurance to COPU given in November 1976 the Company has not introduced standard costing system so far.

The Management stated (May 1989) that the system of "Cost and performance budget" followed by the Company had all the features of standard costing system

and to avoid misunderstanding, if any, this system was termed as standard cost from the year 1989-90. The cost and performance budget cannot, however, be considered a substitute for standard costing system.

8.2 Cost of production

8.2.1 The budgeted cost, actual cost and weighted average sales realisation of main products of the Company for the five years upto 1990-91 are given in Annexure VIII. The following position emerges from the data given in the annexures;

- i) The actual cost of production of various products was generally more than the budgeted cost except in the case of zinc ingots at Vizag in 1986-87, lead ingots at Tundoo and single super phosphate in 1987-88, cadmium at Debari in 1986-87 and at Vizag in 1987-88, 1988-89 and 1989-90.
- ii) The actual cost of cadmium in relation to the budgeted cost showed wide variations.
- iii) The cost of production of phosphoric acid was very high, the excess over budgeted cost ranging between 21.8 per cent and 1,275.2 per cent during the years 1986-87 to 1988-89.

8.2.2 The excess over the budgeted cost upto 1986-87 was attributed by the Management (November 1988) mainly to variance in metal content in concentrates, higher cost of concentrates, lower capacity utilisation and lower content of silver in lead concentrate and increase in power rates (zinc and lead ingots); higher cost of rock phosphate and lower capacity utilisation (phosphoric acid); lower capacity utilisation (single super phosphate) and excess power consumption (cadmium).

Though the Management had analysed reason for variances of actual cost with reference to budgeted cost, remedial measures taken to reduce the cost were not indicated.

8.2.3 The average sales realisation per tonne had generally been more than the cost of sales in respect of all products except phosphoric acid, single super phosphate, lead and cadmium produced at Vizag (in some years). It may also be seen from Annexure VIII that :

- i) While in the zinc smelter at Debari the cost of sales of zinc was less than the average sales realisation in all the five years ending March 1991, in the zinc smelter at Vizag the cost of sales was more than the average sales realisation only in 1987-88.
- ii) The average sales realisation of lead ingots at Tundoo smelter was more than the cost of sales during the five years upto 1990-91 except in 1986-87. At Vizag smelter the average sales realisation was less than the cost of sales in all the years except in 1987-88 and 1989-90. The cost of sales at Tundoo and Vizag differed widely.

8.2.4 The higher cost of lead at Vizag was attributed by the Management (May 1989) to constraints in capacity utilisation, high cost of concentrates from captive mines and lower credits from silver recovered on account of lower silver content in concentrates. The Management also stated (May 1989) that the cost of sales of zinc in Debari and Vizag smelters was not comparable because while the concentrates fed in Vizag were imported, those in Debari were indigenous. Further, the impurity level was higher in Vizag and the incidence of depreciation and interest was also high, being a new plant and there were technological differences between the two plants.

As regards phosphoric acid and single super phosphate, the Management stated (May 1989) that these were downstream plants of an integrated scheme for utilisation of sulphuric acid. The operation of these plants depended on the availability of sulphuric acid after its direct sale, worked on cost benefit analysis. The calculation of profit in isolation was not appropriate.

The above reply of the Management is to be viewed in the light of the huge investment made on the Maton rock phosphate mine (Rs. 661 lakhs), phosphoric acid plant (Rs. 446.82 lakhs) and slurry pipe line (Rs. 267.30 lakhs).

8.2.5 Consumption of stores and chemicals

8.2.5.1 The norms for consumption of zinc sulphate in milling activity at Zawar mines was gradually raised from 0.175 Kg/MT. in 1981-82 to 0.425 Kg/MT in 1986-87 and was reduced to 0.350 Kg/MT in 1988-89. Similarly, the norms for consumption of lime-stone chips in Vizag lead smelter increased from 250 Kg/MT in 1986-87 to 300 Kg/MT in 1988-89 and was reduced to 270 Kg/MT in 1990-91. Norms for consumption of Betanaphthol decreased

from 5.00 Kg./MT in 1981-82 to 1.80 Kg./MT in 1986-87, to 0.570 Kg./MT in 1988-89 and to 0.260 Kg./MT in 1990-91. In 1990-91 the norms for consumption of drill rods varied from 0.0018 No./MT at Zawar mines to 0.005 No./MT at Sargipalli mines and 0.010 No./MT at Rajpura Dariba mines. Similarly norms for consumption of grinding media in 1990-91 varied from 0.480 Kg./MT at Agnigundala mines to 0.855 Kg./MT at Zawar mines and 1.70 Kg./MT at Rajpura-Dariba mines and 0.75 Kg./MT at Sargipalli mines.

8.2.5.2 The actual consumption also varied widely as compared to the norms fixed for respective years. In the case of light diesel oil at Debari smelter, though the norms for consumption increased from 20.00 litres/MT in 1981-82 to 40 litres/MT in 1985-86 and reduced to 30 litres/MT in 1986-87 (this remained unchanged upto 1990-91), the actual consumption decreased from 47.34 litres/MT (1981-82) to 37.15 litres/MT (1989-90) and again decreased to 25.47 litres/MT (1990-91). In the case of consumption of blue dust at Vizag lead smelter, the norms were reduced from 325 Kg./MT in 1981-82 to 200 Kg./MT in 1985-86, increased to 300 Kg./MT and 350 Kg./MT in 1986-87 and 1987-88 respectively and reduced to 320 Kg./MT in 1988-89; the actual consumption increased from 274 Kg./MT in 1981-82 to 411.788 Kg./MT in 1988-89.

The Management stated (September 1991) that the zinc dust consumption was progressively reduced from 70.7 Kg. per tonne of zinc in 1986-87 to 38 Kg. per tonne of zinc in 1990-91 through in-house system improvements and modifications in process flow sheet and was now well below the DPR norm of 65Kg. per tonne of zinc at both the zinc smelters.

8.2.5.3 COPU in its Report *ibid* while observing that the Company had fixed certain norms for consumption of materials like explosives, chemicals, drill rods, etc. which were based on project reports and actual experience gained during operation of the plant, had recommended that norms for consumption of materials should be scientifically fixed based on appropriate data and got approved by the Board. The Government had accepted the above recommendation and instructed the Company in September 1976 for taking necessary action. The Company had not complied with these instructions (May 1989).

8.2.5.4 The Management stated (May 1989) that the consumption of various consumables depended upon the characteristics like hardness, toughness and crushing strength of ore which varied from mine to mine and level to level. Similarly the consumption of re-agents in mill varied with varying metal content. Further, fixation of norms was a difficult issue which could not be decided based on laboratory tests alone but had to be fixed taking

into account the consumption in stabilised operations of the plant over a reasonable period and that even in smelters where norms were indicated in DPR, these were suitably amended as per consumption pattern of the previous years and likely quality of raw material to be used during the year. Again, the norms for the year were incorporated in annual cost budget which was approved by the Board.

8.2.5.5 During the meeting of the Audit Board, the Secretary of the Ministry stated that they would consider the desirability of asking outside expert for developing norms for consumption of chemicals.

8.2.6 Excess consumption of power vis-a-vis norms

8.2.6.1 Yearly norms for consumption of power in each process unit and per unit of main products and by-products were fixed by the Company. The norms fixed and actual consumption for the five years upto 1990-91 are given in Annexure IX. The net excess consumption of power with reference to norms during the years 1982-83 to 1988-89 amounted to Rs. 635.39 lakhs (for mining Rs. 55.80 lakhs), milling (Rs. 180.14 lakhs), zinc ingots (Rs. 166.02 lakhs), lead ingots (Rs. 79.89 lakhs), sulphuric acid (Rs. 67.18 lakhs), cadmium (Rs. 17.50 lakhs), phosphoric acid (Rs. 36.68 lakhs) and other allied products (Rs. 32.09 lakhs).

8.2.6.2 The Management stated (September 1991) that by closely monitoring the energy consumption pattern at different stages of the zinc manufacturing process, the key high energy consumption areas were identified and steps were taken for improving various techniques like anode-cathode spacing in cell house, cell lining and other technological modifications, etc. By the application of these measures coupled with precise scheduling of operations of plants/equipment, minimisation of idle running and installation of capacitors to contain the energy loss, the consumption of electric energy was reduced in 1990-91 as compared to 1986-87.

