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(SONTOSH MOHAN DEV)
MINISTER OF STATE
FOR STEEL

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सत्यमेव जयते

REPORT OF THE COMPTROLLER AND AUDITOR GENERAL OF INDIA

UNION GOVERNMENT
NO. 11 (COMMERCIAL) OF 1995

STEEL AUTHORITY OF INDIA LIMITED
(BHILAI STEEL PLANT)

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PREFACE

Audit Boards are set up under the supervision and control of the Comptroller and Auditor General of India(CAG) to undertake comprehensive appraisals of the performance of the Companies and Corporations subject to audit by CAG.

2. The report on Steel Authority of India Limited, Bhilai Steel Plant was finalised by an Audit Board consisting of the following members:

1. Shri U.N.Ananthan	Deputy Comptroller and Auditor General-cum-Chairman, Audit Board from Ist June, 1993 to 30th November,1993.
2.Shri C.K.Joseph	Deputy Comptroller and Auditor General-cum-Chairman,Audit Board from 13th December, 1993 to 20th March 1995
3. Shri Ravi Saxena	Principal Director of Commercial Audit and Ex-Officio MAB, Ranchi
4. Shri Kanwal Nath	Principal Director of Commercial Audit and Ex-Officio MAB-III, New Delhi.
5. Shri B.B. Manocha	Director (Comml.), Office of the Comptroller and Auditor General of India, New Delhi
6.Shri R. Talwar	Part time Member Technical Director M.N.Dastur and Company Limited, Calcutta.
7. Shri S.M.Srivastva	Part time Member Formerly General Manager (Project), Alloys Steel Plant, SAIL.

(Shri S.M.Srivastva could not attend the Audit Board Meeting with Management and Ministry)

3. The part time members are appointed by the Government of India (in the respective Ministry or Department controlling the Company or Corporation) with the concurrence of Comptroller and Auditor General of India.

4. Audit Board held discussion with the representatives of Ministry of Steel.

5. The Comptroller and Auditor General of India wishes to place on record his appreciation of the work done by the Audit Board.

OVERVIEW

1. Introduction

Bhilai Steel Plant (BSP), a constituent unit of Steel Authority of India Limited (SAIL), was set up with a capacity of 1 Million Tonne per annum in September,1961; the capacity of the Plant was subsequently increased to 2.5 Million Tonnes in October 1967. Capacity expansion to 4 Million Tonnes per annum was completed in March,1988 at a cost of Rs. 2288.63 crores (likely completion cost) against the original sanction of Rs. 937.70 crores.

2. Expansion of Steel Making capacity

The completion of the 4 MT project was delayed by 4 years and 9 months. The cost of slippage in project completion schedule was Rs.210.76 crores. The cost overrun of Rs. 1350.93 crores was attributed to increase in volume and scope of work (Rs.293.59 crores) price escalation (Rs.619.07 crores) increase in duties/taxes (Rs. 162.30 crores) and other reasons (Rs.275.97 crores).

(Paras 2.02 and 2.03)

A few interesting features relating to the expansion project are :

(a) The backlog in concrete work and equipment erection work due to non completion of work on schedule by HSCL was cleared at an extra expenditure of Rs.717.48 lakhs.

[Para 2.04(a)]

(b) A contract awarded to a private contractor in December,1972 was terminated in July,1982 before completion of work. The net amount recoverable from the defaulting contractor was Rs.71.19 lakhs.

[Para 2.04(b)]

(c) The Company incurred an extra expenditure of Rs.4.47 crores due to diversion of the order for supply of 2nd pusher car from HEC to a Soviet supplier.

[Para 2.04(c)]

(d) Improper planning, lack of complete drawings, delayed availability of the site, change in the scope of work etc resulted in increase in the contract price for construction of cast house slag granulation plant by Rs.5.32 crores .

[Para 2.04(d)]

(e) Infructuous expenditure of Rs. 1.80 crores on the construction of steel foundry.

[Para 2.04(e)]

3. Rated Capacity.

Bhilai Steel Plant invested Rs.997.37 crores upto March 1994 on modernisation of its Plant, debottlenecking Schemes, New Scheme, Other Capital Scheme, Addition, Modification and Replacement (AMR) Scheme including expansion of Steel Melting Shop - II (SMS-II) from 1.5 million tonne capacity to 1.7 million tonne capacity. Despite substantial investment, the rated capacity has been retained as 4 million tonne of crude steel (ingot steel/liquid steel) per annum and not revised upwards.

(Para 3)

4. Production Performance.

There was continuing low capacity utilisation of the plant in terms of steel ingots and saleable steel from 1978-79 to 1990-91. The shortfall in production accounted for loss of contribution margin of Rs. 747.46 crores during 1981-82 to 1992-93 in respect of saleable steel.

(Para 4.01)

The average pushing of ovens per day had been less than the capacity and the actual coking time of batteries varied between 18.9 to 21.4 hours as against 17 hours fixed in DPR.

(Para 4.02.01)

The consumption of imported coal in the blend in excess of the norms fixed resulted in extra expenditure of Rs. 14.55 crores for the years 1982-83, 1988-89 and 1990-91.

(Para 4.02.03)

The actual production of hot metal in blast furnaces was always less than the rated capacity (except in 1993-94) and also the target (except 1992-93 and 1993-94). The production of off-grade hot metal ranged from 4.68% to 34.85% during the years 1987-88 to 1993-94.

(Para 4.03.01)

A Movable Throat Armour procured at a cost of Rs.193 lakhs could not be utilised properly because of operational problems/constraints and was rendered surplus; various associated items worth Rs.54 lakhs also became surplus.

(Para 4.03.06)

Due to low machine utilisation and poor productivity of Sintering Plant, the production of sinter ranged from 61.08% to 86.08% of the rated capacity in Sintering Plant I and from 34.20% to 100.62% of the rated capacity in Sintering Plant II.

(Para 4 .04)

There was extra metallic input and consumption of ferro manganese to the tune of Rs.662.98 crores and Rs.50.58 crores respectively as compared to the norms fixed by the Norms Committee.

(Para 4.05.04)

There was short recovery of Steel worth Rs. 349.12 crores due to lower yield .

(Para 4.05.05)

The consumption of ingot moulds and bottom stools per tonne of rollable ingot steel in excess of the norms resulted in an extra expenditure of Rs. 14.74 crores.

(Para 4.05.06)

The production in blooming mill, billet mill, rail and structural mill, merchant mill, and plate mill was below their rated capacity in all the years.

(Paras 4.08.01 to 4.08.04 and 4.08.06)

The rolling of billets in rail and structural mill had resulted into avoidable extra expenditure of Rs.19.72 crores.

(Para 4.08.04)

The capacity of the Plate Mill as well as the product mix was created in excess of the demand. To liquidate the accumulated stock of plates, the plant resorted to export of plates at a price lower than the cost of production leading to a loss of Rs.277.71 crores during the period 1987-88 to 1993-94

(Para 4.08.06)

5. <u>Sources of Raw Material.</u>

The Plant has its own mechanised mines of iron ore at Rajhara & Dalli, production at Rajhara ranged between 48.86% and 100.34% of the rated capacity and production at Dalli ranged between 24.14% and 109.77% of the rated capacity.

(Paras 5.1.01 and 5.1.02.)

The production of lime stone mechanised mines at Nandini had always been lower than the rated capacity.

(Para 5. 2)

During the period from 1978-79 to 1993-94 royalty aggregating to Rs.366.80 lakhs had been paid on the rejects arising from crushing of ROM ore at the crushing plant situated outside the leased area.

(Para 5.2.01)

A quantity of 35.90 lakh tonnes of high silica dolomite was purchased at an extra expenditure of Rs.41.48 crores due to lower production at Plant's captive mines.

(Para 5.3)

6. **Services & Fuel.**

The loss due to leakage of steam in Power Plant-II during the years 1984-85 to 1993-94 worked out to Rs.7.08 crores.

(Para 6.01)

The consumption of services and fuel in excess of norms had resulted in extra expenditure of Rs. 26.25 crores in coke ovens, Rs. 36.41 crores in blast furnace, Rs. 34.10 crores in sintering plants, Rs. 23.80 crores in SMS and Rs.43.83 crores in rolling mills from 1978-79 to 1993-94.

(Para 6.02)

7. **By-products and other arisings.**

The actual yield of by-products viz., crude tar, crude benezol & ammonium sulphate from by-product plant was generally lower than the norms.

The processing of blast furnace slag in slag granulation plants was always below the rated capacity and ranged between 47.47% and 80.0%.

(Para 7)

8. Costing System and Analysis of Cost.

Actual cost of production of almost all the products was higher than the standard cost.

(Para 8)

9. Manpower Analysis.

The actual manpower had always been more than the DPR projection. The actual labour productivity upto the year 1990-91, was much below the norm of 100 ingot tonnes.

(Para 10.1)

10. Inventory Control.

The stock of non moving and surplus items was very high and their disposal was also slow.

(Para 11.1)

Equipments valued at Rs. 12.59 crores were lying idle and awaiting disposal.

(Para 11.2(ii))

CHAPTER-1

INTRODUCTION

The construction of the integrated Steel Plant at Bhilai (Madhya Pradesh) with a capacity of one million tonnes of steel ingot (0.77 million tonnes (MT) of saleable steel) was completed in September,1961 at a cost of Rs.201.39 crores with Soviet collaboration. The capacity was increased to 2.5 million tonnes of steel ingot (1.965 million tonnes of saleable steel) in October, 1967 at a cost of Rs.149.45 crores. The steel making capacity was further expanded to 4 million tonnes of crude steel (ingot steel/liquid steel; 3.153 million tonnes of saleable steel) in March,1988 at a cost of Rs.2288.63 crores. In addition, Rs.117.07 crores on `Advance Action Scheme' for 4 million tonne expansion, Rs.372.94 crores on debottlenecking schemes, Rs.62 crores on other capital schemes, Rs.847 crores on Addition, Modification and Replacement (AMR) schemes, Rs.18 crores on Township and Rs.4.74 crores on new schemes were also spent upto March, 1994.

The main units of the Steel Plant upto 4 million tonnes stage are Coke Ovens, Blast Furnaces, Sintering Plants, Steel Melting Shop, Converter Shop, Continuous Casting Shop and Rolling Mills consisting of Blooming and Billet Mill, Rail & Structural Mill, Merchant Mill, Wire Rod Mill and Plate Mill. Besides there are by-product plants and various service units like Power Plants, Refractory Material Plant, Oxygen Plants, Slag Granulation Plants etc., In addition, the plant has captive Iron Ore Mines at Rajhara, Dalli & Jharandalli, Limestone mines at Nandini & Deorjhal and Dolomite Mines at Hirri.

The product mixes envisaged in project report for 2.5 MT and 4.00 MT stages were as follows :

(Lakh tonnes)

	Particulars of Products	At 2.5 MT stage (per annum)	At 4.00 MT stage (per annum)
A.	Saleable Steel	19.65	31.530
(i)	Billets for sale(Semis)	3.15	5.530
(ii)	Merchant Products	5.00	5.000
(iii)	Wire Rods	4.00	4.000
(iv)	Rails	5.00	5.000
(v)	Heavy Structurals	2.50	2.500
(vi)	Plates	--	9.500
B.	Pig Iron for sale	3.27	6.241

The working of the Plant from 1970-71 to 1977-78 had been discussed in the Report of C&AG Union Government (Commercial),1981 Part-III. This report appraises the working of the Plant from 1978-79 to 1993-94.

CHAPTER - 2

EXPANSION OF STEEL MAKING CAPACITY

2.01 Background

The idea of expanding the steel making capacity from 2.5 MT to 4 MT in Bhilai Steel Plant was mooted in a techno-economic report submitted to Government in April, 1966 by the Plant Authorities. A feasibility report was prepared by MECON (earlier Central Engineering and Design Bureau CEDB) in February, 1970. However, the final view on the units to be installed was taken in consultation with the Soviet collaborators in August, 1972 and a Detailed Project Report (DPR) was prepared by the consultants (MECON) in September, 1973. The Board (Steel Authority of India Limited - SAIL) considered and approved the proposal in January, 1975 subject to certain modifications. The modified scheme submitted to Government in December, 1976 was approved by Government in February, 1978. Preliminary work started in July, 1972 which was fixed as zero date by Government.

The main units proposed to be installed under the expansion project (4 MT Stage) were (i) Coke Oven Battery No.9, (ii) Sintering Plant No.2, (iii) Blast Furnace No.7, (iv) Converter Shop to produce additional 1.5 MT of Crude Steel, (v) Continuous casting shop to produce slabs and blooms out of 1.5 MT Liquid Steel and (vi) Plate Mill. Supporting units proposed included Oxygen Plant No. 2, Power Plant No.2 and Refractory Material Plant No. 2.

2.02 Cost Estimates

The estimated cost of the expansion project as per DPR after taking a final view on the units to be installed was Rs. 539 crores in September, 1973. The Government approved the revised cost estimate of Rs. 937.70 crores (foreign exchange components of Rs. 126.50 crores) in February, 1978. SAIL revised the cost estimates three times; in March 1983 to Rs 1600.50 crores (including a foreign exchange component of Rs.180.30 crores), in January 1987 to Rs. 2145.50 crores (inclusive of a foreign exchange component of Rs.234.48 crores) and in January 1989 when the likely completion cost was assessed at Rs. 2288.63 crores (with a foreign exchange component of Rs.241.73 crores). The approval of Government for the

revised estimates is still awaited (September 1994). The Ministry of Steel stated (April 1994) that the approval is held up for want of the final clearance from the Ministry of Environment and Forests.

2. The likely completion cost of Rs. 2288.63 crores was more by Rs. 1350.93 crores than the original Government approved cost and Rs. 1749.63 crores more than the DPR cost representing increases of 144% and 325% respectively. The cost over-run of Rs. 1350.93crores with reference to the original approved cost was attributed to the increase in volume and scope of work (Rs. 293.59 crores), price escalation, (Rs.619.07 crores) and increase in duties/taxes (Rs.162.30 crores)and other reasons (Rs.275.97 crores). The Ministry stated (April 1994) that cost overrun was due to the fact that several Indian companies including public sector undertakings who were implementing the project were at the early stage of absorbing the new technology and with SAIL's limited experience in project management, the mid-course changes and adjustments experienced during the implementation were perhaps inevitable.

2.03 Delay in Completion

According to the DPR, the expansion project was to be completed by June, 1977. However, while according approval, the Government indicated June, 1983 as the project completion date. This was shifted to December, 1984 and again to January, 1988. The main units were, however, completed by March, 1988. The delay in completion, thus, works out to 10 years 9 months and 4 years 9 months with reference to the DPR and Government's original sanction respectively.

The cost of slippage in the completion schedule from June, 1983 to March,1988 was analysed by the plant management and placed at Rs. 210.76 crores. The Ministry stated (April'94) that the progress of various stages of development of the project was punctuated with several decisions impinging on the scope and volume of the work and also adoption of alternative technologies, and these invariably had implications of delay in execution. Other delays, the Ministry added, were the delays in execution by implementing agencies due to inadequate mobilisation, delays in supply of equipment, supply of defective equipments, and need for rectification of defective equipments etc. However, these delays were not unique to Bhilai Steel Plant but were experienced in execution of other expansion projects of SAIL, such as Bokaro Steel

Plant Stage-II. Further the Ministry also stated (September,1994), "In December,1982 the Cabinet Committee on monitoring the execution and expeditious completion of major projects reviewed the progress of 4.0 million tonne expansion of BSP. The Committee expressed serious concern at the manner in which the project was progressing. The Committee also noted that there were serious complaints in regard to some of the critical equipments supplied to the plant and in particular with reference to power plant supplied by Bharat Heavy Electricals Limited (BHEL) and some of the items of Plate Mill supplied by Heavy Engineering Corporation (HEC). It was also mentioned that there had been delays in responding to the request of Bhilai for deputing experts and in taking measures for rectification of defects. The Committee observed that defective equipment involved wastage of national resources and delayed the development process. They directed that the Cabinet Secretary should set up a Technical Committee to go into the defects that had been pointed out, identify the causes and determine the responsibility for supply of defective equipment."

In pursuance of the direction of the Cabinet, the Technical Committee, set up in May,1983 observed (April,1984) that the contractual arrangements made by the implementing authorities lacked clarity and precision because of which no responsibility could be fixed on any contractor. The slow progress of work at site was allowed to continue year after year without effective augmentation on the work front. With regard to supply of defective equipment by Heavy Engineering Corporation (HEC), the Committee further added that the commercial practice of inspecting equipments before despatch was not adhered to by project authorities of Bhilai Steel Plant.

