REPORT OF THE

COMPTROLLER AND AUDITOR GENERAL OF INDIA

UNION GOVERNMENT (COMMERCIAL)

1981

PART IV

ROURKELA STEEL PLANT

ERRATA

Page No.	Reference	*For*	*Read*
(i)	Line 2 below Annexure	units	inputs
(ii)	Annexure XV	Page 149	page 150
(iv)	Line 1 and 4	Put commas after Director	
1	Line 10 from bottom	tonne	tonnes
3	Heading—column 4 table	Budgeted capacity	Budgeted production
11	Line 6 from top	necessisty	necessity
11	Line 14 from top	strated	started
14	Line 11 from bottom	Substitute commas for fullstop	
15	Table-column 4	Remove bracket before 'unwashed'	
27	Line 15 from top	Substitute small bracket for middle bracket	
35	Heading of 1st table–column 4	steel	column
41	Line 5 and 7 below table	sulpher	sulphur
44	Line 10 from bottom	year	years
45	Line 18 from top	quality	Quality
48	Line 1 from top	inconsistant	inconsistent
50	Line 1 & 2 from top	original capital cost Rs. 48.29 lakhs not in operation since September 1976	not in operation since September 1976 (original capital cost Rs. 48.29 lakhs).
53	Sub-para of 3.02.01	After '1970-71 to' insert '1977-78 are mentioned below :"	
53	Sub-heading table—column 3	Remove bracket before 'sinter'	
55	Table-column 1	Delete 'percentage of' in line 4 of 1st column.	
57	Note below table	April 1981	(April 1981)
64	Table-column 1	purchase	purchased
71	Line 15 from bottom	April 1981	(April 1981)
78	Line 12 from top	Der	per
86	Table–column 2	Anthralene	Anthracene
101	First table from top—column 4	(+) 2–87	(+)2.87

1	2	3	4
102	Line 6 from top	Nitrate CAN	Nitrate-CAN
104	Line 2 below table	cpacity	capacity
105	Table–column 1	Amm nia	Ammonia
106	Line 3 below table	Managemnt	Management
110	Table-column 1 line 8	150	180
111	Line 12 from bottom	valued	and a loss of contribution margin of
115	Line 12 from top	below	blow
116	Line 9 from bottom	Pipe	Pipe Plant
119	Line 6 from top	fules	fuels
120	Line 12 from top	blend	bled
122	Line 6 from bottom	was	over
139	Annexure IX-column 5	Percentage or rejections	Percentage of rejection
142	Heading column 4	Available	Available hours
147		Put stroke after 'furnace' in the heading	
151	Annexure XVI-column 1	Slabing	Slabbing
151	—do— Line 3	'Scrap Arising' to be read above column 6 & 7	
153		Put comma after 'capacity' in the heading	
162	Column 1 line 4	cystallisation	crystallisation
162	Column 5 Annexure XXI line 8	combersome	cumbersome
164	Not below Annexure-line 6 & 7	exapnsion	expansion
165	Annexure XXIII	Insert '(Figures in tonnes)' above table	

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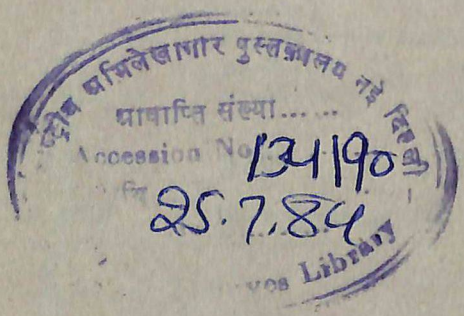
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ANNEXURES

PREFATORY REMARKS

It was mentioned in Paragraph 6 of the Prefatory Remarks contained in the Report of the Comptroller and Auditor General of India—Union Government (Commercial), 1981—Part. III— Bhilai Steel Plant, that the Reports on the working of other units of the erstwhile Hindustan Steel Limited were under finalisation.