The Ministry, inter-alia, stated (April 1991) that since the power consumption norms were stringent in the first instance, the excess consumption was within the variable limits.

As the variation in power consumption inspite of frequent revision of norms has become a regular feature from year to year, it is desirable to evolve a system for fixation of realistic norms and investigating the variations. Further in the context of the present day scarcity of power in the country and the Government's emphasis on the energy conservation the point assumes greater importance.

9. FINANCIAL POSITION, WORKING RESULTS AND CREDIT CONTROL

9.1 Financial position

9.1.1 The financial position of the Company under broad headings for the last five years upto 1990-91 is given below :

Sr. No.	Particulars	(Rs. in lakhs)				
		1986-87	1987-88	1988-89	1989-90	1990-91
<u>Liabilities</u>						
a)	Paid-up capital (including share application money)	17255.69	19478.19	24883.19	31153.19	40373.19
b)	Reserves and surplus	2721.48	3017.47	5771.21	12819.44	21221.26
c) Borrowings :						
i)	From Govt. of India	7129.68	6420.71	3297.82	0.15	0.14
ii)	Banks (Cash credit and others)	1295.04	148.16	258.79	1382.55	2566.75
iii)	Public deposits	4413.86	4715.02	3672.44	2065.05	441.96
iv)	Bonds	-	-	-	8000.00	30000.00
d)	Deferred credits	0.83	-	-	-	52.72
e)	Trade dues and other current liabilities including provisions	5896.76	4715.76	8099.83	14844.62	19373.69
		<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
		38713.34	38495.31	45983.28	70265.00	114029.71
<u>Assets</u>						
f)	Gross block	27919.06	28961.62	30638.59	33942.09	56727.08
g)	Less depreciation	12850.32	14434.30	15996.36	17947.92	20254.52
h)	Net fixed assets	15068.74	14527.32	14642.23	15994.17	36472.56
i)	Capital work in progress	609.12	2011.01	5818.53	17225.19	31057.04
j)	Current assets, loans and advances	17791.62	16852.65	20806.84	32682.18	42313.41

k) Investments	0.27	0.27	0.27	0.27	0.27
l) Mine exploration and development	5187.59	5057.13	4705.00	4355.48	4024.76
m) <u>Misc. expenditure</u>					
Deferred revenue and feasibility report expenditure	56.00	46.93	10.41	7.71	161.67
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	38713.34	38495.31	45983.28	70265.00	114029.71
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Capital employed	26963.60	26664.21	27349.24	33831.73	59412.28
Net worth	19921.17	22448.73	30643.99	43964.92	61432.78

Notes : 1. Capital employed represents net fixed assets plus working capital.

2. Net worth represents paid up capital plus reserves and surplus less intangible assets.

9.2 Working results

9.2.1 Profit earned/loss incurred by the Company during the last five years upto 1990-91 is tabulated below:

Year	(Rs. in lakhs)		
	Profit before tax for the year	Prior period adjustments	Profit after prior period adjustments
1986-87	494.68	(-) 287.98	206.70
1987-88	358.25	(-) 89.26	268.99
1988-89	3467.80	85.48	3553.28
1989-90	8496.22	(-) 60.33	8435.89
1990-91	8645.03	(-) 80.21	8564.82

9.2.2 The substantial increase in the profits for the years 1988-89, 1989-90 and 1990-91 was mainly due to increase in the selling prices of zinc and lead fixed by MMTC in line with the international prices of these metals.

10. MATERIAL MANAGEMENT AND INVENTORY CONTROL

10.1 Inventory control

10.1.1 The table below indicates the value of stock of stores, spares and loose tools at the end of the year, consumption during the year and value of closing stock in terms of months' consumption for the last five years upto 1990-91 :

	(Rs. in lakhs)				
	<u>1986-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>	<u>1990-91</u>
1. Stock of stores spares and loose tools	3608.13	3727.43	3681.92	3982.73	5123.59
2. Consumption	5636.80	5661.33	6198.15	7812.87	9426.00
3. Closing stock in terms of months' consumption	7.68	7.90	7.13	6.12	6.52

The overall stock of stores and spares which was equivalent to 7.68 months' consumption in 1986-87 had come down to 6.52 months' consumption in 1990-91.

10.1.2.1 The table below indicates the year-wise number and value of non-moving/slow-moving stores and spares at the close of the each of the five years upto 1990-91 :

		(Rs. in lakhs)				
Sl. No.	Name of the Mine/Smelter	<u>1986-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>	<u>1990-91</u>
<u>Mines</u>						
1.	Zawar Mine	173.14 (7907)	170.64 (9899)	157.00 (7755)	168.98 (5413)	196.31 (6990)
2.	Rajpura Dariba Mine	60.39 (3345)	145.47 (5820)	210.02 (6991)	139.47 (5795)	141.63 (5640)
3.	Maton Rock Phosphate Mine	26.51 (3922)	48.45 (4188)	55.33 (4720)	56.89 (4655)	41.47 (2331)

4.	Sargipalli Lead Mine	60.00 (1767)	50.03 (3062)	39.05 (2551)	32.76 (2261)	37.98 (2693)
5.	Agnigundala Lead Mine	0.94 (293)	8.24 (591)	9.05 (672)	16.77 (1449)	14.80 (1722)
Total Mines		320.98 (17234)	422.83 (23560)	470.45 (22689)	414.87 (19573)	432.19 (19376)
<u>Smelters</u>						
6.	Debari Zinc Smelter	137.93 (7069)	196.63 (10272)	199.00 (6874)	225.33 (6907)	149.05 (6155)
7.	Vizag Zinc Lead Smelter	109.51 (5894)	126.39 (4842)	120.07 (4306)	82.30 (3080)	45.75 (2286)
8.	Tundoo Lead Smelter	7.37 (1582)	17.38 (1298)	16.30 (1261)	0.23 (32)	2.23 (106)
Total Smelters		254.81 (14545)	340.40 (16412)	335.37 (12441)	307.86 (10019)	197.03 (8547)
Grand total :		575.79 (31779)	763.23 (39972)	805.82 (35130)	722.73 (29592)	629.22 (27923)

(Figures in brackets indicate the number of items)

10.1.2.2 The non-moving/slow-moving stores at mines increased from Rs. 320.98 lakhs (17234 Nos.) in 1986-87 to Rs. 432.19 lakhs (19376 Nos.) in 1990-91. However, they decreased from Rs. 254.81 lakhs (14545 Nos.) in 1986-87 to Rs. 197.03 lakhs (8547 Nos.) in 1990-91 at the smelters. The Company was carrying an overall non-moving/slow-moving inventory of Rs. 629.22 lakhs (27923 Nos.) as on 31st March 1991 against Rs. 575.79 lakhs (31779 Nos.) as on 31st March 1987.

The Ministry stated (April 1991) as under :

"It was not always possible to maintain reduced levels on a sustained percentage reduction, from year to year. This was due to the fact that new equipment was added every year and non-utilisation of initial spares over two years resulted in spares and stores becoming non-moving. However, efforts are being made by the Management to reduce the level of non-moving stores."

10.1.2.3 During test check in Zawar mines, it was observed that 223 items of various types of imported bearings valued at Rs. 5.37 lakhs had not moved for more than five years and were declared surplus.

The Management stated (May 1989) that a Departmental Committee had already reviewed the list of bearings and 32 Nos. imported bearings valuing Rs. 1.65 lakhs were decided to be retained. The Management further stated (August 1991) that though it was decided to dispose of 191 bearings valuing Rs. 3.72 lakhs, no action for disposal could be taken and that the possibility of their use in various plants of the Company was still being explored.

10.1.2.4 The stock in process of Rs. 3537.38 lakhs as on 31st March 1988 which had been taken into account for calculating the working results of the Company included moore cake worth Rs. 352.59 lakhs and neutral sand worth Rs. 300.20 lakhs which was lying unmoved for the last five years. Since the normal residue arising in the process was sufficient for leach residue treatment plant and owing to water shortages, the accumulated moore cake lying in the open was not likely to be used.