2.04 Other points of interest

(a) The contract with Hindustan Steelworks Construction Limited (HSCL) stipulated periodical rates as well as quantum of concreting work to be done in each period. However, the backlog of 110243 M^3 in concreting work upto December, 1981 was paid at the enhanced rate applicable from January, 1982 involving extra expenditure of Rs. 670 lakhs. Similarly, the backlog of 17818.1 M^3 in erection work of mechanical and electrical equipments upto December, 1981 was paid at enhanced rate applicable from January, 1982 involving extra expenditure of Rs. 47.48 lakhs. The Management stated (August, 1992) that the contractual agency could not be held fully responsible for non-fulfilment of targeted volume of work in a particular period and

hence payment was made at the rates applicable to the period of actual execution of work. However, the Management did not state why the contractual agencies could not be held fully responsible.

(b) As a part of site clearance for the expansion project, a private contractor was engaged in December, 1972 for a total value of Rs.2.23 crores. The contractor was required to remove 15 lakh M^3 of open hearth muck and recover 1 lakh tonnes of scrap by December, 1973 and July, 1978 respectively. Extensions of time were allowed keeping alive the provision of escalation stipulated in the contract. Removal of muck was completed in March, 1981 but the target (45,000 tonnes) for recovery of scrap could not be achieved. The contract was finally terminated in July 1982. The amount of escalation paid to the contractor was Rs. 49.50 lakhs. The balance work was got executed through another contractor at the risk and cost of the defaulting contractor from whom the net amount recoverable on various accounts worked out to Rs. 71.19 lakhs. The Management stated (August, 1992) that on account of difficulties in finding out a suitable alternative agency and to avoid delay in fixing the new agency, extensions were granted and apprehending the stoppage of work, escalations were also allowed. The court case for recovery of the extra cost from the defaulting contractor, the Management added (April 1994), was being pursued.

(c) The order placed on HEC in July 1983 included a Coke Pusher Machine (needed for 9th Coke Oven Battery to be commissioned in December 1984) to be supplied by March, 1984 at a cost of Rs. 1.55 crores. Subsequently, the order was diverted to the Soviets in anticipation of delay in supply from HEC. However, the 9th Battery was commisioned in March 1988 and the landed cost of the Coke Pusher Machine (supplied by the Soviets in November/December 1987) worked out to Rs.6.02 crores involving an extra expenditure of Rs.4.47 crores. The Management stated (August, 1992) that HEC was to deliver the machine in March, 1984 so as to match the commissioning of 9th Coke Oven Battery in December, 1984; since delay was apprehended the order was diverted to Soviets. The Management claimed that the extra cost was more than compensated by timely completion of 9th Battery. The reply of the Management is factually incorrect in as much as the Battery was required to be commissioned in December, 1984 but was actually commissioned in March, 1988. Further the reply does not indicate whether HEC was given the opportunity of supplying the equipment by May, 1987 (the delivery schedule given to the Soviets).

The Ministry stated (April 1994) that in the judgement of the Plant, the payment of extra cost was a lesser risk than the risk of a time over-run with implications of higher cost, had the order not been diverted from HEC.

(d) The Cast House Slag Granulation Plant to process slag from Blast Furnace No.7 was commissioned in August, 1987 instead of January, 1984. The contractor was allowed extension five times due to late selection and allotment of land and major changes in the scope of work with increased volume resulting in an increase in the contract price by Rs. 5.32 crores of which price escalation accounted for Rs. 2.54 crores. The Ministry stated (April 1994) that delay was due to exegencies of the situation arising out of a number of factors like adoption of new technology, the prevailing ground realities and relative lack of experience in B.F. construction and could not be attributed to a single agency or agencies.

(e) In anticipation of increased requirement of steel castings at the 4 MT stage, the plant authorities felt the necessity of shifting one of the two furnaces of Steel Foundry to a new location to create additional moulding space. The project was approved (April,1987)at an estimated cost of Rs.4.94 crores and an advance sanction of Rs.25 lakhs was accorded in August, 1987. The construction of the project went ahead without further allotment of funds. In January, 1989 the plant authorities dropped the proposal and the work was stopped after an expenditure of Rs. 1.80 crores had been incurred. The Management stated (August, 1990) that with the anticipated change in technological process of steel making from Open Hearth to Lindz Donavej (LD) process, after 1995, (as envisaged in SAIL Technology Plan upto 2000 AD) the requirement of iron and steel castings was likely to be reduced to zero and therefore, relocation of the steel foundry was not necessary. However, in order to utilise the structure, the construction of a reclamation shop was approved in March, 1989 at a cost of Rs.3.38 crores which included Rs. 1.80 crores spent for relocation of the steel foundry.

CHAPTER - 3.

RATED CAPACITY

After expansion of the Bhilai Steel Plant from 2.5 MT capacity to 4 MT of crude steel (ingot steel and liquid steel) capacity in March 1988, Bhilai Steel Plant invested substantial funds (Rs.997.37 crores) upto March 1994 on modernisation of its plant, debottlenecking schemes, new schemes, other capital schemes, addition, modification and replacement (AMR) schemes including expansion of SMS-II from 1.5 MT capacity to 1.7 MT capacity. Some new schemes have also been undertaken such as conversion of open hearth furnaces (3 out of 6) into twin hearth furnaces (pertaining to SMS-I) at a cost of Rs.74.51 crores upto June, 1992. Consequently the capacity of SMS-I increased (from June 1992) from 25 lakh tonnes of steel ingots to 27 lakh tonnes of steel ingots. The actual production of hot metal, crude steel and saleable steel also, at times, went beyond the rated capacity in the last three years (1991-92 to 1993-94); it also exceeded the production targets during the last two years.

Despite a huge investment of Rs.997.37 crores over and above the capital investment on expansion (Rs.2288.63 crores), the rated capacity of the plant has been retained as 4 million tonnes of crude steel per annum and has not been revised upwards.

In April 1994, the Ministry, clarifying the position, intimated the Audit Board that installation of additional plant, machinery and equipment (other than for replacement purposes) would add to the rated capacity.

CHAPTER 4

PRODUCTION PERFORMANCE

4.01 Production Statistics.

The table below indicates the rated capacity for production of ingot/liquid steel and saleable steel, yearly targets and the actual production thereagainst during the years 1978-79 to 1993-94 :

TABLE-I

Production of Ingot Steel, Liquid Steel and Saleable Steel

(Fig. in lakh tonnes)

Year	Particulars	Rated Capacity	Annual Target	Actual Production	Percentage of actual production to	
					Rated Capacity	Annual Target
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1978-79	Ingot Steel	25.00	24.00	22.00	88.00	91.67
	Saleable Steel	19.65	19.35	18.46	93.94	95.40
1979-80	Ingot Steel	25.00	23.00	21.08	84.32	91.65
	Saleable Steel	19.65	19.00	17.06	86.82	89.79
1980-81	Ingot Steel	25.00	22.00	20.41	81.64	92.77
	Saleable Steel	19.65	18.30	18.18	92.52	99.34
1981-82	Ingot Steel	25.00	21.00	21.15	84.60	100.71
	Saleable Steel	19.65	17.50	18.19	92.57	103.94
1982-83	Ingot Steel	25.00	23.25	21.30	85.20	91.61
	Liquid Steel	-	2.00	-	-	-
	Saleable Steel	19.65	19.80	18.38	93.54	92.83
1983-84	Ingot Steel	25.00	21.50	18.37	73.48	85.44
	Liquid Steel	-	2.00	-	-	-
	Saleable Steel	19.65	18.47	15.74	80.10	85.22
1984-85	Ingot Steel	25.00	21.00	19.25	77.00	91.67
	Liquid Steel	-	3.35	0.73	-	21.79
	Saleable Steel	21.21	19.10	18.10	85.34	94.76
1985-86	Ingot Steel	25.00	22.00	18.90	75.60	85.91
	Liquid Steel	5.60	3.50	4.54	81.07	129.71
	Saleable Steel	24.10	20.40	20.55	85.27	100.74

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1986-87	Ingot Steel	25.00	22.00	15.26	61.04	69.36
	Liquid Steel	9.00	8.00	7.04	78.22	88.00
	Saleable Steel	26.80	26.00	21.50	80.22	82.69
1987-88	Ingot Steel	25.00	20.00	16.57	66.28	82.85
	Liquid Steel	9.00	10.00	8.14	90.44	81.40
	Saleable Steel	26.80	24.65	21.73	81.08	88.15
1988-89	Ingot Steel	25.00	20.70	19.17	76.68	92.61
	Liquid Steel	15.00	13.00	11.77	78.47	90.54
	Saleable Steel	31.53	26.70	25.42	80.62	95.21
1989-90	Ingot Steel	25.00	20.00	19.17	76.68	95.85
	Liquid Steel	15.00	14.00	13.36	89.07	95.43
	Saleable Steel	31.53	27.25	25.94	82.27	95.19
1990-91	Ingot Steel	25.00	21.50	20.74	82.96	96.46
	Liquid Steel	15.00	15.00	14.37	95.80	95.80
	Saleable Steel	31.53	29.41	27.95	88.65	95.04
1991-92	Ingot Steel	25.00	24.50	21.56	86.24	88.00
	Liquid Steel	15.00	15.50	15.88	105.87	102.45
	Saleable Steel	31.53	31.10	31.04	98.45	99.81
1992-93	Ingot Steel	25.00	22.25	23.23	92.92	104.40
	Liquid Steel	15.00	16.00	16.19	107.93	101.19
	Saleable Steel	31.53	30.60	31.18	98.89	101.90
1993-94	Ingot Steel	25.00	23.50	23.95	95.80	101.91
	Liquid Steel	15.00	16.00	16.33	108.87	102.06
	Saleable Steel	31.53	31.30	33.35	105.77	106.55

Note: The graphic presentation of production performance is at **Annexure-I**.

The production during the years 1978-79 to 1990-91 had been mostly lower than the rated capacity as well as annual targets. In the subsequent three years, not only the liquid steel production surpassed the rated capacity but the saleable steel (sum total of finished and semi-finished steel) production also increased and ranged from 98.45% (1991-92) to 105.77% (1993-94) of the rated capacity.

The loss of contribution (sale price minus variable cost) towards fixed cost and profit due to shortfall in production of saleable steel (39.79 lakh tonnes) during the years 1981-82 to 1992-93 works out to Rs.747.46 crores. The Ministry stated (April,1994) that targets had been fixed at lower than the rated capacity on an overall assessment of the various constraints such as shortage of coal, restriction on drawal of

power from Madhya Pradesh Electricity Board (MPEB), shortage of raw material due to restrictions imposed by the Railways on movement of wagons etc. However, they did not mention any internal factors responsible for shortfall in production.

Further, the actual production of saleable finished steel ranged from 79% to 84% only of the rated capacity, whereas, the production of saleable semi finished steel ranged from 133% to 207% of the rated capacity as is evident from the following table:-

TABLE-2
(Lakh tonnes)

Sl.No.	Name of the Product	Rated Capacity 4.00 MT as per DPR	Actual Production			
			1990-91	1991-92	1992-93	1993-94
A.	**Finished Steel**					
(i)	Merchant Products	5.00	4.53	4.69	4.79	4.94
(ii)	Wire Rods	4.00	4.06	4.23	3.93	4.28
(iii)	Rails and Structurals	7.50	5.50	5.99	6.14	6.46
(iv)	Plate	9.50	6.52	6.75	6.60	6.21
	Total of (A)	26.00	20.61	21.66	21.46	21.89
B.	**Semi-finished Steel**					
(i)	Billets for sale	5.53	3.17	3.74	4.07	5.19
(ii)	Blooms	--	1.54	2.15	1.65	2.20
(iii)	Slabs	--	2.26	3.19	3.82	3.78
(iv)	Blooms (from continuous casting shop)	--	0.37	0.30	0.18	0.13
(v)	Cuttings	--	--	--	---	0.16
	Total of (B)	5.53	7.34	9.38	9.72	11.46
	Grand Total of (A + B)	31.53	27.95	31.04	31.18	33.35

TABLE-2
(Lakh tonnes)

Sl.No.	Name of the Product	Rated Capacity 4.00 MT as per DPR	Actual Production			
			1990-91	1991-92	1992-93	1993-94
1.	Percentage of Actual Production of saleable finished steel to rated capacity		79.27	83.31	82.54	84.19
2.	Percentage of Actual Production of saleable semi-finished steel to rated capacity		132.73	169.62	175.77	207.23
3.	Percentage of overall production of saleable (finished & semi-finished) steel to overall rated capacity		88.65	98.45	98.89	105.77

The Management stated (April,1994) that (i) lower production of saleable finished steel was attributable to lower mill utilisation, adverse product mix and order position of Plate Mill and (ii) higher production of saleable semi-finished steel was attributable to input requirement of other plants, the secondary steel sector and the export market for the semi-finished steel. The loss incurred by the Plant in terms of money and value added on account of lesser production of saleable finished steel and higher production of saleable semi-finished steel was not quantified.

UNIT WISE PERFORMANCE

4.02 COKE OVEN BATTERIES

Eight Coke Oven Batteries (including one standby to facilitate the rebuilding of the old batteries without affecting production) were commissioned upto November, 1979 at a total cost of Rs.50.72 crores. For the 4 MT stage one more battery (i.e, 9th Coke Oven Battery) was commissioned on 31st March 1988 at a cost of Rs. 129.33 crores. The rated capacity of Coke oven Batteries for Blast Furnace Grade Coke (+ 25 mm) before and after 4 MT stage was 25.11 lakh tonnes per annum (as adopted by Management against 27.57 lakh tonnes per annum as per DPR) and 33.03 lakh tonnes per annum respectively. Actual production during the period from 1978-79 to 1993-94 however, ranged between 75.20% (1988-89) and 91.16% (1978-79) of the adopted capacity. **(Annexure II).**

4.02:01 Capacity Utilisation

The rated capacity of coke ovens depends upon the number of ovens in operation and the normal coking time as per design. As per DPRs (2.5 MT; 6th BF complex and 8th Coke Oven Battery complex) the coking time is 17 hours. In respect of the 9th Coke Oven Battery coking time as per DPR is 16 hours. The Norms Committee refixed the coking time of batteries 1 to 8 at 18.5 hours. The table below indicates the performance of coke ovens year wise :

Batteries-1 to 8 TABLE - 3

Year	No. of ovens in-operation per day	Ovens pushed/day			Coal(dry) charged/ oven (tonnes)	Coking time (hrs.)	Capacity utilisation	
		Capacity (*)	(**)	Actual			(%) (*)	(%) (**)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1978-79	448	632	581	522	17.61	20.9	82.59	89.85
1979-80	415	586	538	501	17.48	20.5	85.49	93.12
1980-81	422	596	547	477	17.18	21.4	80.03	87.20
1981-82	419	592	544	503	17.34	20.1	84.97	92.46
1982-83	411	580	533	484	17.08	20.4	83.45	90.81
1983-84	395	558	512	475	16.95	19.9	85.13	92.77
1984-85	396	559	514	479	16.95	19.9	85.69	93.19
1985-86	430	607	558	513	17.06	20.0	84.51	91.94
1986-87	392	553	509	487	17.10	19.5	88.07	95.68
1987-88	388	548	503	491	16.90	18.9	89.60	97.61
1988-89	386	545	501	440	17.20	20.5	80.73	87.82
1989-90	394	556	511	460	17.20	19.2	82.73	90.02
1990-91	455	642	590	503	16.80	20.8	78.35	85.25
1991-92	455	642	590	509	17.00	20.5	79.28	86.27
1992-93	455	642	590	506	16.80	20.6	78.82	85.76
1993-94	455	642	590	536	17.00	20.4	83.49	90.85

Battery No.9

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1988-89	67	101	-	76	31.60	21.2	75.25	-
1889-90	67	101	-	81	31.60	19.8	80.20	-
1990-91	67	101	-	82	32.40	19.6	81.19	-
1991-92	67	101	-	84	32.40	19.1	83.17	-
1992-93	67	101	-	86	32.40	18.8	85.15	-
1993-94	67	101	-	88	32.10	18.2	87.13	-

(*) (i) Based on coking time of 17 hours as per DPR (2.5 MT, 6th BF complex and 8th Coke Oven Battery complex) for batteries 1 to 8.

(ii) Based on coking time of 16 hours as per DPR on 9th Coke Oven Battery.

(**) Based on coking time of 18.5 hours as per the Norms Committee.

It would be seen that average pushing of ovens per day had been less than the capacity and fluctuated considerably indicating inconsistent performance and low production. Coking time had been higher than both the DPR as well as Norms Committee norms during the entire period.

Shortfall, in oven pushing and higher coking time, were according to the Management due to the following reasons:

Shortfall

i) Acute shortage of coking coal,

ii) Deteriorating condition of batteries,

iii) poor off-take of coke by Blast Furnaces,

iv) Acute shortage of manpower,

v) Low receipt of coal,

vi) Emergency hot/cold repairs of battery.

Higher coking time

i) Low availability of coal,

ii) Requirement of coke in Blast Furnaces,

iii) Health of batteries.