2. This part contains the results of appraisal undertaken by the Audit Board of the working of Rourkela Steel Plant of the erstwhile Hindustan Steel Limited. The Report has been brought up to date by incorporating data upto 1977-78. In this case, the Audit Board consisted of the following members :—

(1) Shri T. Rengachari, Chairman Audit Board and Ex-officio Additional Deputy Comptroller and Auditor General (Commercial) upto 29th February 1980.

(2) Shri P. P. Gangadharan, Chairman Audit Board and Ex-officio Additional Deputy Comptroller and Auditor General (Commercial) with effect from 1st March 1980.

(3) Shri K. S. Murthy, Member Audit Board and Ex-officio Director of Commercial Audit, Ranchi upto 13th March 1978 and as Member Audit Board and Ex-officio Director of Commercial Audit, Bangalore from 9th March 1979.

(4) Shri M. Prem Kumar, Member Audit Board and Ex-officio Director of Commercial Audit, Bangalore upto 23rd January 1979.

(5) Shri A. Ghosh, Member Audit Board & Ex-officio Director of Commercial Audit, Ranchi from 29th March 1978 to 10th May 1981.

(6) Shri T. K. Krishna Das, Member Audit Board and Ex-officio Director of Commercial Audit, Ranchi with effect from 11th May 1981

(7) Shri B. R. Sule, Executive/Managing Director Mahindra and Mahindra Limited, Bombay—Part-time Member.

(8) *Prof. N. S. Ramaswamy, Director Indian Institute of Management, Bangalore—Part-time Member.

3. The Report was finalised by the Audit Board after taking into account ;

(a) the result of discussions held with the representatives of the Ministry of Steel & Mines and Steel Authority of India Limited, at its meeting held on 19th and 20th February 1981 ; and

(b) the additional information furnished by the Ministry/ Steel Authority of India Limited in April/June 1981.

4. The Comptroller and Auditor General of India, wishes to place on record the appreciation of the work done by the Audit Board and acknowledges with thanks the contribution, in particular, of Shri B. R. Sule, the Part-time technical Member, who is not an officer of the Indian Audit & Accounts Department.

*Prof. N. S. Ramaswamy did not attend any meeting.

1. *Introduction*

The Hindustan Steel Limited (HSL) was registered on 19th January 1954 as a joint stock company for the construction and management of the Rourkela Steel Plant with a capacity of one million tonnes of steel ingots. In March 1973, Hindustan Steel Limited became a subsidiary of Steel Authority of India Limited (SAIL). It was decided, *inter alia,* at that time to constitute Rourkela Steel Plant, which was a part of Hindustan Steel Limited as a separate company. Rourkela Ispat Limited was accordingly incorporated as a subsidiary of Steel Authority of India Limited to take over the functions of Rourkela Steel Plant. However, transfer of assets and liabilities of Rourkela Steel Plant did not take place and the plant continued to function as a part of Hindustan Steel Limited. Under the "Public Sector Iron & Steel Companies (Restructuring) and Miscellaneous Provisions Act 1978", the Steel Authority of India Limited was restructured from 1st May 1978. Hindustan Steel Limited stood dissolved under this Act and Rourkela Steel Plant stands transferred to Steel Authority of India Limited as one of its constituent units with effect from 1st May 1978.

The construction of the Steel Plant with a capacity of one million tonne of steel ingots (0.715 million tonne of saleable steel) was completed in November 1962 at a cost of Rs. 220.10 crores.

The capacity of the Plant was subsequently expanded to 1.8 million tonnes of steel ingots in February 1969 at a further cost of Rs. 160.21 crores. Some important facilities were, however, completed by September 1969. The Project Report for the expanded plant envisaged an output of 1.234 million tonnes of finished steel. Even though a Pipe Plant had been installed by the time the Project Report for expansion was prepared, the

input and output of the Pipe Plant were not taken into account in arriving at the output of 1.234 million tonnes of finished steel. Taking into account the fact that with an input of 84,000 tonnes of hot rolled coils, 75,000 tonnes of pipes could be produced, the output of saleable steel was subsequently arrived at by the Management as 1.225 million tonnes.