The Management stated (May 1989) that when the water situation improved, the consumption of moore cake would be feasible.

10.1.3 Surplus stores and spares

10.1.3.1 The table below indicates the position of surplus stores and spares, their disposal and closing balance at the end of the year during the last five years upto 1990-91 :

(Quantity in numbers and
value Rs. in lakhs)

Year	Opening balance plus items declared surplus during the year		Surplus items disposed of during the year		Closing balance	
	Qty.	Value	Qty.	Value	Qty.	Value
1986-87	4445	211.18	503	97.22	3942	113.96
1987-88	5329	201.18	1042	111.24	4287	89.94
1988-89	5169	210.69	1889	121.54	3280	89.15
1989-90	6592	189.12	1435	70.51	5157	118.61
1990-91	6371	190.92	512	65.64	5859	125.28

It was also seen that there was no disposal of surplus stores and spares in Sargipalli mines since 1986-87 and in Maton mines since 1987-88 and the surplus inventory stood at Rs. 8.81 lakhs and Rs. 13.65 lakhs respectively as on 31st March 1988.

10.2 Physical verification

10.2.1 According to the policy laid down by the Company, physical verification of bulk items like concentrates and raw materials, etc., should be carried out by volumetric method of verification at least once in a year at some point of time when the stocks are minimum. No physical verification was, however, conducted in Vizag smelter in respect of zinc concentrate and lead concentrate till 1984-85 and in respect of lead concentrate during 1986-87. In Maton mines, physical verification was not conducted during the five years upto 1987-88 even though heavy shortages were found in the physical verification conducted in the years 1981-82 and 1982-83. In Sargipalli mines, physical verification of lead and copper concentrate was not conducted from 1984-85 to 1988-89.

10.2.2 The Board of Directors prescribed (November 1977) the norms for handling and storage losses of concentrates at 0.5, 1.5 and 2.0 per cent for bagged concentrates involving one transshipment, in covered godown and in open stock yards respectively. The actual shortages exceeded the norms (1.5 per cent) at zinc smelter, Debari and ranged from 1.60 per cent (1984-85) to 3.29 per cent (1982-83) in the case of zinc concentrates and from 2.64 per cent (1983-84) to 5.02 per cent (1982-83) in the case of rock phosphate. The shortage in excess of the norms in the case of zinc concentrate at Debari amounted to Rs. 56.94 lakhs during 1982-83 to 1985-86 and in case of rock phosphate concentrate to Rs. 11.20 lakhs during 1982-83 to 1984-85. In Maton mines also, the shortages noticed were higher than the norms fixed (two per cent) in 1981-82 and 1982-83.

10.2.3 The Management stated (May 1989) that physical verification was carried out right from inception in the Vizag unit except for the period 1981-82 to 1984-85 due to stocking of concentrates in different places and in uneven heaps and that the cumulative shortages arrived at in the year 1985-86 as a result of physical verification were within the approved norms. The physical verification of lead concentrates was also carried out since inception upto 1979-80 and also in the year 1985-86 and thereafter in 1987-88 and the physical verification during the intervening period could not be done as a variety of concentrates were kept at different places. In respect of Maton mines, physical verification by volumetric method

had its own limitations, particularly when stocks were very huge and scattered over a large area. The physical verification on volumetric method with expected level of accuracy was, therefore, not possible and was not done in subsequent years. Provision was, however, made for the maximum shortage of two per cent as per norms in the respective years.

10.2.4 The practice of making provision based on norms fixed without conducting annual physical verification is not considered desirable. In all cases of bulk material the volumetric method of measurement was an accepted practice and as such it should have been followed. The Management agreed to conduct periodical physical verification.

10.2.5 The Ministry stated (April 1991), inter-alia, as under :

"Since the stocks at Maton mine continued to remain very high, scattered over a large area and embedded to some extent it was not possible to do physical verification with the expected level of accuracy. Physical verification was, however, carried out during 1988-89, 1989-90 and 1990-91..... Physical verification at Sargipalli mine was conducted in the year 1989-90, when the stocks came down to a reasonable level."

11. MANPOWER EFFICIENCY

11.1 Output per manshift (OMS)

11.1.1 The Company was providing two helpers for each skilled worker. With reference to this pattern, the consultants M/s Penarroya had estimated (December 1962) the output per manshift (OMS) in respect of Mochia mine at 2.2 tonnes (mining) and 2 tonnes (overall). The mining and overall OMS of all mines during the five years upto 1990-91 was as under :

(Figures in tonnes)

Name of the mine	Norms as per DPR/Consultants	Actual output per manshift				
		1986-87	1987-88	1988-89	1989-90	1990-91
<u>Mochia</u>						
Mining	2.2	1.43	1.51	1.66	1.64	1.72
Overall	2.0	1.31	1.31	1.43	1.43	1.54
<u>Balaria</u>						
Mining	2.32	2.08	1.62	1.93	1.85	2.16
Overall	2.00	1.70	1.38	1.66	1.58	1.83
<u>Zawamala</u>						
Mining	-	4.30	3.48	3.05	2.84	2.75
Overall	1.70	3.06	2.64	2.39	2.26	2.20
<u>Rajpura Dariba</u>						
Mining	-	2.33	-	2.45	2.36	3.21
Overall	2.76	1.71	1.87	1.76	1.72	2.30
<u>Agnigundala</u>						
Mining	-	1.13	0.95	0.93	1.047	1.117
Overall	0.79	1.02	0.86	0.80	0.865	0.893
<u>Sargipalli</u>						
Mining	-	1.30	1.35	1.45	1.55	1.81
Overall	1.55	0.65	0.71	1.33	1.46	1.71

11.1.2 There was wide variation in overall OMS at different mines. While the overall OMS was the lowest at Sargipalli being 0.65 tonnes (1986-87), it was the highest at Zawarmala being 3.06 tonnes (1986-87). The overall OMS was much less than DPR/Consultant's norms in respect of Mochia, Balaria, Rajpura-Dariba and Sargipalli (except in 1990-91).

11.1.3 The Ministry, inter-alia, stated (April 1991) as under :

"i) The OMS at mines varies due to different methods of stoping and machines used as per the suitability of the ore body. Lower OMS at Sargipalli mine was due to initial teething problems only.

ii) OMS at Rajpura-Dariba mine was low due to adverse roof conditions encountered in stopes which were not anticipated during the project formulation stage. VCR mining has been introduced to increase the productivity.

iii) The comparison with DPR figures may not be realistic as the mines have become very old and are in the declining stages of production."

The Ministry has not indicated whether realistic norms have since been fixed.

12. INTERNAL AUDIT

12.1 Internal audit system was introduced in the Company from July 1973. Upto November 1978 an internal audit party from Corporate Office was conducting audit of all units and thereafter resident audit pattern was introduced. The Internal Audit Department was headed by the Chief Manager (Internal Audit) who reported to the Chairman-cum-Managing Director through Director (Finance) of the Company.

12.2 The strength of Internal Audit Department had remained more or less static despite increase in the activities of the Company. The Management stated (May 1989) that the scope of audit programme was being enlarged year after year.

12.3 The Statutory Auditors in their report on the accounts for the year 1990-91 had observed that the existing internal audit system was not commensurate with the enlarged size and nature of its business. The scope of work covered by Internal Audit was inadequate considering the rapid increase in the Company's financial involvements. The internal audit system needed to be further strengthened by inducting more professional manpower and enlarging scope of audit to include propriety and management audit.

13. OTHER TOPICS OF INTEREST

13.1 Payment of penalty on account of low power factor

13.1.1 In January 1980, the Company entered into an agreement with Orissa State Electricity Board (OSEB) for supply of 700 KW/778 KVA, 2500 KW/2770 KVA and 4500 KW/5000 KVA power from 1st July 1980, 1981 and 1982 respectively for its Sargipalli mine. The terms of the agreement, inter-alia, provided that the demand charges were payable on the maximum demand subject to minimum charges at 80 per cent of the contracted demand and that the average power factor should not be less than 90 per cent.