Due to prolonged coking time, the brick work of batteries was damaged which necessitated extensive repairs. The expenditure incurred in extensive repairs during 1980-81 to 1989-90 was Rs. 22.63 crores. According to the Management (April, 1994), prolonged coking time was necessitated by various factors and expenditure on repairs was essential for maintenance.

4.02.02 Yield of BF Coke & Gas

The actual yield of BF Coke from raw coal charged ranged between 68.30% (1978-79) and 69.65% (1987-88) against the prescribed norms of 68.8% (DPR) and 68.5% (Norms Committee) during the years 1978-79 to 1993-94. The actual yield of gas per tonne of coal charged ranged between 269 M^3 (1982-83) and 295 M^3 (1992-93) and had been lower than both the DPR and Norms Committee norms in all the years. (**Annexure III**). Low yield of gas was attributed by the Management (April, 1994) to low percentage of volatile matters (V.M.) in coal blend as compared to the norm (24.5%). As per the Norms Committee Report (1979), however, the yield of gas (300 M^3 per tonne of coal charged) was based on 24.5% of V.M. in coal blend and effect of variation in V.M. by $\pm$ 1% on the yield was assessed at $\pm$ 11 M^3. With the actual percentage of V.M. in coal blend used, the lowest yield per tonne of coal charged during the entire period should not have been less than 284.6 M^3 in 1982-83 and in the years 1978-79 and 1986-87 to 1993-94, the yield should have been more than 300 M^3.Low yield of gas was also attributed to poor health of batteries.

4.02.03 Coal Blend

In order to improve the quality of coal in the blend, imported coal of prime quality with low ash has been in use since 1978-79. The recommended blend of prime, medium & blendable coal (55:38:7 respectively) could, however, not be adhered to. Norms fixed by the Management for consumption of imported coal were also exceeded in the years 1982-83, 1988-89 and 1990-91, resulting in net extra expenditure of Rs. 14.55 crores on this account, after setting off the saving of Rs. 48.38 crores due to less consumption of indigenous coal. The Management stated

(April, 1994) that the actual blend ratio depended on the receipt and availability of individual varieties of coal over which Bhilai Steel Plant has no control and hence strict adherence to the recommended blend ratio was always not possible. Irregular supply of indigenous coal from month to month, the Management further added, forced consumption of imported coal in excess of norms.

To ensure availability and improve quality of raw material like coal etc., the Management stated (August,1993) that they were in touch with Coal India Limited, the Railways and the Infrastructure Linkage Committee of Cabinet Secretariat.

4.02.04 **Analysis of Blast Furnace (BF) Coke Produced.**

Fixed Carbon & Ash Content

The fixed carbon content in the coke produced from Batteries 1 to 8 ranged between 72.5% (1978-79) and 78.2% (1990-91) and was below the norm of 75.6% (intimated by the Management in December,1977) upto 1984-85, while the ash content varied from 21% (1990-91) to 26.8% (1978-79) and was in excess of the norm of 23% upto 1985-86, inspite of the use of imported coal of prime quality with low ash content valued at Rs. 363.50 crores upto 1985-86. It is pertinent to mention in this connection, that one of the main reasons for shortfall in hot metal production during 1978-79 to 1984-85, according to the Management, was higher percentage of ash in coke. In respect of the coke produced from battery No.9 the ash content, however, varied from 18.6% (1989-90) to 21.3% (1992-93), against the norms of 23.3%. According to the Management (August,1993), the setting up of washeries to help reducing ash content was not advisable unless linked coal mines are also made available. The Government also discouraged leasing out of coal mines to PSUs other than Coal India Limited.

4.03 Blast Furnaces

Of the seven blast furnaces installed at a cost of Rs. 357.15 crores, six were installed prior to 4 MT expansion stage and the 7th one (on 30th August 1987) during the 4 MT expansion stage. The rated capacity of blast furnaces (6 nos.) prior to expansion was 30.50 lakh tonnes of hot metal (22.80 lakh tonnes of basic grade and 7.70 lakh tonnes of foundry grade) as per DPR. The capacity as adopted by the Management was, however, 29.69 lakh tonnes (26.98 lakh tonnes of basic grade and 2.71 lakh tonnes of foundry grade) which was increased to 31.50 lakh tonnes after the commissioning of Sintering Plant-II. The rated capacity of all the seven furnaces as per the DPR is 40.80 lakh tonnes (basic) at the 4 MT stage.

4.03.01 Production Performance

The rated capacity, annual production targets and actual production of hot metal for the years 1978-79 and 1987-88 to 1993-94 are given below:

(TABLE - 4)
(Fig. in lakh tonnes)

Year	Rated Capacity	Annual Target	Actual Production				%age of off grade to total production	% of Actual Production to	
			Basic grade	Foundry grade	Off grade	Total Prodn.		Rated Capa-city	Annual Target
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1978-79	29.69(+)	27.80	10.95	10.82	3.43	25.20	13.61	84.88	90.64
1987-88	31.50(+)	30.25	8.23	13.34	3.99	25.56	15.61	81.14	84.50
1988-89	40.80	34.00	13.67	12.83	6.56	33.06	19.84	81.03	97.24
1989-90	40.80	37.00	16.09	13.09	5.67	34.85	16.26	85.42	94.19
1990-91	40.80	36.00	13.48	9.68	12.33	35.49	34.74	86.99	98.58
1991-92	40.80	39.00	15.82	9.33	13.45	38.60	34.85	94.61	98.97
1992-93	40.80	38.50	22.06	10.88	7.51	40.45	18.56	99.14	105.06
1993-94	40.80	42.00	31.18	9.34	1.99	42.51	4.68	104.19	101.21

Note: 1) Though Blast Furnace No.7 was commissioned on 30th August 1987 the rated capacity was not increased proportionately. The Management stated that it was not done as the matching coke making facilities were not available.

2)(+)Rated Capacity as per the Management.

The actual production which included off-grade hot metal also had always been less than the rated capacity (except in 1993-94) and also the targets (except in 1992-93 and 1993-94). Production of off-grade hot metal ranged from 4.68%(1993-94) to 34.85%(1991-92) and major portion of this off-grade metal was charged in Steel Melting Shop (SMS).

The Management attributed (December,1988) the shortfall in production to low `Fe' content in iron ore, higher ash in coke, higher percentage of undersize iron ore (-12mm) and undersize sinter (-10mm) during 1978-79 to 1984-85, and higher percentage of undersize iron ore during 1986-87 and 1987-88. It was, however, observed that the actual `Fe' content in iron ore consumed in Blast Furnacesduring 1978-79 to 1984-85 had been more than the DPR norms (6th B.F. complex). As regards higher percentage of undersize iron ore and sinter, it is pertinent to mention that the iron ore is raised from the captive mines of Bhilai Steel Plant and the sinter is produced in its Sintering Plants. Therefore, necessary remedial measures should have been taken to ensure supply of the required size of iron ore and sinter. The Management stated (August,1992) that screening facilities had been provided for the furnaces during modernisation/capital repairs to reduce the undersize fraction; they did not mention why the screening facility was not provided earlier.The Management, in addition, also stated (April 1994) that coal injection technology to improve the production was also tried in BF 6 but without much success.

4.03.02 Productivity

The furnace wise productivity achieved against DPR norms is given below :

TABLE - 5

Years	FURNACES						
	No.1 t/m3/d	No.2 t/m3/d	No.3 t/m3/d	No.4 t/m3/d	No.5 t/m3/d	No.6 t/m3/d	No.7 t/m3/d
DPR Norms	1.210	1.210	1.210	1.128	1.128	1.128	1.286
Actual							
1978-79	0.98	0.90	0.99	0.83	0.94	0.94	-
1987-88	0.84	0.95	0.96	0.67	0.78	0.85	0.81
1988-89	1.05	1.04	0.99	0.83	0.89	0.93	1.05
1989-90	1.12	1.17	1.08	0.81	0.97	0.82	1.18
1990-91	1.15	1.12	1.08	1.01	0.98	0.95	1.16
1991-92	1.11	1.07	1.17	1.02	0.88	1.28	1.28
1992-93	0.99	1.02	1.05	1.10	1.24	1.30	1.33
1993-94	0.93	1.08	1.04	1.03	1.31	1.31	1.43

The productivity of blast furnaces had all along been less than the DPR norms (except in 1991-92 in Blast Furnace No.6 and in 1992-93 and 1993-94 in Blast Furnaces No. 5, 6 and 7). Lower productivity in Blast Furnaces Nos. 1 to 6 was attributed by the Management (April, 1994) to (i) higher period of low blast and stoppages, (ii) erratic working of furnaces, (iii) higher fluctuation in quality of raw materials and that in the case of Blast Furnace No.7 for the years 1987-88 and 1988-89, to the longer time taken for stabilisation after commissioning. The Management did not specify the remedial measures taken to overcome these operational problems.

The blast furnace productivity is directly related to the coke rate and wind pr./volume blown into the furnaces. The wind blast

pressure, wind volume, coke rate and the overall furnace productivity are tabulated below :

TABLE - 6.

Year	Coke rate (dry) (Kg/THM)	Slag rate (Kg/THM)	Blast Volume (M^3/min)	Blast pressure (atm.)	Ash content in coke (%)	Productivity $T/MT^3/D$
1978-79	843	567	2023	-	26.9	0.93
1987-88	721	487	1814	1.71	22.7	0.82
1988-89	682	433	2013	1.88	21.3	0.96
1989-90	692	406	2103	1.92	20.6	1.02
1990-91	672	402	2204	1.93	20.6	1.07
1991-92	666	419	2222	1.91	19.5	1.11
1992-93	641	420	2219	1.85	21.3	1.18
1993-94	642	444	2230	1.95	21.9	1.20

Inspite of the drop in ash content, slag rate and coke rate, the productivity did not improve correspondingly.

The Management while admitting (April 1994) that the productivity of Blast Furnaces does not increase proportionately with the decrease in coke rate, slag rate and coke ash, has stated that there were many other factors also having a bearing on the productivity but did not specify the other factors which actually had caused the low production.

4.03.03 Furnace Utilisation:

The blast furnaces were operated for fewer hours than envisaged in the DPR (50400 hours with six furnaces & 58800 hours with

seven furnaces) and for fewer hours than the available hours, as could be seen from the table below :

TABLE - 7

Year	Total calendar hours	Actual Capital repairs/ scheduled maintenance	Total available hours	DELAYS			Furnace utilisation	
				Low wind	Wind off	Total	Hours	As %age of available hrs.
1978-79	52560	2668	49892	1789	3028	4817	45075	90.35
1987-88	52704	6370	46334	2808	4077	6885	39449	85.14
1988-89	61320	5918	55402	1957	3185	5142	50260	90.72
1989-90	61320	4602	56718	1546	2330	3876	52842	93.17
1990-91	61320	5912	55408	1631	1847	3478	51930	93.72
1991-92	61488	3782	57706	1673	1634	3307	54404	94.28
1992-93	61320	4951	56370	2301	1759	4060	52310	92.80
1993-94	61320	4267	57153	1956	1684	3640	53513	93.63

The Management stated (April 1994) that it was not possible to contain the duration of repairs. BSP has followed the strategy of intensive and better maintenance which takes longer duration, but helps in improving the productivity and results in favourable techno-economics.

4.03.04 Silicon Content in Hot Metal

Higher silicon content in hot metal causes more wear and tear of refractories and, therefore, results in more consumption of refractories in Steel Melting Shop (SMS). It also increases the volume of slag arisings and thus results in lower weight per heat in SMS.

In July, 1965, Central Engineering and Design Bureau (CEDB) had recommended that silicon content in hot metal should not exceed 1.25 per cent for smooth operation of Open Hearth Furnaces. However, a substantial quantity (ranging between 65.51% in (1983-84) and 22.74% in (1993-94)of hot metal produced and, consequently, a substantial portion (ranging between 65.41% in (1983-84) and 22.33% in (1993-94)of hot metal supplied to SMS was with silicon content exceeding 1.25%. **(Annexures-IV & V).** The Ministry stated (April 1994) that there had been gradual reduction in the production of high silicon hot metal supplied to steel melting shops.

4.03.05 Consumption of Major Raw Materials

(i) The actual 'Fe' input through iron ore,sinter and scrap in Blast Furnaces Nos. 1 to 6 was in excess of the norms of the DPR (except in 1988-89 & 1990-91) and the Norms Committee (except in 1988-89 & 1990-91 to 1992-93).

(ii) The coke consumption was more than the norms of Norms Committee(1979) from 1978-79 to 1983-84. The extra expenditure on this account works out to Rs.30.14 crores.

(iii)The consumption of manganese ore was more than DPR Norms (except in 1979-80, 1988-89, 1989-90 & 1991-92). It was more than the norms of the Norms Committee (1979) also during the period 1981-82 to 1987-88. The extra expenditure due to consumption in excess of the norms of the Norms Committee works out to Rs.2.17 crores.

(iv) Slag arisings had been more than both DPR and Norms Committee norms during the years 1978-79 to 1983-84.

4.03.06 **Blocking up of fund to the extent of Rs.247 lakhs**

A Movable Throat Armour (MTA) was installed in Blast Furnace No.6 in August, 1986 at a cost of Rs.193 lakhs for better raw-material distribution in the furnace in order to improve production and reduce coke consumption by 1 percent. As the benefits expected of MTA could not be achieved due to operational constraints and maintenance problems, SAIL Board decided (June'88) to install the Bell Less Top (BLT) charging system in Blast Furnace No.6 in place of the MTA which, on removal therefrom, was proposed to be installed in Blast Furnace No. 4. Various items worth Rs. 54 lakhs were also purchased (March'89) for installation of MTA in Blast Furnace No.4. However, the equipment was rendered surplus in view of the decision taken by SAIL Board (June'89) to install BLT charging system in Blast Furnace No.4 also. Although the widely accepted technological superiority of BLT charging system in blast furnace technology, as also the feasibility of its adoption both in the existing furnaces and the new furnace (BF No.7) under construction was well known much before placement of order (October 1985) for suply of MTA, yet the MTA was procured. The Management stated (April, 1994) that the equipment, which was in good shape, would, on disposal, fetch substantially a higher price than the book value in view of the delicensing and opening up of the steel industry and that efforts to sell it were continuing. Although MTA was rendered surplus in view of the decision taken by SAIL, SAIL Board decided to dispose it of in June,1989, the MTA has not been disposed of so far (September,1994).

4.04 Sintering Plants

There are two Sintering Plants to produce 51.77 lakh tonnes of super fluxed sinter per annum (S.P.-I - 20.40 lakh tonnes and S.P-II -31.37 lakh tonnes) from 1991-92 onwards. The machines of S.P-I were commissioned in a phased manner from July, 1961 to April 1971 and those of S.P-II from August, 1979 to February, 1991.

The production of sinter in S.P-I ranged from 61.08% (1983-84) to 86.08% (1989-90) of the rated capacity and 74.61% (1983-84) to 103.75% (1993-94) of the annual plan targets and the production of S.P-II ranged from 34.20%(1979-80) to 100.62% (1991-92) of its rated capacity and 45.60%(1979-80) to 107.80% (1982-83) of the annual plan targets during the years 1978-79 to 1993-94. **(Annexure-VI).** Shortfall in production was attributed by the Management (April 1990) mainly to low machine utilisation. Low machine utilisation as compared to available hours was mainly due to non-availability of transfer cars (upto 1987-88, and in 1992-93 and 1993-94 in the case of S.P.-I and during 1983-84 to 1988-89, 1991-92 and 1992-93 in the case of S.P.-II). Further loss of machine hours due to non-availability of transfer cars had been a recurring phenomenon even prior to 1978-79. Further the Management attributed (May 1990) the poor productivity to suction line leakage, less utilisation and interrupted running of machines, quality of basic raw materials, frequent break-down of equipment in SP-II, dusty working conditions etc. The Management further stated (August,1992) that all efforts were being made to get Sintering Plant-III as a replacement of SP-I in view of the aging and obsolescence of the latter.

4.05 Steel Melting Shop (SMS) - I

The rated capacity of SMS-I with five 250 ton furnaces and five 500 tonne furnaces is 25 lakh tonnes of steel ingots per annum as per DPR. Some of the furnaces were subsequently (September,1986, January, 1990 and June, 1992) converted into Twin Hearth Furnaces,(THF-I,II & III) at a cost of Rs.74.51 crores in order to reduce the energy consumption and to increase productivity. From June, 1992 onwards three 500 tonne furnaces and three Twin Heart Furnaces with a capacity of 27 lakh tonnes per annum have been in operation. According to the Management, (July

1993) the capacity would, however, remain at 25 lakh tonnes till the matching facilities in the teeming bay, mould and stripper yards, handling system at slag yard are available. It was not clear why these matching facilities were not created despite substantial capital investments on expansion and modernisation.