The main units of the integrated steel plant, their rated capacities, main inputs and outputs as per Detailed Project Report (DPR) and as modified on installation of the Pipe Plant are given in Annexure-I.

The table below compares the product-mix of saleable steel envisaged in the Detailed Project Report after taking into account the output of Pipe Plant with that intimated by the Management in October 1979 :—

(In lakh tonnes)

Product	Quantity as per DPR	Quantity as intimated in October 1979	Remarks
(*i*) Plates . . .	2.80	2.80	
(*ii*) HR Sheets, plates and coils	2.00	1.58	
(*iii*) CR Sheets and strips .	2.60	3.12	
(*iv*) HD tin plates . .	0.50	..	Hot Dip Tinning lines not in operation since September 1976 (Refer para 2.07.06).
(*v*) Electrolytic Tin Plates .	1.50	1.50	
(*vi*) Galvanised sheets .	1.60	1.60	
(*vii*) Electrical Steel Sheets .	0.50	0.35	Capacity re-assessed by Consultants (MECON) as 0.35 lakh tonnes.
(*viii*) ERW Pipes . .	0.75	0.75	
(*ix*) S. W. Pipes . .	..	0.55	
	12.25	12.25	

The revised product-mix was put up to the Board of Directors of Steel Authority of India Limited who in their 67th meeting held on 4-7-1980 observed as under :—

> "The product-mix of saleable steel should be retained as per Detailed Project Report and the output of other fabricated products like pipes may be shown separately. The implications of such changes on the incentive schemes may also be examined. The Board also felt that the yield should not be changed, as had been proposed in the case of electrical sheets."

In addition, a Special Steel Plate Plant with a capacity of 1539 tonnes of fully machined plates, equivalent to 120 sets, was commissioned in 1969-70 at a cost of Rs. 6.41 crores. These are manufactured from ingots obtained from the Alloy Steels Plant, Durgapur. The capacity of Special Steel Plate Plant was further increased to 180 sets/year in November 1974 at a cost of Rs. 1.14 crores.

2. *Production Performance*

2.01 The actual production of steel ingots and saleable steel during 1970-71 to 1977-78 as compared with the rated capacity of the Plant and budgeted production is indicated below :—

(In lakh tonnes)

Year	Particulars	Rated capacity	Budgeted capacity	Actual production	Percentage of actual production	
					To rated capacity	To budgeted production
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970-71	Steel Ingots	18.00	15.00	10.38	57.7	69.2
	Saleable Steel	12.25	10.44	6.84	55.8	66.5
1971-72	Steel Ingots	18.00	14.00	8.23	45.7	58.8
	Saleable Steel	12.25	9.87	5.97	48.7	60.5

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1972-73	Steel Ingots	18.00	12.50	11.77	65.4	94.2
	Saleable Steel	12.25	8.89	7.65	62.4	86.1
1973-74	Steel Ingots	18.00	13.00	10.81	60.0	83.2
	Saleable Steel	12.25	8.75	7.36	60.1	84.1
1974-75	Steel Ingots	18.00	11.65	10.66	59.2	91.5
	Saleable Steel	12.25	8.35	8.12	66.3	97.2
1975-76	Steel Ingots	18.00	13.00	12.82	71.2	98.6
	Saleable Steel	12.25	9.00	10.41	84.9	115.7
1976-77	Steel Ingots	18.00	13.50	15.03	83.5	111.3
	Saleable Steel	12.25	10.50	11.74	95.8	111.8
1977-78	Steel Ingots	18.00	15.50	14.07	78.2	98.8
	Saleable Steel	12.25	11.70	11.78	96.2	100.7

The performance of the plant in the one million tonne stage had gradually improved from 70 per cent utilisation of capacity (1962-63) to 106.3 per cent (1965-66) in the case of ingots and from 58.9 per cent (1962-63) to 109.4 per cent (1965-66) in the case of saleable steel. After expansion to 1.8 million tonnes, however, the production of ingots and saleable steel was low upto 1974-75. During 1975-76 to 1977-78 there was some improvement ; capacity utilisation in respect of saleable steel in 1976-77 and 1977-78 being 95.8 per cent and 96.2 per cent respectively.