13.1.2 The power factor during the period for December 1983 to November 1985 could not be maintained at 90 per cent as provided in the agreement. Actual power factor ranged between 66 per cent and 83 per cent and, accordingly, the Company paid a penalty of Rs. 5.60 lakhs.

13.1.3 The Management stated (October 1987) that improvement in power factor was effected by gradual installation of capacitor bank but the system was getting heated up due to poor quality of power supply coupled with abnormal voltage surges resulting in excessive heating of the capacitors. This problem was solved by introducing effective cooling system.

13.2 Delay in commissioning ball mill

13.2.1 In January 1981, the Company invited open tenders for supply of Hot Calcine Grinding Ball Mill for its Vizag smelter. As the offers received were not considered suitable, the Company invited fresh tender in April 1981. The lowest offer of Rs. 26.46 lakhs was again not considered technically suitable. On detailed examination in the context of critical nature of equipment, in February 1984, the Company placed an order on a foreign firm M/s Kone Corporation Helsinki, Finland at a cost of US \$ 209,455.87 (Rs. 27.96 lakhs) F.O.B. Finish Port after obtaining clearance from the Director General of Technical Development in May 1983. The total cost incurred in the purchase of the equipment worked out to approximately Rs. 56.07 lakhs. The Ball Mill was received in June 1985 and after completing the modifications in calcine conveying, trials were conducted in July 1987.

13.2.2 The calcine grind ball mill was finally commissioned in August 1987 after attending to the problems of bag filter. Six components of bag filter which were found damaged could not be replaced by spare bags received along with the original equipment (value : Rs. 3.50 lakhs) as they were found to be of different size and

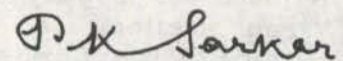
were damaged when the procedure suggested by the supplier was followed. The old bags were repaired and fixed back. Since the warranty period had expired in 1986, the Company could not get free replacement of these bags.

13.2.3 The delay in commissioning of ball mill for about two years resulted in the investment of Rs. 56.07 lakhs remaining blocked and the Company could not derive the benefit of the ball mill apart from loss of Rs. 3.50 lakhs on account of non-replacement of spare filter bags.

13.2.4 The Management stated (May 1989) that the erection was completed in April 1986 but its hooking up with the main plant was deferred for the reasons that a long shut down was required for carrying out some modifications in the conveying system and that during 1986-87 the smelter was mostly treating imported concentrate which was very low in silica content. After carrying out the modifications, the ball mill was commissioned in August 1987.

13.2.5 The Ministry stated (April 1991) as follows :

"Since mostly imported concentrates were treated during the period 1986-87, the hot calcine ball mill was not required to be put to use. Therefore, the smelter could not have derived any additional benefit by its operation during the period."



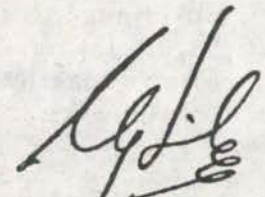
(P.K. SARKAR)

Deputy Comptroller and Auditor
General (Commercial)-cum-Chairman,
Audit Board

New Delhi

The 16 APR 1992

Countersigned



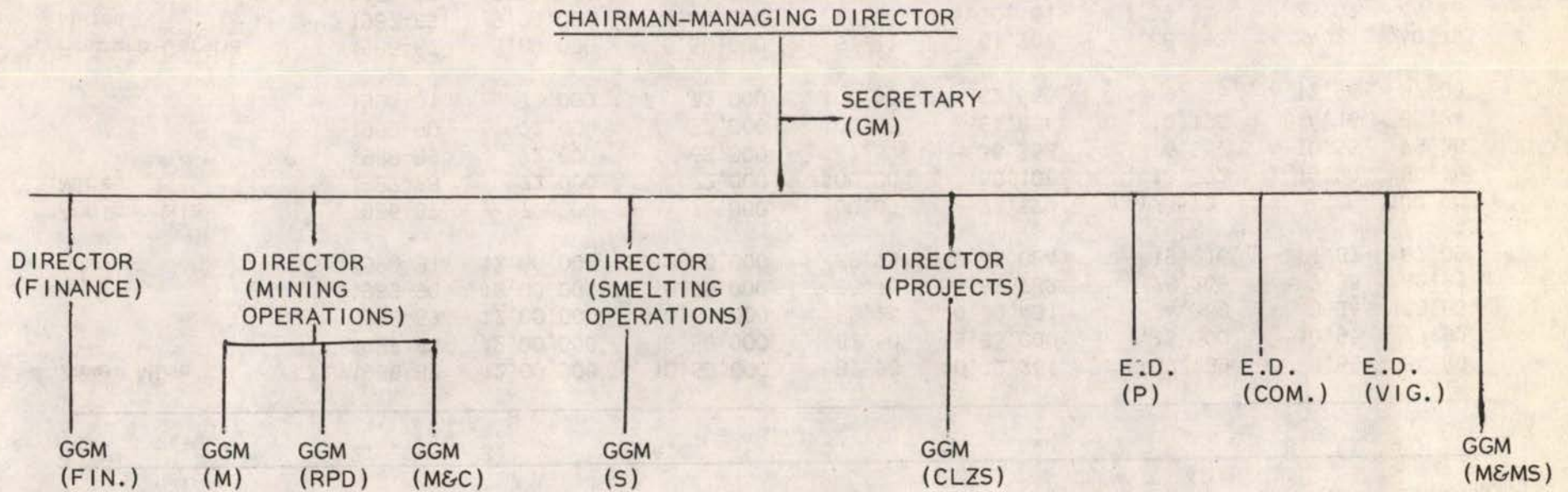
(C.G. SOMIAH)

Comptroller and Auditor General
of India

New Delhi

The 16 APR 1992

ORGANISATION CHART.



NOTE :

G.M. : General Manager
 E.D. : Executive Director
 GGM : Group General Manager
 P : Personnel
 COM. : Commercial
 VIG. : Vigilance

FIN. : Finance
 M : Mines
 RPD : Research, Planning & Development
 M & C : Marketing & Coordination
 S : Smelters
 CLZS : Chanderia Lead-Zinc Smelter
 M&MS : Material & Management Services

ANNEXURE II
(Referred to in para 6.4.2)

STATEMENT SHOWING DETAILS OF CAPACITY, TARGETS FIXED FOR RAISING ORE VIS-A-VIS ACTUAL PRODUCTION

Name of Mine	Year	Installed capacity (M.T.)	Target (M.T.)	Percentage of targets to installed capacity	Actual Production (M.T.)	Shortfall (M.T.)	Percentage of short-fall to target	Percentage of production to installed capacity
1.	2.	3.	4.	5.	6.	7.	8.	9.
Zawar Mine	1986-87	12,00,000	10,50,000	87.50	10,12,261	37,739	3.59	84.36
	1987-88	12,00,000	10,50,000	87.50	9,35,000	1,15,000	10.95	77.92
	1988-89	12,00,000	10,65,000	88.75	10,30,431	34,569	3.24	85.86
	1989-90	12,00,000	10,65,000	88.75	9,86,732	78,268	7.35	82.23
	1990-91	12,00,000	10,65,000	88.75	10,45,084	19,916	1.87	87.09
Agnigundala Mines	1986-87	72,000	72,000	100.00	72,579	(+) 579	-	100.80
	1987-88	72,000	72,000	100.00	58,108	13,892	19.29	80.70
	1988-89	72,000	63,000	87.5	56,353	6,647	10.55	78.26
	1989-90	72,000	72,000	100.00	61,804	10,196	14.16	85.84
	1990-91	72,000	72,000	100.00	62,665	9,335	12.96	87.03
Rajpura-Dariba Mines	1986-87	9,00,000	5,50,000	61.11	3,61,707	1,88,293	34.24	40.19
	1987-88	9,00,000	5,40,000	60.00	4,00,161	1,39,839	25.89	44.46
	1988-89	9,00,000	4,50,000	50.00	3,82,195	67,805	15.07	42.47
	1989-90	5,40,000	4,50,000	83.33	3,85,013	64,987	14.44	71.29
	1990-91	5,40,000	5,40,000	100.00	5,11,641	28,359	5.25	94.75