The table below indicates the rated capacity (as per Management), annual plan targets and actual production of steel ingot for the years 1978-79 and from 1987-88 to 1993-94 :

TABLE - 8
(Figures in thousand tonnes)

Year	Rated capac-ity	Annual plan-target	Actual Production				Percentage of Actual Production to	
			250 T Fce.	500 T Fce.	Twin Hearth Fce.	Total	Rated Capacity	Annual Plan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1978-79	2500	2400	956.3	1243.9	-	2200.2	88.01	91.68
1987-88	2500	2000	532.3	637.4	487.7	1657.4	66.30	82.87
1988-89	2500	2070	661.4	720.6	535.1	1917.1	76.68	92.61
1989-90	2500	2000	393.9	755.2	768.0	1917.1	76.68	95.85
1990-91	2500	2150	185.6	660.1	1228.4	2074.1	82.96	96.47
1991-92	2500	2450	123.0	716.9	1315.7	2155.6	86.22	87.98
1992-93	2500	2225	0.7	563.8	1758.5	2323.0	92.92	104.40
1993-94	2500	2350	--	506.3	1888.7	2395.0	95.80	101.91

The shortfall in production was attributed by the Management (August,1992) to technological constraints in daily working of Open Hearth Furnaces, non-achievement of full heat weight from 500 tonne furnaces, increase in heat duration due to high silicon in hot metal etc. However, the Management did not specify the remedial measures taken by them.

4.05.01 Furnace Utilisation

The actual working hours of all the furnaces during 1978-79 to 1993-94 had been less than the DPR norms while hours under repair had been more. The idling of furnaces for other reasons varied from 2571 hours (1984-85) to 11154 hours (1990-91). **(Annexure-VII)** The Management attributed (August 1992) the hours lost in repairs in excess of norms to high silicon in hot metal and overage of open hearth furnaces. They, however, did not specify the remedial measures taken by them.

4.05.02 Number of Heats to be Tapped during the hours worked.

The table below compares the number of heats actually tapped with the number of heats that should have been tapped during the hours worked on the basis of the tap to tap time as per DPR (10 hours for 250 tonne furnaces and 13.15 hours for 500 tonne furnaces) and as per the Norms Committee (9 hours for 250 tonne furnaces and 13 hours for 500 tonne furnaces) and also on the basis of tap to tap time of 5 hours 20 minutes in the case of Twin Hearth Furnaces for the period upto 1993-94 :

TABLE - 9

Year	Actual working Hrs.			No. of heats that should have been tapped during the hours worked				No. of heats actually tapped			
	250 T Fce.	500 T Fce.	Twin Hearth Fce.	250 T Fce.		500 T Fce.		Twin Hearth Fce.	250 T Fce.	500 T Fce.	Twin Hearth Fce.
				As per DPR	As per Norms Committee	As per DPR	As per Norms Committee				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
78-79	36132.0	36804.0	--	3613	4015	2799	2831	--	3826	2685	--
87-88	25436.0	23388.0	6895.0	2544	2826	1779	1799	2586	2298	1562	2037
88-89	26997.0	23449.0	6906.0	2700	2999	1783	1804	2590	2787	1760	2234
89-90	17830.0	23769.0	8782.0	1783	1981	1808	1828	3293	1734	1803	3196
90-91	8787.0	22886.5	14577.5	879	976	1740	1760	5466	805	1566	5118
91-92	5559.1	25747.4	15383.8	556	618	1958	1981	5769	532	1743	5423
92-93	33.0	18669.2	20886.8	3	4	1420	1436	7833	3	1346	7279
93-94	--	16906.6	23049.6	-	-	1286	1301	8644	-	1179	7767

The shortfall in number of heats was attributed by the Management (August 1992) to (i) hot metal availability, quality of hot metal, furnace availability, (ii) inadequate supply of hot metal to S.M.S.-I after commissioning of SMS-II (July 1984) as priority was given to the new shop (SMS-II) till the commissioning of Blast Furnace No. 7 etc. However, they did not specify the remedial measures taken by them.

4.05.03 Weight Per Heat and Productivity of Furnaces per Hour.

The actual production of ingot per heat in 250 tonne furnace, 500 tonne furnace & Twin Hearth Furnaces ranged from 222.7 tonnes (1992-93) to 250 tonnes (1978-79); 404 tonnes (1986-87) to 464.6 tonnes (1979-80) and 227 tonnes (1986-87) to 243 tonnes (1993-94) respectively during the years from 1978-1979 to 1993-94.

The actual productivity per furnace per hour in respect of 250 tonne furnaces was lower than the DPR norm (25 tonnes) from 1983-84 to 1987-88 and from 1989-90 to 1992-93 and was lower than the DPR norm (37.7 tonnes) in respect of 500 tonne furnances in all the years upto 1993-94.

Lower weight per heat and lower productivity were attributed by the Management (August 1992) to higher silicon content in hot metal, poor quality of scrap, premature break-down due to longer use of equipment, deformation and damage of furnace structures and increase in the number of rail heats. The Management did not specify the remedial measures initiated by them.

4.05.04 Consumption of Major Raw Materials

The total metallic input (hot metal and iron/steel scrap) during the years 1978-79 to 1993-94 was more than the norms (1016.9 kg/1045.0 kg per tonne of steel ingots as per DPR/Norms Committee. The extra expenditure due to exceeding the latter norms was Rs. 662.98 crores . Even the yearly norms fixed by the Management were exceeded involving an extra expenditure of Rs. 296.58 crores. The consumption of ferro-manganese per tonne of ingot steel was also higher than the Norms Committee norms (18 kg) from 1978-79 to 1989-90. **(Annexure-VIII)** The extra expenditure due to consumption of ferro-manganese in excess of the Norms Committee norms worked out to Rs. 50.58 crores and with reference to the yearly norms fixed by the Management, the excess worked out to Rs.38.79 crores.

Higher metallic input was attributed by the Management (February 1989) to (i) the arising of very high volume of slag due to high silicon content in hot metal, (ii) use of bad quality scrap from muck dump due to shortage of scrap (iii) metal spillage in transit etc. The Management further stated (August/September'92) that the metallic input increased with the introduction of new technology in the form of Twin Hearth Furnaces. It may, however, be mentioned that the norms revised by the Management after taking into account the increased demand of the new technology from 1986-87 onwards were also exceeded.

4.05.05 Metallic yield

The actual metallic yield ranged from 78.4% (1986-87) to 84.8% (1979-80) during the years 1978-79 to 1993-94 against the norm of 85.8% envisaged in DPR as well as fixed by Norms Committee.

The short recovery of steel due to lower metallic yield worked out to 15.10 lakh tonnes valued at Rs.524.23 crores which was off set to the extent of Rs.175.11 crores owing to excess arising of scrap as compared to the DPR Norms(2.1%). The value of net short recovery of steel during 1978-79 to 1993-94 was thus Rs. 349.12 crores.

Lower metallic yield was attributed (January,1990) by the Management to higher silicon and sulphur content in hot metal, slag carry over with hot metal to furnaces, spill through, cold heats etc. The Management further stated (April, 1994) that with the modernisation of blast furnaces the silicon and sulphur content in hot metal had reduced and consequently the metallic yield was likely to improve in the coming years.

4.05.06 Excess consumption of Ingot Moulds & Bottom Stools.

The consumption of ingot moulds per tonne of rollable ingot steel had been more than the norm (22 Kg) fixed by the Norms Committee (1979) during 1978-79 to 1988-89 while that of bottom stools had been more than the norm (10 kg) from 1985-86 to 1988-89. The extra expenditure on this account worked out to Rs.14.74 crores with reference to the variable cost of production of these items.

Excess consumption of ingot moulds and bottom stools was attributed by the Management (August, 1992) to longer time taken for stabilization of the process of Twin Hearth Furnace technology, the aging of the furnaces, temperature

variations in some heats, high temperature and cold heat tappings, and the production demand. They, however, did not mention the remedial measures taken by them.

Even though the Foundry Shop of BSP is equipped with the facilities to manufacture ingot moulds and bottom stools, these were being purchased from outside from 1982-83 to 1987-88 at an extra expenditure of Rs.8.63 crores.

4.05.07 Excess consumption of Refractories

The consumption of refractories (excluding the old salvaged bricks) per tonne of steel ingot had been higher than the DPR norms (31.19 kg) during the years 1978-79 to 1990-91. It was also higher than the yearly norms fixed by the Management in the years 1983-84 to 1986-87 & 1988-89. The extra expenditure due to excess consumption as compared to the DPR norm and the yearly norms fixed by the Management was Rs.2.98 crores and Rs.0.42 crores respectively. Excess consumption was attributed by the Management(January 1990) to high silicon in hot metal, inferior quality of refractories, intensive oxygen lancing of O.H. furnaces, calculation of consumption on rollable steel production, instead of gross steel production, skulling of ladles etc. They, however, did not mention the remedial measures taken by them to overcome the operational problems.

4.06 Steel Melting Shop-II (converter Shop)

Three oxygen blown converters with a capacity to produce 1.5 million tonne of liquid steel were commissioned between July, 1984 and August, 1985 at a cost of Rs.111.15 crores to expand the capacity of the plant from 2.5 MT to 4.00 MT of steel ingot.

The rated capacity, the annual targets and the actual production there against during the years 1984-85 to 1993-94 were as under :-

TABLE - 10
(Fig. in lakh tonnes)

Year	Rated Capacity	Annual Target	Actual Production	%age of actual production to	
				Rated Capacity	Annual Target
1984-85	–	3.35	0.73	–	21.79
1985-86	5.60	3.50	4.54	81.07	129.71
1986-87	9.00	8.00	7.04	78.22	88.00
1987-88	9.00	10.00	8.14	90.44	81.40
1988-89	15.00	13.00	11.77	78.47	90.54
1989-90	15.00	14.00	13.36	89.06	95.43
1990-91	15.00	15.00	14.37	95.80	95.80
1991-92	15.00	15.50	15.88	105.87	102.45
1992-93	15.00	16.00	16.19	107.93	101.19
1993-94	15.00	16.00	16.33	108.87	102.06

Actual production during three consecutive years i.g. 1991-92, 1992-93 & 1993-94 and also fixation of production target for these years above the rated capacity imply that the rated capacity needs upward revision. The Management, however, stated (April, 1994) that the rated capacity should not necessarily be revised for occasional higher achievement.

Regarding the shortfall in production during the period upto 1990-91, the Management stated (August 1992) that construction/commissioning of equipments and production in Steel Melting Shop-II were undertaken simultaneously and some time was taken in developing the skill of manpower and establishing the performance of equipments/streamlining the peripheral facilities.

4.07 Continuous Casting Shop (Concast)

The liquid steel (1.5 million tonnes) produced in converter shop (SMS-II) is converted into slabs (1.18 million tonnes) and blooms (0.245 million tonnes) in the continuous casting shop (consisting of four slab casters and one bloom caster) set up at a cost of Rs.222.22 crores under the 4 MT expansion.

The table below indicates the annual targets and actual production in continuous casting shop from 1985-86 to 1993-94 :

TABLE - 11
(Fig. in lakh tonnes)

Years	Annual Targets			Actual Production		
	Slabs	Blooms	Ingots	Slabs	Blooms	Ingots
1985-86	2.80	0.50	—	3.66	0.04	0.59
1986-87	6.10	1.50	—	5.42	0.72	0.36
1987-88	7.70	1.80	—	6.00	1.20	0.34
1988-89	10.27	2.08	—	8.93	1.56	0.31
1989-90	10.89	2.06	—	9.76	2.44	0.16
1990-91	11.45	2.56	—	10.46	3.03	0.03
1991-92	11.38	3.13	—	11.48	3.62	0.08
1992-93	12.26	3.50	—	11.74	3.62	0.07
1993-94	11.78	3.50	—	11.33	4.24	0.002

Actual production of slabs and blooms was less than the annual target in all the years (except 1985-86 and 1991-92 in case of slabs and from 1989-90 to 1993-94 in case of blooms). The tap to tap time of converter in Steel Melting Shop-II was 70 minutes of which the blowing time was only 18 minutes. The remaining 52 minutes required for logistics between SMS-II and Continuous Casting Shop appeared to be very high. According to the Management (April, 1994), there were certain inherent deficiencies and problems in the process of continuous casting which had to be accepted.

4.08 Rolling Mills

The Rolling Mill Complex consisting of Blooming and Billet Mill, Merchant Mill, Rail and Structural Mill, Wire Rod Mill and Plate Mill was designed to produce 3.153 million tonnes of saleable steel out of crude steel input of 4 million tonnes; the remainder representing waste/scrap. Actual production of saleable steel over the years was as under :

TABLE-12

Figure in lakh tonne

Year	Rated Capacity			Actual Production			Percentage of Actual Production to		
	Saleable finished	Saleable semi-finished	Total	Saleable finished	Saleable semi-finished including cutting	Total	Saleable finished	Saleable semi-finished	Overall
1978-79	16.50	3.15	19.65	15.90	2.56	18.46	96	81	94
1987-88	22.20	4.60	26.80	16.60	5.13	21.73	75	112	81
1988-89	26.00	5.53	31.53	19.42	6.00	25.42	75	108	81
1989-90	26.00	5.53	31.53	19.89	6.05	25.94	77	109	82
1990-91	26.00	5.53	31.53	20.61	7.34	27.95	79	133	89
1991-92	26.00	5.53	31.53	21.66	9.38	31.04	83	170	98
1992-93	26.00	5.53	31.53	21.46	9.72	31.18	83	176	99
1993-94	26.00	5.53	31.53	21.89	11.46	33.35	84	207	106

The actual production of saleable finished products ranged between 75% and 84% of the rated capacity in recent years, though overall attainment of capacity gradually increased to 106% (1993-94). This situation was occasioned by increased production of saleable semi-finished products which reached a level of 207% of the capacity (1993-94).

Lower production of saleable finished steel was attributed (April, 1994) by the Management to (i) lower mill utilisation as compared to DPR Norms, (ii) adverse product mix and (iii) order position of plate mill, while higher semi-finished steel production was attributed to (i) input requirement of other plants and secondary steel sectors and (ii) export market for semi-finished products.

Mill-wise rated capacity, annual target and actual production are given in **Annexure-IX**. Notable features of performance of individual mills are as under:

4.08.01 Blooming Mill

The mill could neither produce its rated capacity nor meet the annual targets in any of the years. The performance of the mill was also not upto the mark even when the annual targets of production were fixed lower than the previous year's targets (1987-88 and 1989-90). The production varied from 65.31% (1986-87) to 93.90% (1993-94) as compared to rated capacity. The utilisation of the available working hours ranged between 58.7% (1986-87) and 79.6% (1993-94). The mill utilisation was affected adversely due to high incidence of delays caused by shortage of steel ingot and gas (both the items are produced by BSP itself) particularly from 1983-84 to 1988-89.

4.08.02 Billet Mill

The mill did not produce to its rated capacity or achieve the annual targets in any of the years except in 1984-85, 1989-90 and in 1993-94. (The targets fixed during these years were lower than earlier targets. The production varied from 64.29% (1986-87) to 96.94% (1993-94) of the rated capacity.

4.08.03 Merchant Mill

The mill did not produce to its capacity or achieve the annual targets in any of the years. The production of the mill varied between 67% (1986-87) and 98.8% (1993-94) of the rated capacity. The shortfall in production was due to shortage of gas (produced by BSP itself), the rolling rate being lower than the norm of 91 tonnes per hour (from 1983-84 to 1993-94 excepting the year 1991-92) and idling of the mill due to operational reasons which were controllable in nature. The Management attributed (April, 1994) the lower rolling rate to the change in the ratio of product mix of the mill due to market demand. They, however, did not mention the steps taken to overcome delays caused by operational reasons and shortage of gas.

4.08.04 Rail & Structural Mill

The mill did not attain the rated capacity in any of the years from 1978-79 to 1993-94. The production ranged between 65.47% (1986-87) and 86.13% (1993-94) of the rated capacity. The mill also could not achieve the targeted production except in the year 1981-82. The mill utilisation was low due to increase in operational delay, delay due to shortage of power, steel, gas and external factors. The loss of production was attributed by the Management (August 1992) to low mill utilisation on account of equipment failure, delay in availability of gas, metal and production of heavier (52 Kg. & 60 kg rails per meter) and higher strength (UTS-90) rails as governed by the demand and market conditions instead of lighter rails envisaged in the DPR.

The yearly requirement of the Indian Railways for rails for the period 1978-79 to 1993-94 could not be met in any of the years except in 1984-85 and 1988-89 despite capacity being available. Even the commitment for supply of rails to the Railways could not be fulfilled by the Plant in many years. From 1978-79 to 1993-94, the mill was utilised to roll 10.18 lakh tonnes of billets though not envisaged in the DPR. This involved extra cost to the extent of Rs.19.72 crores. The Management stated (August, 1992) that for want of sufficient orders for rails in the

earlier period, billets were rolled to avoid idling of the mill. It was, however, observed that the requirement of Indian Railways could not be met in earlier years also.