The shortfall in production during 1970-71 to 1977-78 was attributed by the Management mainly to labour problems, power restrictions, inadequate supply of coal both in terms of quality and quantity, disruption in the movement of essential raw materials due to work-stoppage by railway employees, roof collapse of steel melting shop (July 1971), want of balancing facilities, equipment troubles and technical breakdowns in coke ovens, blast furnace, soaker stripper cranes, Plate Mill and Hot Strip

Mill etc. Some of these factors like equipment troubles, technical breakdowns, etc. could be deemed to be controllable through better maintenance and planning.

The Ministry stated (June 1981) that "in order to improve the maintenance of plant and equipment and production, Management have been taking various measures such as systematising the capital/annual repairs and rebuilding of coke ovens, setting up of separate capital repairs organisation and maintaining Planning Department in addition to another organisation for investigation of maintenance problems and evaluation of maintenance performance".

The Plant Management analysed the loss of contribution margin during 1973-74 to 1977-78, as attributable to internal and external causes ; the extent of loss due to these causes aggregated to 3,88,582 tonnes of saleable steel and 11,977 tonnes of pig iron, valued at Rs. 28.09 crores. Details are given in Annexure-II.

2.02 *Unit-wise performance Coke Oven Batteries*

2.02.01 Three coke oven batteries with 70 ovens each were built under the one million tonne stage of the plant and were commissioned on different dates upto November 1962. A sub-battery (40 ovens) of another coke oven battery with 80 ovens was commissioned in December 1966 and the full battery was commissioned in February 1969. The total cost of installation of these batteries as on 31st March 1976 was Rs. 18.50 crores.

The total input capacity of the 4 coke oven batteries, according to the Project Report, is 23.80 lakh tonnes of coal (dry basis) per annum and these are expected to yield 17.36 lakh tonnes of coke of different sizes as indicated in Annexure-I.

To facilitate the repair programme of the existing batteries without affecting production, an additional half battery of 40 ovens

was installed at a cost of Rs. 5.01 crores as on 31st March 1976 (including foreign exchange element of Rs. 0.28 crore). This was commissioned in September 1974.

The rated capacity, budgeted production and actual production of coke during 1970-71 to 1977-78 are given in Annexure-III. It will be seen from data given therein that coke oven batteries did not attain the rated as well as budgeted production of coke in any of the years, except in 1972-73 in respect of budgeted production.

2.02.02 *Productivity and Efficiency Analysis of Coke Ovens*

(1) The following assumptions were made in the Project Report regarding the rated capacity (input of coal and output of coke) of Coke Ovens :—

(a) Coal charge per oven—15.55 tonnes.

(b) Coking time—16 hours.

(c) Input capacity—23.80 lakh tonnes of coal per annum.

(d) Yield of blast furnace and foundry grade coke—62 per cent of the input of coal (14.76 lakh tonnes) and yield of other grades of coke 10.9 per cent of input of coal (2.60 lakh tonnes).

(e) Yield of gas—325 NM^3 per tonne of dry coal charge.

On the above basis, the availability of ovens comes to 352 days in a year, thereby leaving 13 days for normal and capital maintenance.