1.	2.	3.	4.	5.	6.	7.	8.	9.
Sargipalli	1986-87	1,50,000	1,13,000	75.33	86,400	26,600	23.54	57.60
Mines	1987-88	1,50,000	1,20,000	80.00	1,00,000	20,000	16.66	66.67
	1988-89	1,50,000	1,20,000	80.00	1,11,495	8,505	7.08	74.33
	1989-90	1,50,000	1,27,500	85.00	1,13,000	14,500	11.37	75.33
	1990-91	1,50,000	1,35,000	90.00	1,38,100	(+) 3,100	-	92.06

ANNEXURE III
(Referred to in para 6.5.1)

PERCENTAGE OF METAL RECOVERY

Year	ROM		Concentrate produced		Total metal contents in concentrate		Metal produced		(Production figures in M.T.)			
	Produced	Treated	Pb (Lead)	Zinc	Lead	Zinc	Lead	Zinc	Percentage of metal recovery		DPR/Budget norms of recovery	
									Lead	Zinc	Lead	Zinc
<u>1986-87</u>												
Zawar	10,12,261	10,12,076	23,928	55,488	16,699	33,601	13,878	28,854	83.1	85.9	77	88
Agnigundala	72,579	72,372	4,692	-	3,199	-	3,050	-	95.3	-	-	-
Rajpura-Dariba	3,61,707	3,70,042	11,389	35,116	7,771	22,203	5,694	18,260	73.2	82.2	-	85
Sargipalli	86,400	85,100	5,788	1,009	4,289	289	3,473	192	81.0	66.4	85	-
	15,32,947	15,39,590	45,797	91,613	31,958	56,093	26,095	47,306				
<u>1987-88</u>												
Zawar	9,35,000	9,57,812 *	19,817	49,046	14,586	31,510	11,923	25,504	81.74	80.94	82	86
Agnigundala	58,108	54,242	3,405	-	2,343	-	2,213	-	94.45	-	-	-
Rajpura-Dariba	4,00,161	4,75,492 *	1,31,990	41,851	8,738	26,472	6,335	21,762	72.50	82.20	-	85
Sargipalli	1,00,000	98,600	6,386	-	4,812	-	3,832	-	79.63	-	85	-
	14,93,269	15,86,146	1,61,598	90,897	30,479	57,982	24,303	47,266				

1988-89

Zawar	10,30,431	10,91,572*	16,084	56,581	12,200	34,201	9,650	29,422	79.10	86.02	82	86
Agnigundala	56,353	59,436	3,731	-	2,538	-	2,425	-	95.54	-	-	-
Rajpura-Dariba	3,82,195	4,78,354*	11,800	40,418	8,073	25,545	5,782	21,017	71.62	82.27	-	85
Sargipalli	1,11,495	1,16,135	7,228	-	5,412	-	4,337	-	80.13	-	85	-
	15,80,474	17,45,497	38,843	96,999	28,223	59,746	22,194	50,439				

1989-90

Zawar	9,86,732	10,49,167*	18,810	50,136	13,781	30,279	11,286	26,071	81.89	86.10	80	85
Agnigundala	61,804	62,609	3,907	-	2,673	-	2,540	-	95.02	-	-	-
Rajpura-Dariba	3,85,013	5,21,101*	10,408	35,567	8,386	23,265	4,995	18,495	59.56	79.50	-	83
Sargipalli	1,13,000	1,22,518	7,395	-	5,424	-	4,806	-	88.61	-	80	-
	15,46,549	17,55,395	40,520	85,703	30,264	53,544	23,627	44,566				

1990-91

Zawar	10,45,084	11,00,535*	14,639	51,334	10,915	30,994	8,783	26,694	80.46	86.13	81	86.5
Agnigundala	62,665	62,737	3,890	-	2,660	-	2,528	-	95.04	-	-	-
Rajpura-Dariba	5,11,641	5,83,003*	12,748	47,898	9,582	31,670	6,119	24,907	63.86	78.65	-	83
Sargipalli	1,38,100	1,38,100	8,689	-	6,808	-	5,647	-	82.94	-	80	-
	17,57,490	18,84,375	39,966	99,232	29,965	62,664	23,077	51,601				

* Including Rampura Agucha ore treated.

ANNEXURE IV
(Referred to in para 6.6.1)

**STATEMENT SHOWING INSTALLED CAPACITY, TARGETS FIXED, ACTUAL PRODUCTION AND
SHORTFALL IN PRODUCTION OF VARIOUS PRODUCTS**

Product	Year	Installed capacity (M.T.)	Targets (M.T.)	Percentage of targets to installed capacity	Actual production (M.T.)	Shortfall (-)/Excess (+)	Percentage of shortfall/ Excess to targets	Percentage of actuals to installed capacity
1.	2.	3.	4.	5.	6.	7.	8.	9.
Zinc Ingots Debari	1986-87	49,000	34,500	70.41	40,361	(+) 5,861	(+) 16.99	82.37
	1987-88	49,000	37,000	75.51	31,332	(-) 5,668	(-) 15.32	63.94
	1988-89	49,000	36,000	73.47	37,108	(+) 1,108	(+) 3.08	75.73
	1989-90	49,000	38,000	77.55	38,145	(+) 145	(+) 0.38	77.85
	1990-91	49,000	41,000	83.67	44,310	(+) 3,310	(+) 8.07	90.42
Zinc Ingots Vizag	1986-87	30,000	25,500	85.00	26,017	(+) 517	(+) 2.03	86.72
	1987-88	30,000	26,000	85.67	17,403	(-) 8,597	(-) 33.06	58.01
	1988-89	30,000	21,000	70.00	21,506	(+) 506	(+) 2.41	71.69
	1989-90	30,000	27,000	90.00	26,868	(-) 132	(-) 0.49	89.56
	1990-91	30,000	27,000	90.00	28,052	(+) 1,052	(+) 3.90	93.51
Lead Ingots Vizag	1986-87	22,000	15,400	70.00	12,553	(-) 2,847	(-) 18.49	57.06
	1987-88	22,000	16,500	75.00	12,703	(-) 3,797	(-) 23.01	57.74
	1988-89	22,000	16,500	75.00	12,252	(-) 4,248	(-) 25.74	55.69
	1989-90	22,000	17,000	77.27	15,508	(-) 1,492	(-) 8.78	70.49
	1990-91	22,000	17,600	80.00	17,060	(-) 540	(-) 3.07	77.55

1.	2.	3.	4.	5.	6.	7.	8.	9.	
Lead Ingots	1986-87	8,000	7,200	90.00	7,381	(+)	181	(+) 2.51	92.26
Tundoo	1987-88	8,000	7,400	92.50	7,461	(+)	61	(+) 0.82	93.26
	1988-89	8,000	7,500	93.75	6,342	(-)	1,158	(-) 15.44	79.27
	1989-90	8,000	7,500	93.75	7,502	(+)	2	-	93.77
	1990-91	8,000	7,500	93.75	7,859	(+)	359	(+) 4.78	98.24
Cadmium Debari	1986-87	250	120	48.00	123.97	(+)	3.97	(+) 3.31	49.59
	1987-88	250	153	61.20	109.03	(-)	43.96	(-) 28.73	43.61
	1988-89	250	148	59.20	150.07	(+)	2.07	(+) 1.4	60.63
	1989-90	250	156	62.40	150.78	(-)	5.22	(-) 3.35	60.31
	1990-91	250	171	68.40	168.04	(-)	2.96	(-) 1.73	67.22
Cadmium Vizag	1986-87	115	53.3	46.35	26.81	(-)	26.49	(-) 49.70	23.31
	1987-88	115	72.0	62.61	64.04	(-)	7.96	(-) 11.05	55.69
	1988-89	115	54.0	46.96	80.44	(+)	26.44	(+) 48.96	69.95
	1989-90	115	65.0	56.52	110.33	(+)	45.33	(+) 69.74	95.94
	1990-91	115	65.0	56.52	91.28	(+)	26.28	(+) 40.43	79.37
Sulphuric Acid Debari	1986-87	87,000	57,400	65.98	62,506	(+)	5,106	(+) 8.89	71.85
	1987-88	87,000	62,000	71.26	48,724	(-)	13,276	(-) 21.41	56.00
	1988-89	87,000	59,000	67.82	56,688	(-)	2,312	(-) 3.92	65.16
	1989-90	87,000	63,000	73.22	58,482	(-)	4,518	(-) 7.17	67.22
	1990-91	87,000	67,700	77.82	75,692	(+)	7,992	(+) 11.80	87.00
Sulphuric Acid Vizag	1986-87	75,000	46,800	62.40	44,283	(-)	2,517	(-) 5.38	59.04
	1987-88	75,000	54,000	72.0	34,543	(-)	19,457	(-) 36.03	46.06
	1988-89	75,000	46,000	61.33	50,809	(+)	4,809	(+) 10.45	67.74
	1989-90	75,000	54,500	72.66	57,487	(+)	2,987	(+) 5.48	76.64
	1990-91	75,000	55,000	73.33	57,919	(+)	2,919	(+) 5.30	77.22