4.08.05 Wire Rod Mill

The performance of this mill was better than other rolling mills. The production of the mill varied from 58.00% (1983-84) to 114.50% (1978-79) of the rated capacity and 66.29% (1983-84) to 142.67% (1993-94) of the annual targets. The volume of wastage/scrap, however, exceeded the norm (4% of input) in all the years. The Management stated (August, 1992) that excess scrap was due to bad input material. The input material is billets which are produced in BSP itself.

4.08.06 Plate Mill

The Plate Mill with a designed capacity of 9.50 lakh tonnes of plates was commissioned between March, 1983 and December, 1985 at a cost of Rs.752.05 crores under the 4 MT expansion scheme. Provision exists for

increasing its capacity to 12 lakh tonnes per annum. Actual production of plates over the years was as under :

TABLE - 13
(Fig. in lakh tonnes)

Year	Rated Capacity	Annual Target	Actual Production	Percentage of actual production to	
				Rated Capacity	Annual Target
1983-84	N.A.	1.00	0.12	--	12.00
1984-85	N.A.	2.60	0.50	----	19.23
1985-86	3.55	2.40	2.94	82.82	122.50
1986-87	5.70	4.95	3.74	65.61	75.56
1987-88	5.70	4.85	3.81	66.84	78.56
1988-89	9.50	6.00	5.74	60.42	95.67
1989-90	9.50	6.33	5.97	62.84	94.31
1990-91	9.50	7.40	6.51	68.53	87.97
1991-92	9.50	6.40	6.74	70.95	105.31
1992-93	9.50	6.70	6.60	69.47	98.51
1993-94	9.50	6.75	6.21	65.37	92.00

The mill never produced to its rated capacity. It also did not meet the annual targets except in the years 1985-86 and 1991-92. The highest production over the years was only 82.82% of the rated capacity. Lower production was stated to be mainly due to inadequate market demand for the plates. According to the Ministry (April, 1994) the product mix determined on the basis of market demand differed from the DPR based capacities and this fact would have to be considered while assessing the percentage capacity utilisation.

The capacity of Plate Mill as well as product mix (thickness-wise) was not in line with the demand pattern. The capacity of the Plate Mill exceeded the projected demand of all the categories of plates except 5 to 10 mm plates for which the capacity was for only 15% of the demand as will be evident from the following table

TABLE - 14
(Fig. in '000 tonnes)

Sl. No.	Thickness(mm)	Demand projections adopted by the consultant (MECON)	Capacity of Plate mill as per DPR	Percentage of production capacity to total demand
1.	5-10	624.2	94.2	15.1
2.	12	127.7	214.0	167.6
3.	Above 12 to 20	198.6	325.3	163.8
4.	22 - 36	115.3	196.5	170.4
5.	36 and above	74.2	120.0	161.7

Further while deciding upon capacity of the Plate Mill, the capacity already available with Rourkela Steel Plant (RSP) (1.50 lakh tonnes) and Tata Iron & Steel

Company Limited (TISCO) (1.15 lakh tonnes) were also not taken into account. According to the Ministry (April 1994) it was fairly evident at the time of approving the Bhilai Steel Plant expansion in February, 1978 that strictly on the basis of return on investment, Bhilai Steel Plant expansion would not be a viable proposition. The creation of excess capacity of Plate Mill with reference to the changed demand pattern was, therefore, a known and acceptable risk. The Ministry also stated (April, 1994) that the capacity of the Plate Mill was based on the best available advice from the eminent agencies regarding future demand specially from ship building industry and these estimates under went unanticipated changes due to several economic and other factors. The fixation of capacity, as further stated by the Ministry, was also based on a techno-economic consideration of the fact that there was already a mill of such capacity working in the Soviet Union thereby facilitating easy adoption of engineering drawing and other technical details in readymade form. However, the Ministry did not assign any reason for not taking into account the capacities of RSP and TISCO to produce plates, while deciding on the capacity to be set up in BSP.

The quantity wise and thickness wise actual production of plates was also not in line with DPR provisions and market demand.

The excess production of plates of higher thickness in deviation from DPR provisions as well as the annual production plans prepared on the basis of the assessment by Central Marketing Organisation (a unit of SAIL) resulted in piling up stock of plates. Consequently, a considerable quantity of plates was held in stock each year as would be evident from the data given below :

TABLE - 15
(Fig. in lakh tonnes)

Year	Actual Production stock	Closing	Percentage of Closing stock to actual production
1984-85	0.50	0.19	38.00
1985-86	2.94	1.49	50.68
1986-87	3.74	1.96	52.41
1987-88	3.81	1.54	40.42
1988-89	5.74	1.43	24.91
1989-90	5.97	0.78	13.07
1990-91	6.51	0.98	15.05
1991-92	6.74	0.99	14.69
1992-93	6.60	1.65	25.00
1993-94	6.21	1.40	22.54

In order to liquidate the accumulated stock of plates the steel plant resorted to export of plates from 1988-89 onwards at a price lower than the domestic selling price as well as cost of production. The export of plates at a price less than the cost of production resulted into a loss of Rs277.71 crores during the period 1987-88 to 1993-94. The Ministry stated (April, 1994) that the fall in domestic demand for plates made the compulsion for export even greater, primarily with a view to keep up production and cut down losses. The loss due to unremunerative export prices, as further contended by the Ministry, was only notional as export was made at prices which were ruling in the international market. The Ministry's contention is not correct, as much as, the loss sufferred on account of export of plates at prices lower than the cost of production is a real loss and not notional.

The Plate Mill also suffered production loss due to idling of the plant on account of controllable delays such as operational, mechanical & electrical delays. Loss of production on this account worked out to 3.53 lakh tonnes during the period from 1986-87 to 1993-94.

CHAPTER - 5

SOURCES OF RAW MATERIALS:

The plant obtains Iron Ore, Limestone and Dolomite from its captive mines.

5.1 Iron Ore

The Plant has developed a number of iron ore mines comprising of Rajhara Mechanised Mines (commissioned in 1960), Dalli Mechanised Mines (commissioned in 1979) and manual mines at Mahamaya, Jharandalli, Aridongri, Mayurpani etc.

5.1.01 Rajhara Iron Ore Mechanised Mines

The rated capacity of Rajhara Mechanised Mines is 35 lakh tonnes per annum (21.87 lakh tonnes of lump and 13.13 lakh tonnes of fines).

The production of Rajhara Mechanised Mines during the years 1978-79 to 1993-94 as seen from **Annexure - X,** had been lower than the rated capacity (except in 1993-94) ranging from 48.86%(1983-84) to 100.34% (1993-94)and also the annual targets (except in 1986-87, 1990-91, 1991-92 and 1993-94) ranging from 61.07% (1983-84) to 107.59% (1990-91) of the targets. Shortfall in production was attributed by the Management (September 1992) to non-availability of mining faces, single track for transportation, shortage of waste rock handling facilities, occurrence of hard massive ore at 1800 bench etc.

Since Rajhara and Dalli Mechanised Mines were not able to meet the plant's requirement, iron ore was also raised manually at a cost higher than the variable cost of Rajhara/Dalli Mechanised Mines. From 1984-85 to 1988-89, manually mined ore was reprocessed at an extra cost of Rs.6.54. crores. According to the Management (Septemberl 1992) reprocessing was done to screen out the undersize, the generation of which was not controllable at manual mines due to industrial relations problems.

5.1.02 Dalli Mechanised Mines

Dalli Mechanised Mines was commissioned in March,1979 with an annual capacity of 21.50 lakh tonnes of the finished product which with the additional arrangement made for processing ore fines in dry circuit,was increase to 25.50 lakh tonnes in 1986-87 and to 30 lakh tonne (on three shift working basis) in 1990-91.

The production at Dalli Mechanised Mines (**Annexure - XI),** had been lower than the rated capacity (upto 1990-91) and also the annual targets (upto 1989-90 and 1993-94), and ranged from 24.14% (1979-80) to 109.77% (1993-94) and 33.53% (1979-80) to 104.68% (1992-93) of the rated capacity and annual targets respectively during the years 1979-80 to 1993-94.

Shortfall in production was attributed by the Management (August,1992)to under utilisation of crushing, screening and washing plants due to jamming, non-availability of ore/compressed air, non-supply of power by Madhya Pradesh Electricity Board (MPEB), industrial relations problems etc.

5.1.03 Accumulation of Iron Ore Lumps and Fines

Iron ore (lump)raised but not despatched to the Steel Plant in the same year was dumped at the Raw Ore Storage Yard (ROSY) and other yards. The stock of such ore as on 31st March 1993 was 3.44 lakh tonnes. The Management stated (August 1992) that contractual manual labour had to be kept engaged on production work even when the off-take was less than production.

The iron ore fines of sizes ranging from (-) 8 mm to (-) 12 mm generated at different manual mines were stacked as rejects. These rejects (47.51 lakh tonnes as on 31st March 1993) could not be used/reclaimed/disposed of.

According to the Management (April 1994), trials conducted for the upgradation of rejects/fines did not indicate any favourable result and the Research and Development Centre for Iron & Steel (R.D.C.I.S.) of SAIL finally abandoned the project of undertaking testing with foreign colloboration. In view of the decreasing trend of production from Rajhara Mines which would be completely exhausted by 2000 AD,a new iron ore deposit with more than 700 million tonnes of good quality iron ore at Rowghat located in the Bastar district of Madhya Pradesh (about 95 K.M.away from Dalli - Rajhara) was identified. The mining plan for Rowghat deposit was prepared by Bhilai Steel Plant and got approved by the Indian Bureau of Mines and forwarded to the Government of Madhya Pradesh. for grant of the mining lease. The project area was inspected by the Environmental Advisory Committee constituted by the Ministry of Environment in November 1990 and also by the Forest Advisory Committee in July 1991. The Ministry of Environment has, however advised BSP to conduct a comprehensive four season bio-diversity study and stop the second stage prospecting which is required for preparation of DPR. Consequently, preparation of

DPR would get further delayed and thereby delaying the total project further. As stated by the Management (June 1994),in the event of delay in clearance of the Rowghat Project by the Ministry of Environment & Forests, the production of steel at BSP would soon get jeopardised.

5.2 Limestone

Limestone required for the production of steel is obtained from captive mines at Nandini.

The Nandini Mechanised Mines had two crushing plants - Old and New - with a total capacity of 21 lakh tonnes of Run of Mine (ROM) Ore yielding 17.50 lakh tonnes of lumps and chips based on two shift operation of each crushing plant. Owing to poor off-take of the processed limestone,one crushing plant is operated in two shifts and the other in one shift. The production of Nandini Mechanised Mines during the years 1978-79 to 1993-94 had been less than the annual targets except in 1984-85 and ranged from 64.21% (1982-83) to 103.34% (1984-85) **(Annexure-XII)**. Shortfall in production was attributed by the Management(August 1992) to the technological deficiencies and constraints in operation of rail transport system. The actual production was however, lower than the annual target even after replacement of Rail Transport by dumper transport in April 1987. According to the Management (April, 1994) lot of processed ore had to be rehandled at outside bay in view of poor off-take by BSP. Fresh production was, therefore, restricted to avoid rehandling at loading bay.

Generation of chips ranged from 11.45% (1981-82) to 31.94% (1989-90) of the total production during the period from 1978-79 to 1993-94. Chips so generated were dumped as rejects. Although the benefication tests revealed that the chips dumped as rejects could be used after upgradation, no action in this regard was taken. According to the Management (August,1992) benefication was found to be uneconomical and efforts made to dispose of the rejects did not yield any result.

Due to low production in Nandini Mechanised Mines, limestone (OH/RMP grade) was also raised manually upto 1986-87 at a cost higher than that of mechanised mining as the pattern of mechanised working was not extended to the area containing OH/RMP grade limestone. The extra expenditure on this account (with reference to the variable cost of mechanised mining) was Rs.5.40 crores for the period from 1978-79 to 1986-87.

The manual mine was mechanised in the year 1986-87 at a cost of Rs.1.06 crores. The production of OH/RMP grade limestone was, however, less than that envisaged in the scheme for mechanisation. During 1981-82 to 1985-86, and in 1991-92 a quantity of 4.53 lakh tonnes of BF/SP grade (high silica) limestone was procured from outside sources at an extra expenditure of Rs.6.26 crores. A quantity of 28.15 lakh tonnes of low silica lime stone was also purchased/imported during the period from 1982-83 to 1993-94 at an extra expenditure of Rs.179.16 crores, though the low silica limestone was to be procured from Sahapura (M.P.) under a mining lease obtained by BSP. The Management stated (April, 1994) that Sahapura limestone was not suitable for consumption in Steel Melting Shop-II.

During the period from 1985-86 to 1992-93, 5 lakh tonnes of low silica limestone was diverted to Sintering Plant, Open Hearth Furnaces and RMP-I, although use of low silica limestone in these units is not envisaged in the DPR. The Management stated (August,1992) that such transfer was necessitated due to receipt of excessive undersize materials from a supplier against whom penal action, was stated (April, 1994) to have been taken.

5.2.01 Avoidable Payment of Royalty

The crushing plant at Nandini is situated outside the areas taken on mining lease. Consequently, royalty is being paid on the entire quantity of ROM ore raised from the mine and sent to crushing plant i.e. also on the rejects arising from crushing. During 1978-79 to 1993-94, the amount of royalty paid on rejects was Rs.3.67 crores. The fact of payment of royalty (Rs.38.39 lakhs) on rejects upto 1977-78 was brought out in the Report of the Comptroller and Auditor General of India, Union Govt.(Commercial),1981 Part-III, Bhilai Steel Plant (Paragraph) - 3.03.02(5). The Ministry stated (April, 1994) that the matter regarding obtaining an additional mining lease was being pursued with the Ministry of Environment & Forests.

5.3 Dolomite

The reqirement of dolomite is mainly met from captive mines at Hirri. The rated capacity of Hirri Dolomite Mines was fixed at 60,000 tonnes per annum from 1979-80. The actual production was lower than the rated capacity and annual targets and varied between 17.36% (1993-94) and 79.91% (1982-83) and 49.46% (1989-90) and 115.70% (1993-94) of the rated capacity and annual targets respectively.

Due to lower production at captive mines, a quantity of 35.90 lakh tonnes of `high silica' dolomite was purchased during the period 1978-79 to 1993-94 at an extra expenditure of Rs.41.48 crores (as compared to the variable cost of departmental mining) in addition to 6.23 lakh tonnes of `low silica' dolomite valuing Rs.23.23 crores purchased due to its non-availability at captive mines.

CHAPTER - 6.

SERVICES AND FUEL

6.01 In addition to raw materials and refractories, different units of the steel plant require various types of services and fuel for the production of iron and steel. Some of the important services required are steam, electricity, oxygen, compressed air, water and air blast. The fuel requirements comprise gases like coke oven gas and blast furnace gas and liquid fuel such as coal tar fuel (pitch creosote mixture), benzene, naptha and furnace oil. For the production of some of these services and fuel, separate units have been set up in BSP., while other items are produced as concomitants of the regular operation of certain other units of the Steel Plant. The production and consumption of imported services and fuel are discussed in the succeeding paragraphs.

Steam is produced in the main boilers installed in the power plant and also in the waste heat boilers of Open Hearth Furnaces and Sulphuric Acid Plant. The steam boilers were designed to use blast furnace gas, coke oven gas and coal to the extent of 50,000 tonnes per annum. On account of inadequate availability of gases, coal and other liquid fuel (coal tar fuel, furnace oil etc.) had to be used in excess. The loss due to leakage of steam in Power Plant-II during the years 1984-85 to 1993-94 works out to Rs. 7.08 crores.

The annual requirement of electricity upto 6th B.F. complex stage and after 4 MT expansion stage was estimated at 707310×10^3 KWH and 1415000×10^3 KWH respectively which is met mainly by purchase from M.P.Electricity Board and partly by generation from the captive Power Plants of BSP. Oxygen is produced in Oxygen Plant-I & II and is used in Steel Melting Shop-I & II. Compressed air is produced in Compressed Air Station I, II and III for use in Coke Ovens, Blast Furnaces, Steel Melting Shop-I & II and Rolling Mills. Air blast is produced in Power & Blowing Station for supply to blast furnaces. Coke oven gas and blast furnace gas are used as the principal fuels.

6.02 **Excess consumption of services.**

During the years 1978-79 to 1993-94 the actual consumption of some of these services and fuel was more than the norms fixed resulting in extra expenditure of Rs.26.25 crores in Coke Ovens, Rs.36.41 crores in Blast Furnaces Rs.34.10 crores in Sintering Plants, Rs.23.80 crores in Steel Melting Shop and Rs.43.83 crores in Rolling Mills. According to the Management (April, 1994),norms were fixed on certain

assumptions like quality of input materials, operating conditions, condition of equipments etc and variation between the norms and the actual consumption was due to deviation from these assumptions. The service inputs, as further stated by the Management, were almost fixed in nature and hence, when the production was low the specific consumption of services was more.