The yield of blast furnace grade coke during 1970-71 to 1976-77 was more than the percentage envisaged in the project report but was less than the norm fixed by the Norms Committee in 1968. The yield of coke oven gas was less than the projected norm as well as the norm fixed by the Norms Committee (1968)

in all the years except 1976-77 when actual yield was equivalent to the 1968 Norm. The data are given in the table below :—

Year	Yield as envisaged in the Project Report		Norms fixed by the Norms Committee (1968)		Actuals	
	B.F. Coke as percentage of coal input	Gas (NM^3) per tonne of coal charge	B.F. Coke as percentage of coal charge	Gas (NM^3) per tonne of coal charge	B.F. Coke as percentage of coal charge	Gas (NM^3) per tonne of coal charge
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970-71	62	325	66	275	64.47	261
1971-72	62	325	66	275	64.37	257
1972-73	62	325	66	275	64.35	262
1973-74	62	325	66	275	63.85	256
1974-75	62	325	66	275	63.69	253
1975-76	62	325	66	275	63.69	271
1976-77	62	325	66	275	63.00	275
1977-78	62	325	66	275	61.57	265

The reasons for low yield of blast furnace coke and coke oven gas during 1970-71 to 1977-78 as compared with DPR/Norms Committee's norms were stated by the Management to be as follows :

(i) Non-availability of coal of specified blend.

(ii) Leakage of gas through doors of batteries, installed under the one million tonne stage, due to ageing.

(iii) Low temperature due to ageing of ovens and also due to thermal shocks suffered since 1964 because of strained industrial relations and other abnormal situations.

The effect of low yield of coke oven gas on the consuming units of the Steel Plant, including Fertilizer Plant, has been dealt with in appropriate paragraphs hereinafter.

(2) The coal charge per oven during 1970-71 to 1977-78 was more than the projected norm as indicated below :—

(Coal charge per oven in tonnes)

Year	As per Project Report	Actual
1970-71	15.55	17.18
1971-72	15.55	17.14
1972-73	15.55	17.17
1973-74	15.55	16.90
1974-75	15.55	16.80
1975-76	15.55	16.80
1976-77	15.55	16.80
1977-78	15.55	16.80

NOTE : Coal charge per oven has been determined on the basis of the average capacity of ovens supplemented, for control purposes, by actual weighment of about 10 to 15 per cent of coal charged in each shift on a random sample basis; hoppers were also marked to have a check on the quantity of coal charged.

It was stated by the Management (December 1976) that the charge rate of 15.55 tonnes was envisaged with bulk density of coal as 0.72 T/M^3 whereas the actual density of coal was around 0.78 T/M^3 during 1970-71 to 1975-76, 0.73 T/M^3 in 1976-77 and 0.74 T/M^3 in 1977-78.

It will be seen from the preceding paragraphs that there was shortfall in overall production of blast furnace coke notwithstanding the fact that the coal charge per oven and the percentage of yield of blast furnace coke was more than that envisaged in the Project Report. This was due to the following reasons :—

(a) Non-availability of ovens due to longer coking time, running major and capital repairs and re-building programmes.

(b) Shortfall in pushing the required number of ovens due to higher coking time and non-availability of right quality and quantity of coal (sub-paragraphs 7 to 9 refer).

(3) The number of hours for which the coke ovens actually worked during 1970-71 to 1977-78 were as follows :—

Year	Total oven hours as per Project Report	Oven hours actually worked	Shortfall in hours worked (2 — 3)
(1)	(2)	(3)	(4)
1970-71	24,48,875	24,07,500	41,375
1971-72	24,48,875	20,94,206	3,54,669
1972-73	24,48,875	22,00,251	2,48,624
1973-74	24,48,875	20,71,867	3,77,008
1974-75	24,48,875	22,40,716	2,08,159
1975-76	24,48,875	23,68,934	79,941
1976-77	24,48,875	24,28,190	20,685
1977-78	24,48,875	22,42,244	2,06,631

The figures in column 2 have been worked out on the basis of provisions in the D.P.R. for four batteries and do not take into account the additional half battery commissioned in September 1974 to facilitate repair programme without affecting production programme. It will, however, be seen that though there was an improvement in the number of hours worked in 1975-76 and 1976-77 over the data for 1974-75, the hours actually worked went down steeply in 1977-78.

The Ministry stated (June 1981) that the drop in oven hours worked in 1977-78 was due to one half battery being down throughout the year for re-building.