1.	2.	3.	4.	5.	6.	7.	8.	9.
Silver	1986-87	30,000	23,750	79.17	16,572	(-) 7,178	(-) 30.22	55.24
Vizag (Kgs.)	1987-88	30,000	24,500	81.67	17,475	(-) 7,025	(-) 28.67	58.25
	1988-89	30,000	21,500	71.67	16,260	(-) 5,240	(-) 24.37	54.20
	1989-90	30,000	20,000	66.66	12,737	(-) 7,263	(-) 36.31	42.45
	1990-91	30,000	15,500	51.67	11,074	(-) 4,426	(-) 28.55	36.91
Silver	1986-87	12,000	10,800	90.0	10,186	(-) 614	(-) 5.69	84.88
Tundoo (Kgs.)	1987-88	12,000	9,650	80.42	10,255	(+) 605	(+) 6.27	85.46
	1988-89	12,000	9,200	76.67	11,420	(+) 2,220	(+) 24.13	95.17
	1989-90	12,000	10,200	85.00	11,800	(+) 1,600	(+) 15.69	98.33
	1990-91	12,000	10,200	85.00	13,990	(+) 3,790	(+) 37.15	116.58
Phosphoric	1986-87	26,000	6,000	23.07	4,149	(-) 1,851	(-) 30.85	15.96
Acid	1987-88	26,000	6,000	23.07	543	(-) 5,457	(-) 90.95	2.09
Debari	1988-89	26,000	5,000	19.23	208	(-) 4,792	(-) 95.84	0.80
	1989-90	26,000	-	-	843	(+) 843	-	3.24
	1990-91	26,000	3,600	13.85	79	(-) 3,521	(-) 97.80	0.30
Single Super	1986-87	72,600	35,000	48.21	11,027	(-) 23,973	(-) 68.49	15.18
Phosphate	1987-88	72,600	-	-	2,715	-	-	3.74
Debari	1988-89	72,600	-	-	-	-	-	-
	1989-90	72,600	-	-	-	-	-	-
	1990-91	72,600	-	-	-	-	-	-

ANNEXURE V

(Referred to in para 6.7.1)

STATEMENT SHOWING RECOVERY EFFICIENCY OF ZINC, LEAD ETC.

Particulars	1986-87	1987-88	1988-89	1989-90	1990-91
(in tonnes)					
<u>Zinc Smelter Debari</u>					
1. Net Input	45,312	36,143	42,993	43,383	50,259
2. Zinc produced	40,599@	31,452@	37,244@	38,451@	44,597@
3. Percentage of recovery to net input	89.60	87.02	86.63	88.63	88.73
<u>Zinc Smelter Vizag</u>					
1. Net Input	29,972	20,570	25,387	31,543	32,524
2. Zinc produced	26,017	17,403	21,506	26,868	28,052
3. Percentage of recovery to net input	86.80	84.60	84.71	85.18	86.25
<u>Lead Ingots Vizag</u>					
1. Net Input	14,541	14,623	14,131	17,254	19,371
2. Lead produced	12,553	12,703	12,052*	15,059£	17,060
3. Percentage of recovery to net input	86.33	86.87	85.29	87.28	88.07
<u>Lead Ingots Tundoo</u>					
1. Net Input	8,406	8,477	7,199	8,517	8,917
2. Lead produced	7,381	7,461	6,342	7,502	7,859
3. Percentage of recovery to net input	87.81	88.01	88.09	88.08	88.14

Particulars	1986-87	1987-88	1988-89	1989-90	1990-91
<u>Cadmium Debari</u>					
1. Net Input	216	189	240	220	242
2. Cadmium produced	124	109	150	151	168
3. Percentage of recovery to net input	57.48	57.57	62.62	68.38	69.49
<u>Cadmium Vizag</u>					
1. Net Input	57	131	161	206	162
2. Cadmium produced	27	64	80	110	91
3. Percentage of recovery to net input	47.04	48.75	50.10	53.60	56.29
<u>Sulphuric Acid Vizag</u>					
1. Net Input	44,642	10,413\$	16,439\$	18,805\$	67,207
2. Sulphuric Acid produced	38,533@@	8,987\$	14,160\$	16,241\$	57,919
3. Percentage of recovery to net input	86.32	86.31	86.13	86.37	86.18
<u>Sulphuric Acid Debari</u>					
1. Net Input	74,829	19,242\$	21,643\$	21,928\$	27,692\$
2. Sulphuric Acid produced	62,506	15,531\$	18,106\$	18,684\$	24,082\$
3. Percentage of recovery to net input	83.53	80.71	83.66	85.21	86.96

Particulars	1986-87	1987-88	1988-89	1989-90	1990-91
	(in Kgs.)				
<u>Silver Tundoo</u>					
1. Net Input	11,268	11,379	12,614	13,036	15,421
2. Silver produced	10,186	10,255	11,420	11,800	13,990
3. Percentage of recovery to net input	90.39	90.12	90.53	90.52	90.72
<u>Silver Vizag</u>					
1. Net Input	18,948	19,813	18,770	14,702	N.A.
2. Silver produced	16,572	17,475	16,260	12,737	N.A.
3. Percentage of recovery to net input	87.46	88.20	86.63	86.63	N.A.

NOTES :

@ Includes production of Zinc Sulphate.

* Does not include high Silver content Lead from anode scrap of Debari, processed at Vizag.

£ Does not include Lead dross (by product of blast furnace) converted into hard lead outside the Company.

@@Does not include production from the 70 TPD plant (lead circuit) because that was not stabilised till 1986-87.

\$ Sulphur used as the basis of calculation of recovery efficiency instead of Sulphuric Acid/Sulphur Dioxide.

ANNEXURE VI

(Referred to in para 6.8.1)

STATEMENT SHOWING TRANSIT LOSS IN CONCENTRATES

Particulars (1)	1986-87 (2)	1987-88 (3)	1988-89 (4)	1989-90 (5)	1990-91 (6)
<u>Zinc Lead Smelter Vizag</u>					
<u>(a) Zinc concentrates</u>					
i) Zinc concentrates despatched from various units (in tonnes)	7,870.183	28,890.400	52,677.700	55,177.514	35,571.410
ii) Loss in transit (in tonnes)	244.373	443.030	523.500	506.976	223.84
iii) Percentage of loss in transit to despatches	3.11	1.53	0.994	0.92	0.63
iv) Value of zinc concentrates lost in transit (Rs. in lakhs)	13.60	25.09	28.08	35.40	15.64
<u>Lead concentrates</u>					
i) Lead concentrates despatched from various points (tonnes)	29,372.465	29,420.192	N.A.	27,463.602	13,630.247
ii) Loss in transit (tonnes)	415.085	784.407	N.A.	218.650	210.407
iii) Percentage of loss in transit to despatches	1.41	2.67	N.A.	0.80	1.54
iv) Value of lead lost in transit (Rs. in lakhs)	24.96	55.89	N.A.	20.42	18.91

	(1)	(2)	(3)	(4)	(5)	(6)
<u>Zinc Smelter Debari</u>						
i) Zinc concentrates despatched from various points (in tonnes)	84,735.661	70,000.793	75,348.70	78,326.572	1,01,246.618	
ii) Loss in transit (in tonnes)	501.786	85.541	267.448	417.372	489.294	
iii) Percentage of loss in transit to despatches	0.59	0.12	0.35	0.53	0.48	
iv) Value of loss in transit (Rs. in lakhs)	25.73	4.86	15.16	28.61	37.68	

ANNEXURE VII

(Referred to in para 7.2.1)

SALES PERFORMANCE

(Qty. in tonnes except silver which is in Kgs.)