However, overall energy consumption (Giga Calories) per tonne of crude steel has been on the decrease as may be seen from the data given below:

Year	Consumption of energy per tonne of crude steel (in Giga Calories)
1989-90	8.85
1990-91	8.65
1991-92	8.36
1992-93	8.25
1993-94	8.14

CHAPTER - 7

BY-PRODUCTS AND OTHER ARISINGS

The actual yield of the principal by-products viz. crude tar, crude benzol and ammonium sulphate was generally lower than DPR norms during 1978-79 to 1993-94 (except in the case of crude tar for the years 1979-80 and 1988-89 onwards). Lower yield of coke oven gas due to lower percentage of volatile matters in coal charged in coke ovens was responsible according to the Management (August 1992) for the lower yield of by-products.

The actual production of sulphuric acid during the years 1978-79 to 1993-94 ranged between 22436 tonnes (1982-83) and 37305 tonnes (1993-94) against the rated capacity of 45,000 tonnes. According to the Management (August 1992) Sulphuric Acid Plant was operated at a low level to meet the requirements of sulphuric acid. However,the old Sulphuric Acid Plant, was according to the Ministry (April, 1994), being phased out.

The slag generated in blast furnaces is used in the form of granulated slag for the manufacture of cement, slag aggregate as ballast for railway tracks, road making etc.. The processing of blast furnace slag during the years 1979-80 to 1993-94 ranged from 47.47% (1993-94) to 80.0% (1988-89), although with the available capacity of Slag Granulation Plant the entire quantity could have been processed. Lower processing of slag was attributed by the Management (August 1992) to (i) delay in sending loads to slag granulation plant, (ii) low temperature of slag leading to skull formation, (iii) bunching of slag loads leading to diversion of some of the loads to dump post. Since processed slag has a ready market necessary steps could have been taken to overcome the constraints and sell the slag.

7.1 Arising of Small Size Coke

The actual arising of small size coke (-25 mm) during the years 1978-79 to 1993-94 ranged from 16.49% (1990-91) to 19.95% (1978-79) of the total production of coke (wet) against the DPR norm (14.1%). The arising of (-) 25 mm coke on screening at blast furnaces ranged from 1.31 lakh tonnes (1986-87) to 2.70 lakh tonnes (1993-94) against the DPR norms of 0.98 lakh tonnes. According to the Management (April, 1994) deviations from norms were due to quality of coal charged and also coking regime not being identical with those envisaged in the DPR.

CHAPTER - 8

COSTING SYSTEM AND ANALYSIS OF COST

Different costing systems, viz. unit costing in mines and quarries, process costing in the case of manufacture of iron and steel, by-product costing in by-product plant etc., are being followed by SAIL.

In pursuance of the recommendations made by the COPU in its Fifteenth Report (1967-68), standard costing system was introduced in Bhilai Steel Plant from April,1970. In addition to the monthly cost statement, an annual cost statement based on financial accounts is also prepared and variance with standard cost analysed.

A comparison of the actual cost with the standard cost revealed that the actual cost of almost all the products during the years 1978-79 to 1992-93 was higher than the standard cost. In the year 1993-94, however, the actual cost was less than the standard cost except in the case of structurals and rounds. The Management stated (August 1992) that the price increase on input materials, lower capacity utilisation and adverse techno-economic factors were responsible for the increased cost.

CHAPTER - 9

FINANCIAL PERFORMANCE

The Financial Performance of the plant during the last six years ended 31st March, 1994 is given below :-

TABLE - 16
(Rs. in crores)

	Years					
	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94
Net sales	1518.02	1727.17	2007.90	2533.86	2526.67	3103.92
Cost of sales	1451.50	1654.95	1903.87	2327.55	2353.83	2736.15
Percentage of cost of sales to Net sales	95.62	95.82	94.82	91.86	93.16	88.15
Profit(+)	(+)66.52	(+)72.22	(+)104.03	(+)206.31	(+)172.84	(+) 367.78
Cumulative Profit (+) to the end of year	(+)458.66	(+)530.88	(+)634.91	(+)841.22	(+)1014.06	(+)1381.84

The sales of the plant which increased steadily from Rs.1518.02 crores in 1988-89 to Rs.2533.86 crores in 1991-92 marginally decreased to Rs.2526.67 crores in 1992-93 but again increased to Rs.3103.92 crores in 1993-94. The profit of the plant which was gradually increasing also decreased from Rs.206.31 crores in 1991-92 to Rs.172.84 crores in 1992-93 and again increased to Rs.367.78 crores in 1993-94 due to increase (1992-93)/decrease (1993-94) in cost of sales as compared to the respective previous years.

CHAPTER - 10

MANPOWER ANALYSIS

The actual manpower during the years 1978-79 and 1987-88 to 1993-94 and also DPR provisions therefor are tabulated below :

TABLE - 17

	Departments				
	Works	Gen.Admn. Township including Medical	Expn./ Constn.	Mines	Total
As per 2.5 MT & 6th BF complex DPR	13464	-	-	-	-
As per 4 MT DPR	11881	1471	-	-	-
Total(DPR)	25345	1471	-	-	-
ACTUALS AS ON					
1.4.78	30351	10781	5624	9350	56106
1.4.88	38323	11452	2899	8786	61460*
1.4.89	36945	12690	2680	8115	60430
1.4.90	36447	12384	2387	7998	59216
1.4.91	35443	11874	2066	7522	56905
1.4.92	34808	11599	1814	7108	55329
1.4.93	33275	11350	1554	6753	52932
1.4.94	34346	11183	1392	6400	53321

* Excluding 284 trainees regularised.

The actual manpower in respect of works and general administration including township and medical facilities had always been more than provision made in DPR. According to the Management, sanctioned/actual manpower was based on the studies made by the Industrial Engineering. Department. (IED) from time to time and also other prevailing work practices.The Management further stated (April 1994) that reduction was achieved gradually and in a phased manner without closure or retrenchment.

10.1 Labour Productivity and Cost

It was observed (June 1966) by Mehtab Committee (constituted to study/fix norms on manpower and productivity in steel plants) that it should be possible to increase the productivity of works personnel from the then existing level of 55 to 70 ingot tonnes per man year to about 125 ingot tonnes per man year and above in each steel plant. However, the norm fixed by the BSP management was 100 ingot tonnes per man year. The actual labour productivity during 1978-79 to 1990-91 ranged

from 60 ingot tonne (1984-85) to 98 ingot tonne (1990-91). However, labour productivity went upto 107 ingot tonne in 1991-92 to 116 ingot tonnes in 1992-93 and further to 121 ingot tonnes in 1993-94.

10.2 Salaries, Wages and other benefits per employee

The incidence of salaries and wages including bonus and other benefits per employee increased from Rs.13322 in 1978-79 to Rs.90434 in 1993-94. Low level of production and employment of excessive staff contributed to higher cost. The labour cost per tonne of crude steel and saleable steel has been increasing continuously since 1990-91 and 1988-89 respectively. The Management stated (August 1992) that measures like reduction in manpower and improvement in capacity utilisation had been taken to reduce the incidence of labour cost in cost of production and, consequently, there was only marginal increase in the cost per tonne of crude steel despite increase in the earnings per employee year after year.

CHAPTER - 11

INVENTORY CONTROL

11.1 The inventory of the plant comprises of (a) raw materials, (b) stores & spares and (c) finished and semi-finished products. The inventory holding of stores & spares and that of finished & semi-finished products as on March,1994 represented 5.37 months consumption and 1.76 months sales respectively.

An analysis made by the Management revealed that non-moving stores and spares worth Rs.39.64 crores and surplus items worth Rs.2.46 crores as detailed below were in stock as on 31.3.94 :-

TABLE -18
(Rs. in lakhs)

Year	Declared Surplus (opening stock + declared surplus during the year)	Disposal during the year	Closing Stock of surplus items	Non-moving stores	Slow moving stores	Percentage of Disposal to Non-moving	Percentage of Disposal to Declared Surplus
1988-89	540.46	229.08	311.38	1810	1125	12.66	42.39
1989-90	413.99	142.18	271.81	1809	2412	7.86	34.34
1990-91	507.39	124.37	383.02	1649	2228	7.54	24.51
1991-92	468.33	183.64	284.69	2622	1855	7.00	39.21
1992-93	551.56	104.95	446.61	3308	2322	3.17	19.03
1993-94	514.28	268.44	245.84	3964	1389	6.77	52.20

The stock of non-moving and surplus items was very high and their disposal very slow. The stock of slow moving stores was also very high. Poor response from buyers for such items and low prices (as compared to book value) generally offered for such items in auction by the highest bidders were stated to be the constraints in the disposal of the surplus items.

11.2 Physical Verification

i) The results of physical verification of stores, raw materials and semi/finished products during the last four years are given below :

TABLE - 19
(Rs. in lakhs)

Year	Stores & Spares		Raw Materials			Semi/Finished products	
	Excess	Shortage	Excess	Shortages		Excess	Shortage
				Normal	Abnormal		
1990-91	388.73	314.86	463.03	2653.31	18.04	5415.01	5006.40
1991-92	43.55	32.84	213.49	2459.32	19.49	4203.68	5388.35
1992-93	35.56	208.90	234.61	3283.75	-	4652.20	5499.46
1993-94	3.54	2.55	4.04	3869.85	196.23	297.23	2341.11

It would be seen that there was abnormal shortage of stores and spares during the year 1992-93 and semi/finished products during the years 1991-92 to 1993-94. The shortage of indigenous coal (both coking and non-coking) beyond the norm (5%) during the years 1984-85 to 1988-89 was to the extent of Rs.10.57 crores. Shortage of coal was attributed by the Management to (i) underloading at loading points, (ii) pilferage enroute and (iii) tampering of weigh bridge at loading points. There was also a shortage of 1,34,836.54 tonnes of imported coal worth Rs.22.58 crores during the period 1987-88 to 1991-92.

ii) IDLE EQUIPMENT

Equipments valued at Rs.12.59 crores (approx) were lying idle, out of which equipments valued at Rs.4.56 crores were recommended for disposal. The non-utilisation of individual equipments valued at Rs.10 lakhs and above was mainly due to design defects, obsolescence etc.

CHAPTER - 12

INTERNAL AUDIT

Internal Audit Department, was formed in 1962. GM (F&A), is in-charge of the Department. The size of the department was not considered adequate to cover the activities of a 4 MT Steel Plant and the Statutory Auditors advised strengthening of internal audit wing as well as change in the reporting systems. While Internal Audit is being gradually strengthened, no action has been taken to change the reporting systems. The Internal Audit Department has not undertaken an appraisal of the performance of the Steel Plant as recommended by the COPU in their Fifteenth Report, 4th Lok Sabha. The Management stated (August, 1992) that strengthening of the internal audit wing by making it multi-disciplined was under active consideration.

CHAPTER - 13.

POLLUTION CONTROL & ENVIRONMENTAL MANAGEMENT

The Pollution Control and Environmental Management Department was set up in April 1983. Investment on pollution control measures under the 4 MT expansion was estimated at Rs.72 crores, but no special budgetary allotment was made. Funds were, however, made available to various departments for taking pollution control measures. Actual expenditure in this direction upto March 1994 was Rs.113.44 crores. The Management stated (March 1994) that a time bound action plan drawn up, has been under implementation to meet pollution control norms at SAIL Plants.

New Delhi
The - 3 MAY 1995

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

Countersigned

New Delhi
The - 4 मई MAY 1995

(C.G. SOMIAH)
Comptroller and Auditor General of India

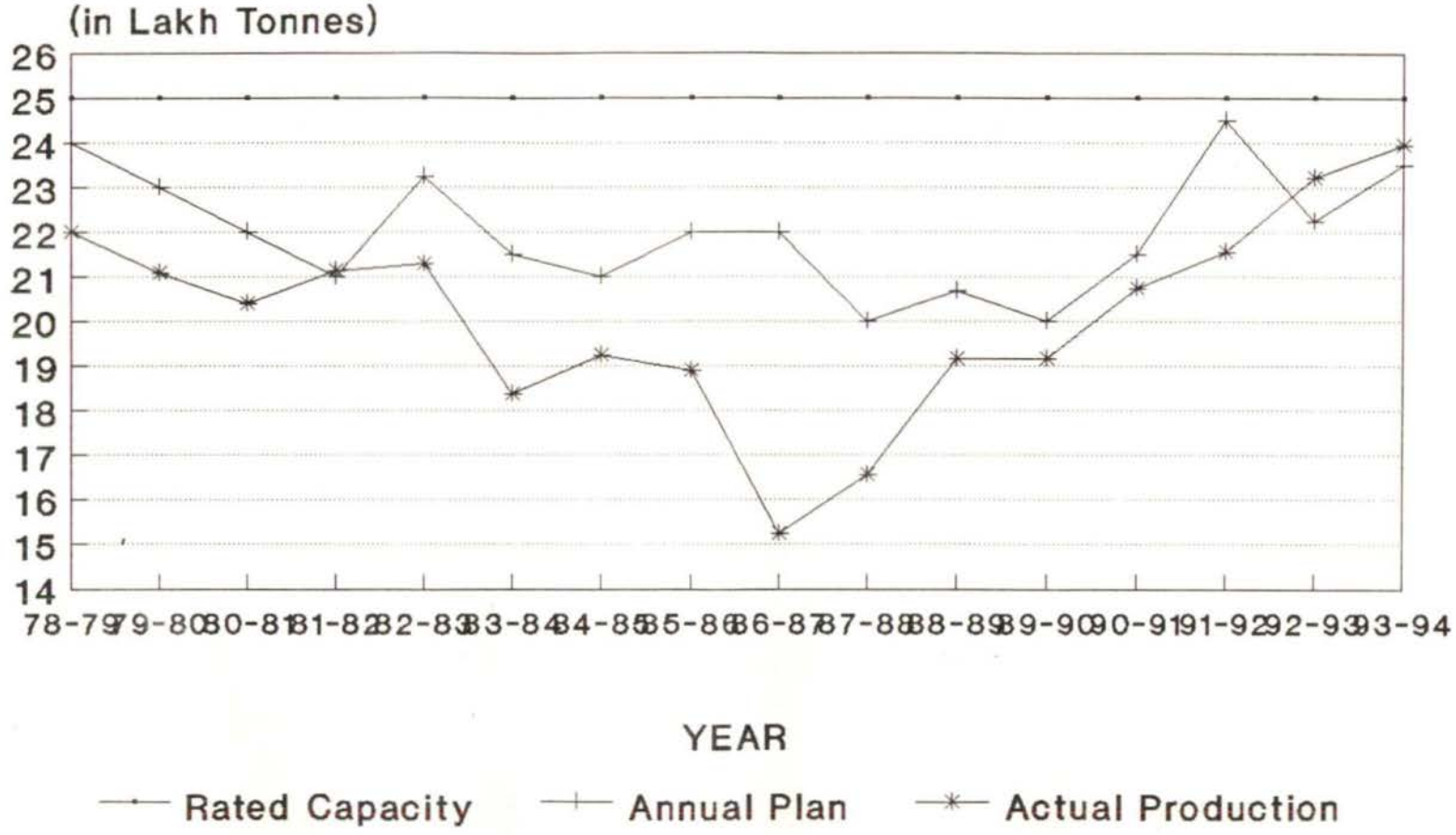
ANNEXURES

ANNEXURE-I

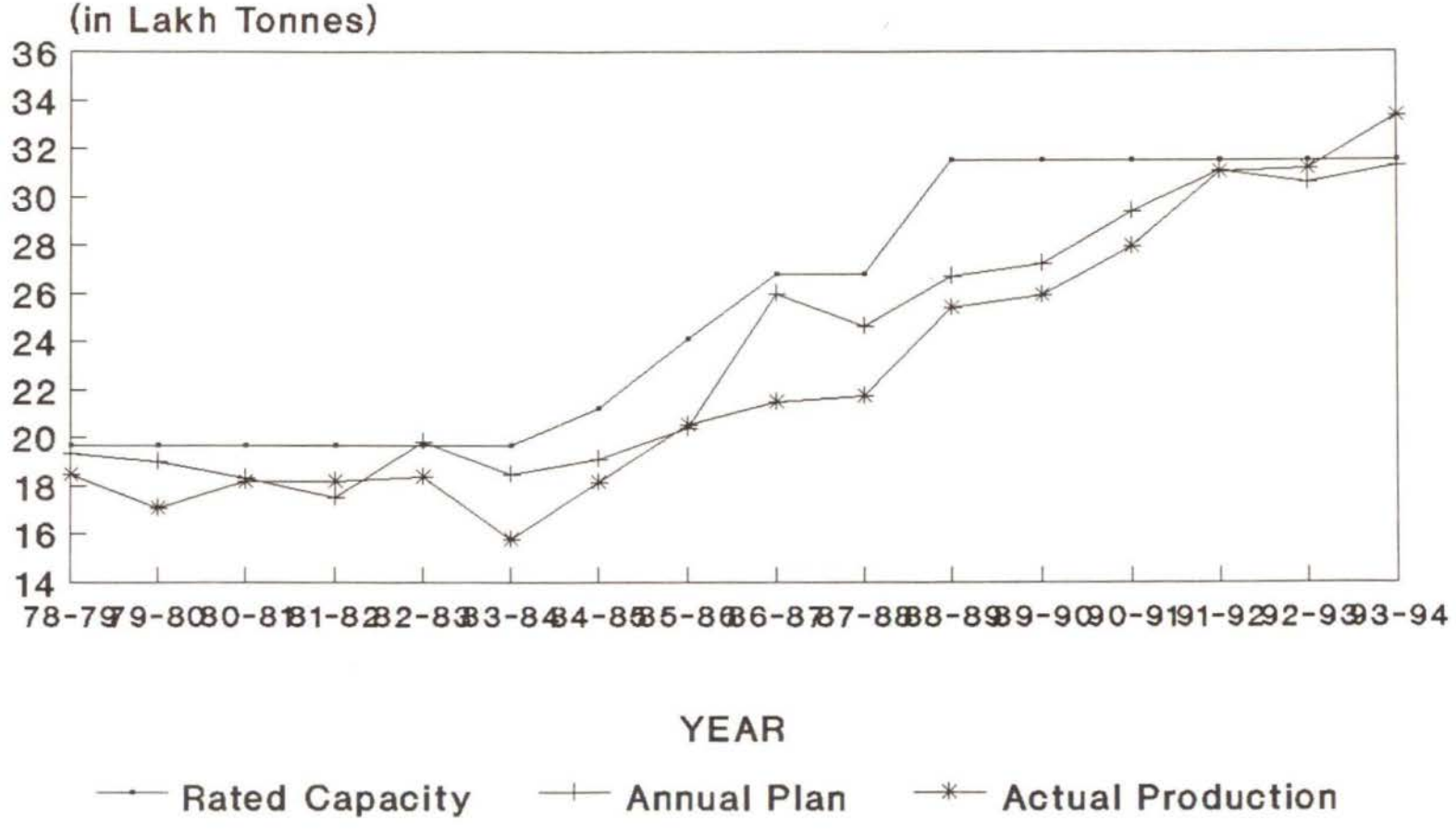
(Referred to Para 4.01)

Particulars	Ingot Steel			Saleable Steel			Liquid Steel		
Years	Rated Capa-city	Annual Plan	Actual Produc-tion	Rated Capa-city	Annual Plan	Actual Produc-tion	Rated Capa-city	Annual Plan	Actual Produc-tion
1978-79	25.00	24.00	22.00	19.65	19.35	18.46	-	-	-
1979-80	25.00	23.00	21.08	19.65	19.00	17.06	-	-	-
1980-81	25.00	22.00	20.41	19.65	18.30	18.18	-	-	-
1981-82	25.00	21.00	21.15	19.65	17.50	18.19	-	-	-
1982-83	25.00	23.25	21.30	19.65	19.80	18.38	-	2.00	-
1983-84	25.00	21.50	18.37	19.65	18.47	15.74	-	2.00	-
1984-85	25.00	21.00	19.25	21.21	19.10	18.10	-	3.35	0.73
1985-86	25.00	22.00	18.90	24.10	20.40	20.55	5.60	3.50	4.54
1986-87	25.00	22.00	15.26	26.80	26.00	21.50	9.00	8.00	7.04
1987-88	25.00	20.00	16.57	26.80	24.65	21.73	9.00	10.00	8.14
1988-89	25.00	20.70	19.17	31.53	26.70	25.42	15.00	13.00	11.77
1989-90	25.00	20.00	19.17	31.53	27.25	25.94	15.00	14.00	13.36
1990-91	25.00	21.50	20.74	31.53	29.41	27.95	15.00	15.00	14.37
1991-92	25.00	24.50	21.56	31.53	31.10	31.04	15.00	15.50	15.88
1992-93	25.00	22.25	23.23	31.53	30.60	31.18	15.00	16.00	16.19
1993-94	25.00	23.50	23.95	31.53	31.30	33.35	15.00	16.00	16.33

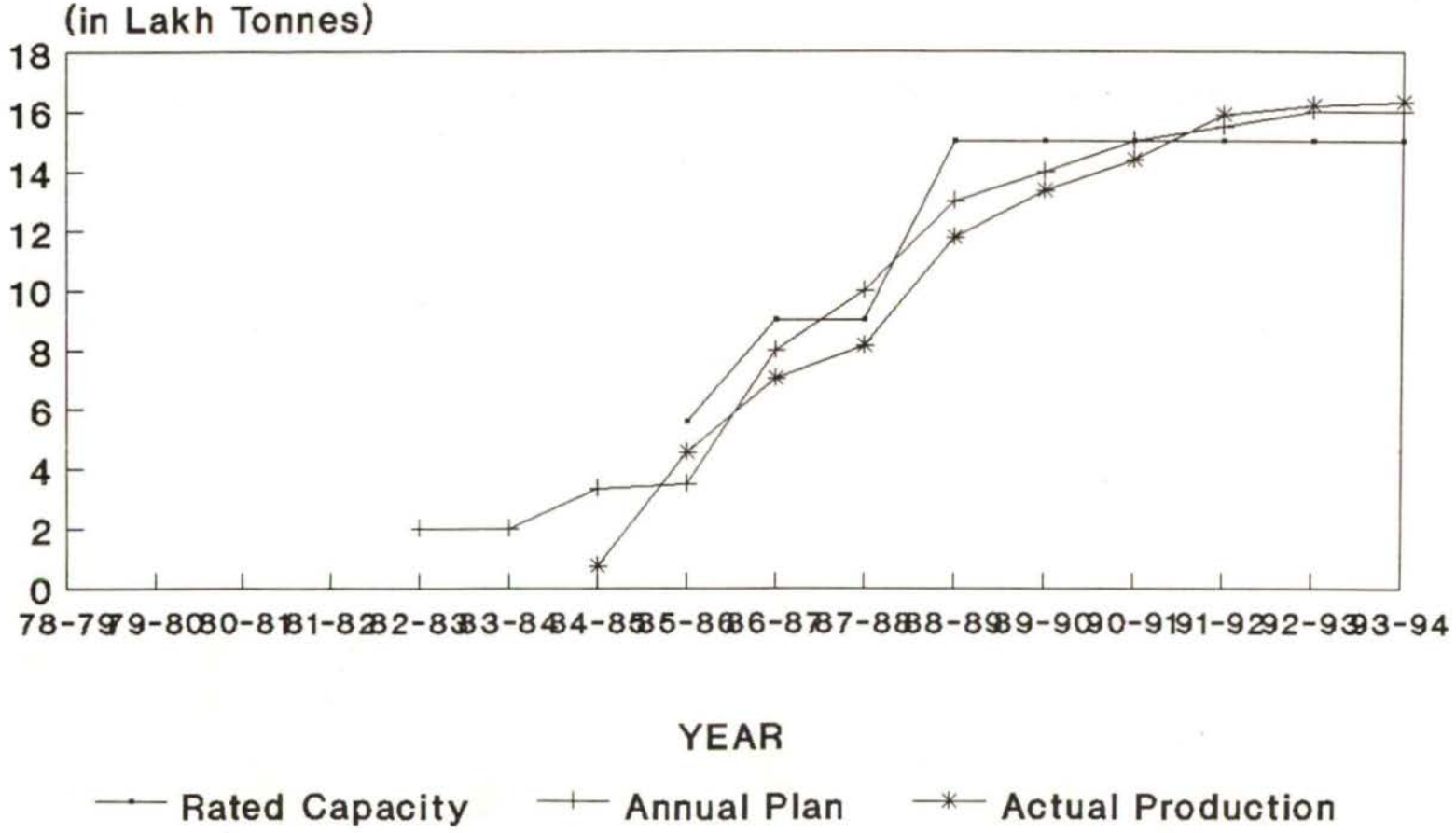
Production of Ingot Steel vs Rated Capacity and Annual Plan



Production of Saleable Steel vs Rated Capacity and Annual Plan



Production of Liquid Steel vs Rated Capacity and Annual Plan



ANNEXURE - II (Refer to in Paragraph No.4.02)

Production performance - Coke Oven

(Fig.in '000 tonnes)

Year	Rated Capacity (B.F. Coke)		Annual Plan	Actual Production	%age of production to	
	As per D.P.R.	Adopted by BSP Mgt.			Rated capacity as adopted by BSP Mgt.	Annual Plan
1	2	3	4	5	6	7
1978-79	2757	2511	2441	2289	91.16	93.77
1979-80	2757	2511	2444	2196	87.46	89.85
1980-81	2757	2511	2364	2066	82.28	87.39
1981-82	2757	2511	2224	2197	87.50	98.79
1982-83	2757	2511	2385	2093	83.35	87.75
1983-84	2757	2511	2306	2027	80.72	87.90
1984-85	2757	2511	2154	2033	80.96	94.38
1985-86	2757	2511	2343	2192	87.30	93.56
1986-87	2757	2511	2320	2087	83.11	89.96
1987-88	2757	2511	2444	2110	84.03	86.33
1988-89	3303	3303	2624	2484	75.20	84.66
1989-90	3303	3303	2710	2620	79.32	96.68
1990-91	3303	3303	2625	2772	83.92	105.60
1991-92	3303	3303	2755	2872	86.95	104.25
1992-93	3303	3303	2860	2840	85.98	99.30
1993-94	3303	3303	2906	3001	90.86	103.27

A N N E X U R E - III (Refer to in paragraph No.4.1.02)

Statement showing the actual yield of gross coke, B.F. Coke and gas against DPR/Norms Committee Norm (1979) for the years 1978-79 to 1993-94.

Year	Yield of gross coke B.F. Coke as percentage of raw coal charged and yield of gas per tonne of raw coal charged as per DPR of 9th B.F. Complex-9th C.O. Battery.			Yield of gross coke B.F. Coke as percentage of raw coal charged and also yield of gas per tonne of coal charged as per Norms Committee (1979)			Actual yield of gross coke B.F.Coke and Gas		
	Gross Coke (%)	B.F. Coke (%)	Gas (M^3)	Gross Coke (%)	B.F. Coke (%)	Gas (M^3)	Gross Coke (%)	B.F. Coke (%)	Gas (M^3)
1	2	3	4	5	6	7	8	9	10
Battery 1 to 8									
1978-79	76.4	68.8	304	76.4	68.5	300	76.15	68.30	294
1979-80	76.4	68.8	304	76.4	68.5	300	76.42	68.55	289
1980-81	76.4	68.8	304	76.4	68.5	300	76.97	69.05	286
1981-82	76.4	68.8	304	76.4	68.5	300	76.87	68.95	280
1982-83	76.4	68.8	304	76.4	68.5	300	77.35	69.38	269
1983-84	76.4	68.8	304	76.4	68.5	300	76.76	68.85	275
1984-85	76.4	68.8	304	76.4	68.5	300	76.39	68.85	270
1985-86	76.4	68.8	304	76.4	68.5	300	76.50	68.62	277
1986-87	76.4	68.8	304	76.4	68.5	300	76.47	68.59	276
1987-88	76.4	68.8	304	76.4	68.5	300	77.70	69.65	284
1988-89									
Batt.1-8	76.4	68.8	304	76.4	68.5	300	76.30	68.20	279
Batt.9	76.2	68.35	304	--	--	--	76.50	68.40	--
1989-90									
Batt.1-8	76.4	68.8	304	76.4	68.5	300	76.62	68.59	283
Batt.9	76.2	68.35	304	--	--	--	76.35	68.35	

1990-91									

Batt.1-8	76.4	68.8	304	76.4	68.5	300	76.00	68.50	293
Batt.9	76.2	68.35	304	--	--	--	76.00	68.30	
1991-92									

Batt.1-8	76.4	68.8	304	76.4	68.5	300	76.2	69.00	295
Batt.9	76.2	68.35	304	--	--	--	76.2	69.00	
1992-93									

Batt.1-8	76.4	68.8	304	76.4	68.5	300	75.4	68.80	295
Batt.9	76.2	68.35	304	--	--	--	75.6	69.00	
1993-94									

Batt.1-8	76.4	68.8	304	76.4	68.5	300	75.8	68.90	294
Batt.9	76.2	68.35	304	--	--	--	75.8	69.00	--

ANNEXURE - IV (Refer to in paragraph No.4.03.04)

Statement showing the production of hot metal in different silicon ranges during the year 1978-79 to 1993-94.

Year	Quantity produced with silicon content upto 1.25% (Tonnes)	Quantity produced with silicon content ranging from 1.26% to 3.25% (Tonees)	Quantity produced with silicon content above 3.25% (Tonnes)	Total production (Tonnes) (col.2+3+4)	Percentage of quantity produced with silicon content upto 1.25% to the total production	%age of quantity produced with silicon content above 1.25% to total production
1	2	3	4	5	6	7
1978-79	1320858	1197503	1823	2520184	52.41	47.59
1979-80	1188220	1148658	1649	2338527	50.81	49.19
1980-81	1108245	1103546	2340	2214131	50.05	49.95
1981-82	1216470	1154367	5933	2376770	51.18	48.82
1982-83	1220532	1106151	3649	2330332	52.38	47.62
1983-84	732668	1385587	5858	2124113	34.49	65.51
1984-85	1074210	1258955	5572	2338737	45.93	54.07
1985-86	1290307	1309797	3910	2604014	49.55	50.45
1986-87	1220463	1287360	2178	2510001	48.62	51.38
1987-88	1037539	1513085	5480	2556104	40.59	59.41
1988-89	1699552	1602038	4622	3306112	51.41	48.59
1989-90	1924133	1557597	3773	3485503	55.20	44.80
1990-91	1948803	1598363	2250	3549416	54.90	45.10
1991-92	2404718	1453967	1931	3860616	62.29	37.71
1992-93	2778106	1258914	7632	4044652	68.69	31.31
1993-94	3284117	964218	2327	4250662	77.26	22.74

ANNEXURE - V (Refer to in paragraph No.4.03.04)

Statement showing the details of Hot Metal supplied to Steel Melting Shop during 1978-79 to 1993-94.

Year	Total quantity of Hot Metal supplied (Tonnes)	Supply of Hot Metal with silicon content ranging from 1.25% to 3.25% and above (Tonnes)	Percentage of supply of Hot Metal with silicon content exceeding 1.25% to the total supply of Hot Metal to SMS.
1	2	3	4
1978-79	1796343	795560	44.29
1979-80	1709537	797690	46.66
1980-81	1675148	809593	48.33
1981-82	1759485	843861	47.96
1982-83	1765400	836330	47.87
1983-84	1475355	964966	65.41
1984-85	1688053	905234	53.63
1985-86	2074651	1021861	49.25
1986-87	2097748	1042642	49.70
1987-88	2272148	1434837	63.15
1988-89	2917469	1378628	47.25
1989-90	3015725	1304431	43.25
1990-91	3368675	1505949	44.70
1991-92	3588622	1334020	37.17
1992-93	3813697	1179369	30.92
1993-94	3841673	857721	22.33

ANNEXURE - VI (Refer to in paragraph No.4.04)

Statement showing the Rated Capacity, Budgetted Production and Actual Production of Sinter in Sintering Plants-I and II during 1978-79 to 1993-94.