Particulars (1)	1986-87 (2)	1987-88 (3)	1988-89 (4)	1989-90 (5)	1990-91 (6)
A. <u>Zinc Ingots</u>					
i) Target of production	60,000	63,000	57,000	65,000	68,000
ii) Actual production	66,378	48,735	58,614	65,013	72,362
iii) Variation	(+)6,378	(-)14,265	(+)1,614	(+) 13	(+) 4,362
iv) Percentage of actual production to target	110.63	77.36	102.83	100.02	106.41
v) Target of sales	58,320	64,000	52,000	62,400	66,000
vi) Actual sales	63,270	53,930	50,035	61,253	60,667
vii) Variation	(+) 4,950	(-)10,070	(-) 1,965	(-) 1,147	(-) 5,333
viii) Percentage of actual sales to target	108.49	84.26	96.22	98.16	91.92
ix) Percentage of actual sales to actual production	95.32	110.66	85.36	94.22	83.84
x) Percentage of target of sales to target of production	97.20	101.59	91.23	96.00	97.06

	1.	2.	3.	4.	5.	6.
B. Lead Ingots						
i)	Target of production	22,600	23,900	24,000	24,500	25,100
ii)	Actual production	19,934	20,164	18,594	23,010	24,919
iii)	Variation	(-) 2,666	(-) 3,736	(-) 5,406	(-) 1,490	(-) 181
iv)	Percentage of actual production to target	88.20	84.37	77.48	93.92	99.28
v)	Target of sales	23,200	24,000	23,500	24,000	25,200
vi)	Actual sales	15,247	24,467	16,960	18,920	21,082
vii)	Variation	(-) 7,953	(+) 467	(-) 6,540	(-) 5,080	(-) 4,118
viii)	Percentage of actual sales to target	65.72	101.94	72.17	78.83	83.66
ix)	Percentage of actual sales to actual production	76.49	121.34	91.21	82.23	84.60
x)	Percentage of target of sales to target of production	102.65	100.42	97.92	97.96	100.40
C. Cadmium						
i)	Target of production	120	225	202	221	236
ii)	Actual production	150.778	173.074	231	261.11	259.32
iii)	Variation	(+) 30.778	(-) 51.926	(+) 29	(+) 40.11	(+) 23.32
iv)	Percentage of actual production to target	125.65	76.92	114.36	118.15	109.88
v)	Target of sales	173	215	200	240	240
vi)	Actual sales	151	185	171	213.104	158.86
vii)	Variation	(-) 22	(-) 30	(-) 29	(-) 26.896	(-) 81.14
viii)	Percentage of actual sales to targets	87.28	86.05	85.50	88.79	66.19
ix)	Percentage of actual sales to actual production	100.15	106.89	74.03	81.62	61.26
x)	Percentage of target of sales to target of production	144.17	95.56	99.00	108.60	101.70

	(1)	(2)	(3)	(4)	(5)	(6)
D Silver						
i) Target of production		39,550	42,150	40,700	40,200	33,900
ii) Actual production		26,746	37,057	37,748	33,679	31,589
iii) Variation	(-)	12,804	(-) 5,093	(-) 2,952	(-) 6,521	(-) 2,311
iv) Percentage of actual production to target		67.63	87.92	92.75	83.78	93.18
v) Target of sales		41,800	37,000	36,000	38,000	32,000
vi) Actual sales		32,893	34,977	33,281	32,938	28,395
vii) Variation	(-)	8,907	(-) 2,023	(-) 2,719	(-) 5,062	(-) 3,605
viii) Percentage of actual sales to target		78.69	94.53	92.45	86.68	88.73
ix) Percentage of actual sales to actual production		122.98	94.39	88.17	97.80	89.89
x) Percentage of target of sales to target of production		105.69	87.78	88.45	94.53	94.40
E. Single Super Phosphate						
i) Target of production		35,000	-	-	-	-
ii) Actual production		11,027	2,715	-	-	-
iii) Variation	(-)	23,973	-	-	-	-
iv) Percentage of actual production to target		31.51	-	-	-	-
v) Target of sales		35,000	-	-	-	-
vi) Actual sales		13,743	3,845	2,122	1,245	-
vii) Variation	(-)	21,257	-	-	-	-
viii) Percentage of actual sales to target		38.26	-	-	-	-
ix) Percentage of actual sales to actual production		124.63	141.62	-	-	-
x) Percentage of target of sales to target of production		100.00	-	-	-	-

	(1)	(2)	(3)	(4)	(5)	(6)
F. Phosphoric Acid						
i)	Target of production	6,000	6,000	5,000	-	-
ii)	Actual production	4,149	543	208	843	79
iii)	Variation	(-) 1,851	(-) 5,457	(-) 4,792	-	-
iv)	Percentage of actual production to target	69.15	9.05	4.16	-	-
v)	Target of sales	6,000	-	-	-	-
vi)	Actual sales	4,267	599	174	759	263
vii)	Variation	(-) 1,733	-	-	-	-
viii)	Percentage of actual sales to target	71.12	-	-	-	-
ix)	Percentage of actual sales to actual production	102.84	110.31	83.65	90.04	332.91
x)	Percentage of target of sales to target of production	100.00	-	-	-	-
G. Sulphuric Acid						
i)	Target of production	1,04,200	1,16,000	1,05,000	1,17,500	1,22,700
ii)	Actual production	1,06,789	83,267	1,07,497	1,15,969	1,33,611
iii)	Variation	(+) 2,589	(-) 32,733	(+) 2,497	(-) 1,531	(+) 10,911
iv)	Percentage of actual production to target	102.48	71.78	102.38	98.70	108.89
v)	Target of sales	48,435	69,000	64,000	85,000	87,000
vi)	Actual sales	59,637	50,308	73,339	76,643	99,134
vii)	Variation	(+) 11,202	(-) 18,692	(+) 9,339	(-) 8,357	(+) 12,134
viii)	Percentage of actual sales to target	123.12	72.91	114.59	90.17	113.95
ix)	Percentage of actual sales to actual production	55.85	60.42	68.22	66.09	74.20
x)	Percentage of targets of sales to target of production	46.48	59.48	60.95	72.34	70.90

ANNEXURE VIII
(Referred to in para 8.2.1)

STATEMENT SHOWING BUDGETED COST, ACTUAL COST AND SALES REALISATION OF MAIN PRODUCTS

(Amount in Rs.)

Sl. No.	Product	Year	Budgeted cost per M.T.	Actual cost per M.T.	Percentage of actual cost over budgeted cost	Weighted average sales price per M.T.	Excess of actual cost over weighted average sales price per M.T.	Percentage of cost to average sales price
1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Zinc Ingots Debari	1986-87	22,533	22,589	0.25	24,529	-	92.09
		1987-88	23,350	26,904	15.22	27,480	-	97.90
		1988-89	25,332	26,452	4.42	39,452	-	67.05
		1989-90	26,914	29,124	8.21	50,259	-	57.95
		1990-91	27,756	31,276	12.68	49,264	-	63.49
	Vizag	1986-87	22,076	20,222	(-) 8.4	24,634	-	82.05
		1987-88	23,579	28,419	20.52	27,192	1,227	104.51
		1988-89	28,627	29,201	2.0	39,039	-	74.80
		1989-90	28,881	30,845	6.8	50,299	-	61.32
		1990-91	30,936	45,555	47.26	49,324	-	92.36
2.	Lead Ingots Tundoo	1986-87	13,868	14,185	2.3	13,663	522	103.82
		1987-88	16,108	14,931	(-) 7.3	19,657	-	75.96
		1988-89	15,300	15,591	1.9	23,788	-	65.54
		1989-90	16,008	17,829	11.37	28,584	-	62.37
		1990-91	16,401	20,367	24.18	32,690	-	-