(in lakhs tonnes)

Year	Rated Capacity		Annual Plan Target	Actual Production	Percentage of Actual Production to	
					Rated Capacity	Annual Plan Target
1	2		3	4	5	6
1978-79	SP-I	20.40	18.50	17.21	84.36	93.03
	SP-II	--	1.60	--	--	--
1979-80	SP-I	20.40	18.20	14.94	73.24	82.09
	SP-II	5.00	3.75	1.71	34.20	45.60
1980-81	SP-I	20.40	16.50	15.17	74.36	91.94
	SP-II	7.50	5.00	4.01	53.47	80.20
1981-82	SP-I	20.40	16.50	13.85	67.89	83.94
	SP-II	15.00	7.50	7.60	50.67	101.33
1982-83	SP-I	20.40	19.38	14.84	72.75	76.57
	SP-II	15.00	10.00	10.78	71.87	107.80
1983-84	SP-I	20.40	16.70	12.46	61.08	74.61
	SP-II	15.00	13.50	10.60	70.67	78.52
1984-85	SP-I	20.40	15.30	14.32	70.20	93.59
	SP-II	15.00	12.70	11.60	77.33	91.34
1985-86	SP-I	20.40	15.50	14.80	72.55	95.48
	SP-II	15.00	13.30	12.79	85.27	96.17
1986-87	SP-I	20.40	15.50	13.18	64.61	85.03
	SP-II	19.38	15.50	13.24	68.32	85.42
1987-88	SP-I	20.40	16.50	12.60	61.76	76.36
	SP-II	22.50	18.00	14.04	62.40	78.00
1988-89	SP-I	20.40	16.00	14.75	72.30	92.19
	SP-II	22.50	20.70	17.15	76.22	82.85
1989-90	SP-I	20.40	17.50	17.56	86.08	100.34
	SP-II	22.50	20.50	18.50	82.22	90.24
1990-91	SP-I	20.40	20.20	17.30	84.80	85.64
	SP-II	22.50	20.30	20.32	90.31	100.10
1991-92	SP-I	20.40	20.20	15.31	75.05	75.79
	SP-II	22.50	26.30	22.64	100.62	86.08
1992-93	SP-I	20.40	15.50	15.56	76.27	100.39
	SP-II	31.37	26.50	24.82	79.12	93.66
1993-94	SP-I	20.40	16.00	16.60	81.37	103.75
	SP-II	31.37	27.50	28.10	89.58	102.18

A N N E X U R E VII (Refer to in paragraph No.4.05.01)

Statement showing the actual working hour/hours under repairs against the expected working hours/provision for repairs

Year	250 Tonne Furnaces		500 Tonne Furnaces		T.H. Furnace		Actual Working hours				Hours under repairs				Number of hours under repair in excess of projected Norms				Idleness of furnace for other reasons		
	Expected working hours (DPR)	Provision for repair (DPR)	Expected working hours (DPR)	Provision for repair (DPR)	Expected working hours (on the basis 330 working days)	Provision for repair	250 T furnace	500 T furnace	Twin Hearth furnace	Total	250 T furnace	500 T furnace	Twin Hearth furnace	Total	250 T furnace	500 T furnace	Twin Hearth furnace	Total	Revised idle period	Down time for other reasons	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1978-79	39600	4200	39600	4200	--	--	36132	36804	--	72936	6080	5196	--	11276	1880	966	--	28⁴⁄₆	199	3079	3278
1979-80	39600	4200	39600	4200	--	--	35516	35882	--	71398	6536	6171	--	12707	2336	1971	--	4307	--	3421	3421
1980-81	39600	4200	39600	4200	--	--	33948	34086	--	68034	6258	7374	--	13632	2058	3174	--	5232	2934	3000	5934
1981-82	39600	4200	39600	4200	--	--	35188	36297	--	71485	6770	5746	--	12516	2570	1546	--	4116	668	2931	3599
1982-83	39600	4200	39600	4200	--	--	36551	36318	--	72869	5778	5881	--	11659	1578	1681	--	3259	--	3072	3072
1983-84	39600	4200	39600	4200	--	--	35173	34007	--	69180	6816	7140	--	13956	2616	2940	--	5556	1842	2861	4703
1984-85	39600	4200	39600	4200	--	--	35967	36328	--	72295	6639	6095	--	12734	2439	1895	--	4334	--	2571	2571
1985-86	39600	4200	39600	4200	--	--	34576	35297	--	69873	7792	7236	--	15028	3592	3036	--	6628	--	2700	2700
1986-87	39600	4200	32340	3430	4620	490	31442	26021	3422	60885	10238	11560	856	22654	6037	8130	366	14533	870	3190	4060
1987-88	39600	4200	31680	3360	7920	840	25436	23388	6895	55719	11968	9399	1606	22973	7767	6039	766	14572	5640	3508	9148
1988-89	39600	4200	31680	3360	7920	840	26996	23449	6906	57352	14289	9676	1495	25460	10089	6316	655	17060	143	4646	4789
1989=90	39600	4200	31680	3360	7920	1050	17830	23769	8782	50381	7782	8414	1675	17871	5073	5054	625	10752	3243	2718	5961
1990-91	15480	1680	31680	3360	15880	1680	8787	22886	14578	46251	2902	6974	2055	11931	1222	3614	375	5211	8555	2599	11154
1091-92	7920	840	31680	3360	15840	1680	5559	25747	15384	46690	1964	6854	2021	10839	1124	3494	341	4959	1406	2553	3959
1982-93	--	--	24420	2590	22440	2380	33	18668	20887	39589	--	5882	2463	8345	--	1522	83	1605	3007	1322	4328
1993-94	--	--	23760	2520	23760	2520	--	16907	23049	39956	--	5381	2946	8327	--	2861	426	3287	2880	1397	4277

A N N E X U R E - VIII (Refer to in paragraph No.4.5.04)
Statement showing the actual consumption of major raw materials per tonne of ingot steel during the years 1978-79 to 1993-94
(Kgs. per tonne)

Y e a r	Metallic Input				Iron Ore	Limestone	Ferro Manganese	Ferro Silicon
	Hot Metal	Iron Scrap Cold Pig	Steel Scrap	Total				
As per Project Report	785	29.6	202.3	1016.9	200	65	--	---
As per Norms Committee (1979)	790	45.0	210.0	1045.0	153	70	18.0	1.0
1978-79	817	48	211	1076	145	61	21.2	1.2
1979-80	811	50	202	1063	140	58	21.4	1.0
1980-81	821	54	211	1086	139	55	21.0	1.0
1981-82	831	50	207	1088	124	55	21.8	0.9
1982-83	830	48	209	1087	126	48	21.8	1.1
1983-84	803	47	244	1094	118	47	23.2	1.1
1984-85	837	58	216	1111	129	52	23.3	1.2
1985-86	850	77	220	1147	123	55	25.4	1.3
1986-87	880	67	230	1177	108	58	26.1	1.3
1987-88	837	55	252	1144	71	45	21.8	1.3
1988-89	864	52	232	1148	83	43	19.6	1.1
1989-90	866	38	253	1157	69	63	18.2	1.4
1990-91	934	43	239	1216	46	65	16.2	1.9
1991-92	909	46	232	1187	47	69	16.0	1.9
1992-93	918	40	224	1182	37	62	15.0	2.2
1993-94	915	41	203	1159	38	62	14.0	2.3

ANNEXURE IX (Refer to in paragraph No.4.08.01)

STATEMENT SHOWING PRODUCTION PERFORMANCE OF ROLLING MILLS FOR THE YEARS 1978-79 TO 1993-94.

A.BLOOMING MILL

(Fig. in lakh tonnes.)

Year	Rated Capacity	Annual target	Actual Production	Percentage of production to	
				Rated Capacity	Annual Target
1	2	3	4	5	6
1978-79	21.42	20.99	19.59	91.46	93.33
1979-80	21.42	20.43	18.13	84.64	88.74
1980-81	21.42	19.73	19.11	89.21	96.86
1981-82	21.42	18.74	18.99	88.66	101.33
1982-83	21.42	20.76	19.08	89.08	91.91
1983-84	21.42	18.59	16.33	76.24	87.84
1984-85	21.42	17.88	17.58	82.07	98.32
1985-86	21.42	18.96	16.73	78.10	88.24
1986-87	21.42	19.17	13.99	65.31	72.98
1987-88	21.42	17.55	15.37	71.76	87.58
1988-89	21.42	18.22	16.82	78.52	92.32
1989-90	21.42	17.56	17.43	81.37	99.26
1990-91	21.49	18.85	17.83	82.97	94.59
1991-92	21.49	21.25	19.24	89.53	90.54
1992-93	21.49	20.68	19.46	90.55	94.10
1993-94	21.49	20.80	20.18	93.90	97.02

STATEMENT SHOWING PRODUCTION PERFORMANCE OF BILLET MILL FOR THE YEARS 1978-79 TO 1993-94.

B.BILLET MILL

(Fig. in lakh tonnes.)

Year	Rated Capacity	Annual target	Actual Production	Percentage of production to	
				Rated Capacity	Annual Target
1	2	3	4	5	6
1978-79	12.63	12.80	12.12	95.96	94.69
1979-80	12.63	13.14	10.81	85.59	82.27
1980-81	12.63	12.43	11.48	90.89	92.36
1981-82	12.63	11.88	10.78	85.35	90.74
1982-83	12.63	12.00	11.01	87.17	91.75
1983-84	12.63	10.80	9.72	76.96	90.00
1984-85	12.63	10.50	10.51	83.21	100.10
1985-86	12.63	11.00	9.50	75.22	86.36
1986-87	12.63	12.04	8.12	64.29	67.44
1987-88	14.06	11.25	9.58	68.14	85.16
1988-89	15.01	12.06	10.22	68.09	84.74
1989-90	15.01	11.00	11.58	77.15	105.27
1990-91	15.01	13.35	12.13	80.81	90.86
1991-92	15.01	15.00	13.11	87.34	87.40
1992-93	15.01	15.00	13.61	90.67	90.73
1993-94	15.01	14.36	14.55	96.94	101.32

C.MERCHANT MILL

(Fig. in lakh tonnes.)

Year	Rated Capacity	Annual target	Actual Production	Percentage of production to	
				Rated Capacity	Annual Target
1	2	3	4	5	6
1978-79	5.00	5.00	4.83	96.60	96.60
1979-80	5.00	5.00	4.16	83.20	83.20
1980-81	5.00	4.75	4.13	82.60	86.95
1981-82	5.00	4.75	4.13	82.60	86.95
1982-83	5.00	5.00	3.68	73.60	73.60
1983-84	5.00	4.70	3.41	68.20	72.55
1984-85	5.00	4.80	3.84	76.80	80.00
1985-86	5.00	5.00	3.62	72.40	72.40
1986-87	5.00	5.20	3.35	67.00	64.42
1987-88	5.00	5.00	4.01	80.20	80.20
1988-89	5.00	5.00	3.75	75.00	75.00
1989-90	5.00	4.75	4.11	82.20	86.53
1990-91	5.00	4.76	4.53	90.60	95.17
1991-92	5.00	5.00	4.69	93.80	93.80
1992-93	5.00	5.00	4.79	95.80	95.80
1993-94	5.00	5.30	4.94	98.80	93.21

C.RAIL AND STRUCTURAL MILL

(Fig. in lakh tonnes.)

Year	Rated Capacity	Annual target	Actual Production	Percentage of production to	
				Rated Capacity	Annual Target
1	2	3	4	5	6
1978-79	7.50	7.00	6.45	86.00	92.14
1979-80	7.50	6.25	6.00	80.00	96.00
1980-81	7.50	6.25	5.78	77.07	92.48
1981-82	7.50	6.00	6.39	85.20	106.50
1982-83	7.50	6.60	6.01	80.13	91.06
1983-84	7.50	6.30	4.91	65.47	77.94
1984-85	7.50	6.00	5.42	72.27	90.33
1985-86	7.50	6.20	5.51	73.47	88.87
1986-87	7.50	6.80	4.91	65.47	72.21
1987-88	7.50	6.65	5.15	68.67	77.44
1988-89	7.50	6.50	6.11	81.47	94.00
1989-90	7.50	7.00	5.65	75.33	80.71
1990-91	7.50	6.20	5.55	74.00	89.52
1991-92	7.50	6.25	5.90	78.67	94.40
1992-93	7.50	6.30	6.14	81.87	97.46
1993-94	7.50	6.90	6.46	86.13	93.62

E.WIRE ROD MILL

(Fig. in lakh tonnes.)

Year	Rated Capacity	Annual target	Actual Production	Percentage of production to	
				Rated Capacity	Annual Target
1	2	3	4	5	6
1978-79	4.00	4.50	4.58	114.50	101.78
1979-80	4.00	4.50	3.85	96.25	85.56
1980-81	4.00	4.25	3.71	92.75	87.29
1981-82	4.00	4.25	3.67	91.75	86.35
1982-83	4.00	4.25	3.52	88.00	82.82
1983-84	4.00	3.50	2.32	58.00	66.29
1984-85	4.00	3.75	3.38	84.50	90.13
1985-86	4.00	4.30	3.45	86.25	80.23
1986-87	4.00	4.50	3.62	90.50	80.44
1987-88	4.00	4.00	3.52	88.00	88.00
1988-89	4.00	4.00	3.72	93.00	93.00
1989-90	4.00	4.25	4.11	102.75	96.71
1990-91	4.00	4.05	4.06	101.50	100.25
1991-92	4.00	4.25	4.23	105.75	99.53
1992-93	4.00	4.25	3.93	98.25	92.47
1993-94	4.00	3.00	4.28	107.00	142.67

F.PLATE MILL

(Fig. in lakh tonnes.)

Year	Rated Capacity	Annual target	Actual Production	Percentage of production to	
				Rated Capacity	Annual Target
1	2	3	4	5	6
1983-84	N.A.	1.00	0.12	--	12.00
1984-85	5.70	2.60	0.50	8.77	19.23
1985-86	5.70	2.40	2.94	51.58	122.50
1986-87	5.70	4.95	3.74	65.61	75.56
1987-88	5.70	4.85	3.81	66.84	78.56
1988-89	9.50	6.00	5.74	60.42	95.67
1989-90	9.50	6.33	5.97	62.84	94.31
1990-91	9.50	7.40	6.51	68.53	87.97
1991-92	9.50	6.40	6.74	70.95	105.31
1992-93	9.50	6.70	6.60	69.47	98.51
1993-94	9.50	6.75	6.21	65.37	92.00

ANNEXURE X [Refer to in paragraph No.5.1.01]

Statement showing the Rated capacity, Annual Plan and Actual production of Iron Ore (Lump & Fines) in respect of Rajhara Mechanised Mines for the years 1978-79 to 1993-94.

(Figure in lakh tonnes)

Year	Rated Capacity	Annual Plan	Actual Production			Percentage of Actual production to	
			Lumps	Fines	Total	Rated Capacity	Annual Plan
1	2	3	4	5	6	7	8
1978-79	35	28.00	11.29	13.42	24.71	70.60	88.25
1979-80	35	28.00	10.45	12.75	23.20	66.29	82.86
1980-81	35	24.00	9.00	11.90	20.90	59.71	87.08
1981-82	35	24.00	8.26	10.77	19.03	54.37	79.29
1982-83	35	28.00	7.57	11.48	19.05	54.43	68.04
1983-84	35	28.00	7.72	9.38	17.10	48.86	61.07
1984-85	35	28.40	9.00	10.96	19.96	57.03	70.28
1985-86	35	26.40	12.30	10.85	23.15	66.14	87.69
1986-87	35	26.40	12.28	15.22	27.50	78.57	104.17
1987-88	35	33.50	12.69	13.70	26.39	75.40	78.78
1988-89	35	31.00	13.40	14.07	27.47	78.49	88.61
1989-90	35	33.80	16.12	15.78	31.90	91.14	94.38
1990-91	35	32.00	17.05	17.38	34.43	98.37	107.59
1991-92	35	34.50	17.54	17.10	34.64	98.97	100.41
1992-93	35	33.73	16.15	17.37	33.52	95.77	99.38
1993-94	35	35.00	16.87	18.25	35.12	100.34	100.34

ANNEXURE XI [Refer to in paragraph No.5.1.02]

Statement showing the Rated Capacity, Annual Production Plan and Actual production in respect of Dalli Mechanised mines for the years 1978-79 to 1993-94.

(Fig in lakh tonnes)

Year	Rated Capacity	Annual Production Plan	Actual Production Plan	Percentage of Actual Production to	
				Rated Capacity	Annual Production Plan
1	2	3	4	5	6
1978-79	21.50	N.A.	0.17	0.79	--
1979-80	21.50	15.48	5.19	24.14	33.53
1980-81	21.50	15.48	6.70	31.16	43.28
1981-82	21.50	17.20	9.50	44.19	55.23
1982-83	21.50	17.20	10.90	50.70	63.37
1983-84	21.50	17.20	12.72	59.16	73.95
1984-85	21.50	17.20	12.43	57.81	72.27
1985-86	21.50	20.40	14.89	69.26	72.99
1986-87	25.50	24.32	17.24	67.61	70.89
1987-88	25.50	26.30	20.96	82.20	79.70
1988-89	25.50	24.00	22.00	86.27	91.67
1989-90	25.50	29.45	23.93	93.84	81.26
1990-91	30.00	28.00	29.02	96.73	103.64
1991-92	30.00	30.50	30.60	102.00	100.33
1992-93	30.00	29.50	30.88	102.93	104.68
1993-94	30.00	35.00	32.93	109.77	94.09

A N N E X U R E XII (Refer to in paragraph No.5.2)

STATEMENT SHOWING THE ANNUAL TARGET AND ACTUAL PRODUCTION OF NANDINI MECHANISED FOR THE PERIOD 1978-79 TO 1993-94.

Y e a r	Annual Target as per App. of respective year (Tonnes)	Actual production BF/SP grade (Tonnes)	% of actual production to target
1	2	3	4
1978-79	1214000	940417	77.46
1979-80	1221000	866664	70.98
1980-81	1114000	872100	78.29
1981-82	1090000	837365	76.82
1982-83	1200000	770548	64.21
1983-84	1131000	772791	68.33
1984-85	1010000	1043736	103.34
1985-86	1187000	1143454	96.33
1986-87	1214800	1068989	88.00
1987-88	1465800	1137949	77.63
1988-89	1430000	987965	69.09
1989-90	1117000	864256	77.37
1990-91	1028000	855534	83.22
1991-92	1150000	1116510	97.09
1992-93	1175000	1017794	86.62
1993-94	1083000	927695	85.66

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