1.	2.	3.	4.	5.	6.	7.	8.	9.
	Vizag	1986-87	14,678	18,987	29.35	13,513	5,474	140.51
		1987-88	17,027	18,035	5.92	19,793	-	91.12
		1988-89	17,003	27,553	62.04	23,539	4,014	117.05
		1989-90	19,482	23,844	22.4	28,148	-	84.71
		1990-91	23,698	33,207	40.13	32,264	943	102.92
3.	Phosphoric Acid	1986-87	7,941	9,673	21.8	5,014	4,659	192.92
		1987-88	7,927	50,144	532.6	6,480	43,664	773.83
		1988-89	9,421	1,29,558	1,275.2	7,447	1,22,111	1,739.73
		1989-90			Incidental Production			
		1990-91			Incidental Production			
4.	Single Super Phosphate	1986-87	1,078	1,678	55.7	827	851	202.90
		1987-88	1,835	1,690	(-) 7.9	698	992	242.12
		1988-89	-	-	-	-	-	-
		1989-90	-	-	-	-	-	-
		1990-91	-	-	-	-	-	-
5.	Cadmium Debari (Kgs.)	1986-87	48	35	(-)27.08	71	-	49.29
		1987-88	43	74	72.09	N.A.	N.A.	N.A.
		1988-89	52	104	100.00	N.A.	N.A.	N.A.
		1989-90	56	90	60.71	382.21	-	23.55
		1990-91	64	94	46.88	280.00	-	33.57
6.	Vizag	1986-87	27	34	(+)25.9	71	-	47.89
		1987-88	43	38	(-)11.6	-	N.A.	N.A.
		1988-89	33	27	(-)19.54	N.A.	N.A.	N.A.
		1989-90	37	25	(-)32.43	382	-	6.54
		1990-91	57	99	73.68	282	-	35.10

ANNEXURE IX

(Referred to in para No. 8.2.6.1)

STATEMENT INDICATING ACTUAL CONSUMPTION OF POWER VIS-A-VIS NORMS

Description (1)	1986-87		1987-88		1988-89		1989-90		1990-91	
	Norms (2)	Actual (3)	Norms (4)	Actual (5)	Norms (6)	Actual (7)	Norms (8)	Actual (9)	Norms (10)	Actual (11)
(KWH per tonne except silver and cadmium which are in Kgs.)										
1. Mining										
i) Mochia Mine/ Zawar Mine	21.60	21.83	21.55	22.13	21.65	22.35	23.25	24.42	24.00	24.18
ii) Agnigundala Mine	21.0	21.75	22.00	20.78	21.54	20.99	21.54	21.05	21.00	22.65 (Provis.)
iii) Rajpura Dariba Mine	35.0	32.35	32.00	34.62	32.0	36.52	34.00	39.56	34.00	31.31
iv) Sargipalli Mine	35.0	40.02	38.00	37.40	38.0	31.64	38.00	31.19	38.00	29.68
2. Milling										
i) Zawar Mine	31.0	34.05	31.0	35.72	31.0	34.73	34.25	34.95	34.00	34.26
ii) Agnigundala Mine	29.0	27.97	28.0	28.30	28.0	26.90	28.0	25.20	25.00	23.26 (Provis.)
iii) Rajpura Dariba Mine	55.0	48.14	48.0	47.55	45.0	49.88	45.0	49.72	45.0	50.16
iv) Sargipalli Mine	35.0	31.97	32.0	30.13	28.0	32.90	28.0	28.80	28.00	25.71
3. Zinc Ingots										
i) Zinc smelter Debari	4350	4384	4300	4352	4300	4265	4300	4241	4250	4250
ii) Zinc Lead smelter Vizag	4500	4496	4500	4426	4450	4306	4450	4015	4250	4201

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4.	<u>Lead Ingots</u>										
	i) Zinc lead smelter Vizag	675	550	550	430	360	540	500	483	500	582
	ii) Lead smelter Tundoo	400	305	600	543	480	588	550	475	550	551
5.	<u>Cadmium</u>										
	i) Zinc smelter Debari	10	12	10	10	10	9	10	10	10	7
	ii) Zinc lead smelter Vizag	10	19	10	10	10	9	10	6	7	8
6.	<u>Sulphuric Acid</u>										
	i) Zinc smelter Debari	66	86	66	92	66	73	66	84	66	80
	ii) Zinc lead smelter Vizag	80	90	80	112	80	103	80	92	80	90
7.	<u>Single super phosphate</u> Zinc smelter Debari	15	31	15	23	-	-	-	-	-	-
8.	<u>Phosphoric acid</u> Zinc smelter Debari	400	540	400	1141	400	2860	-	-	-	-
9.	<u>Zinc dust</u> Zinc smelter Debari	900	1005	801	837	891	1126	900	931	900	878
10.	<u>Silver</u>										
	i) Zinc smelter Debari	230	262	230	224	230	233	230	201	230	219
	ii) Zinc lead smelter Vizag	-	-	-	-	500	1922	-	-	-	-

E R R A T A

Sl.No.	Page No.	Line No.	For	Read
1.	2.	3.	4.	5.
1.	(iv)	30	(Paras 2.1 to 2.3)	(Paras 2.1 to 2.4)
2.	(vi)	2	Rs.4689.00 lakhs	Rs.4689.80 lakhs
3.	5	Table percentage satisfaction		
		1993-94	72.0	72.4
		1996-97	60.0	60.1
		1999-2000	49.7	50.3
4.	13	Table	154.17	156.00
5.	16	1	5.2.4.4	5.2.2.4.4
6.	16	7th line from bottom	99th COPU Report	88th COPU Report
7.	20	Table- Col.3	9098 14449	9647 14434
8.	21	- do -	14389	14008
9.	21	15	0.80	8.11
10.	23	24	Silicon	Silica
11.	23	last line	Rs.4689 lakhs	Rs.4689.80 lakhs
12.	32	11	61.93	61.43
13.	34	12	Wartz	Waelz
14.	34	16	February 1991	February 1981
15.	34	2nd from bottom	efficient	efficiency
16.	35	1	47.04	47.37
17.	35	2	56.29	56.17
18.	35	17	98.4	88
19.	36	20	Quantity	Quality
20.	37	16	89 percent	88.79 percent
21.	39	22	April 1976	1975-76
22.	43	23	(Rs.17.50 lakhs)	(Rs.17.59 lakhs)
23.	52	Table Zawarmala overall	1.70	1.79

1.	2.	3.	4.	5.
24.	60	Percentage of metal recovery lead Rajpura Dariba 1986-87	73.2	73.3
25.	60 Annexure III	Zawar & Rajpura Dariba 1987-88	957812 475492	957812* 475492*
26.	62 Annexure IV	Zinc ingots Vizag 1987-88	85.67	86.67
27.	63 Annexure IV	Sulphuric Acid Debari 1989-90	73.22	72.41
28.	- do -	Cadmium Debari 1988-89	60.63	60.03
29.	66 Annexure V	Percentage of recovery to net input		
	Cadmium Debari	1986-87	57.48	57.41
		1987-88	57.57	57.67
		1988-89	62.62	62.5
		1989-90	68.38	68.64
		1990-91	69.49	69.42
	Cadmium Vizag	1986-87	47.04	47.37
		1987-88	48.75	48.85
		1988-89	50.10	49.69
		1989-90	53.60	53.40
		1990-91	56.29	56.17
30.	72 Annexure VII	Percentage of actual sales to targets	1986-87 38.26 Single Super Phosphate	39.26
31.	74 Annexure VIII	Table Col. 6	Percentage of actual cost over budgeted cost.	Percentage of excess of actual cost over budgeted cost.
32.	- do -	Table Col.9	Percentage of cost to average sale price.	Percentage of actual cost to weighted average sale price.
33.	75	Table-Col.6 Cadmium vizag	(-)25.9 (-)19.54	(+)25.9 (-)18.18
34.	75	Col.8 Cadmium vizag	357.46	---
35.	75	Vol.8 Lead ingots vizag	4340	---