(4) *Impact of changes in operational parameters on production*

The variations from the Project Report parameters resulted in lower production of blast furnace coke. The shortfall in production attributable to variances in oven utilisation, oven pushing,

coal charge per oven and yield during 1970-71 to 1977-78 was as under :—

(In lakh tonnes)

Year	Oven utilisation	Pushing variance	Charge variance	Yield variance	Total	Remarks
1970-71	(—)0.25	(—)4.16	(+)1.09	(+)0.45	(—)2.87	(—) Adverse
1971-72	(—)2.14	(—)3.27	(+)0.95	(+)0.39	(—)4.07	(+) Favourable
1972-73	(—)1.50	(—)3.18	(+)1.05	(+)0.42	(—)3.21	
1973-74	(—)2.27	(—)2.99	(+)0.83	(+)0.30	(—)4.13	
1974-75	(—)1.26	(—)3.76	(+)0.78	(+)0.29	(—)3.95	
1975-76	(—)0.48	(—)3.21	(+)0.89	(+)0.32	(—)2.48	
1976-77	(—)0.12	(—)2.70	(+)0.96	(+)0.20	(—)1.66	
1977-78	(—)1.25	(—)2.49	(+)0.89	(—)0.09	(—)2.94	

(5) *Break-down of Coke Oven Batteries*

The Coke Oven Batteries in the 1 million tonne stage were commissioned between December 1958 and November 1962. Within 2 to 5 years of their operation, the batteries started giving serious troubles from time to time. By about the middle of 1964, the Management set up a Technical Committee (consisting of the Technical Adviser of the Company and an Ex-Adviser on Coke Ovens and By-products of TISCO) to investigate into the causes, to assess the extent of damage to the batteries and to suggest remedial measures for their rehabilitation and for preventing future damage. In its report (October 1964) the Committee, *inter alia*, pointed out serious neglect of good housekeeping and preventive maintenance, leading to extensive damage and deterioration in the condition of coke ovens. The Committee also pointed out lapses on the part of staff and the state of slack discipline in the Plant. Acting on the report, the Management repaired the damaged ovens over a period of 18 months at a cost of Rs. 25 lakhs.

In 1970, the condition of ovens again started deteriorating, and the number of sick ovens increased from 20 in October 1970 to 76 in October 1971. The daily oven pushing also declined to

240 which adversely affected production. In November 1971, the Company appointed another Technical Committee :—

(a) to examine the current repair programme and mode of repairs of the existing coke oven batteries and to suggest the steps for its speedier completion ; and

(b) to examine the necessisty of re-building of batteries and/or additional batteries and to suggest a broad programme of action to achieve the same.

The Committee in its report of November 1971, *inter alia*, stressed the need for uniformity of pushing rate and observance of proper operating and maintenance practices for ensuring prolonged life of coke oven batteries.

(6) *Maintenance of Coke Ovens*

In March 1971, the Management strated a crash programme for repair of damaged ovens with the help of the Refractory Department. A Coke Oven Repair Organisation was set up in March 1972 to look after coke oven repairs and re-building activities.

The number of coke ovens programmed for repairs and the number of ovens actually repaired during 1972-73 to 1977-78 are indicated below :—

(Figures in number of ovens)

Year	Repairs programmed		Repairs Actually completed	
	Ordinary	Capital	Ordinary	Capital
1972-73	35	33	36	33
1973-74	36	53	42	49
1974-75	21	35	21	35
1975-76	19	12	19	12
1976-77	240	38	230	38
1977-78	240	45	277	36

In this connection, the Ministry stated (June 1981) as follows :

> "During the years 1975 to 1978, considerable work has been done in this regard. All the ovens have undergone capital repairs in a systematic manner leading to marked improvement in their condition. Thorough and regular inspection is being carried out by an independent inspection organisation to effect systematic preventive maintenance.
>
> Considering battery conditions as per studies made by Expert Committee, a systematic long term plan of Coke Oven Batteries was also drawn out and as per this plan re-building of Batteries II(A) and I(A) has already been completed. Re-building of Battery II(B) is under progress. Thereafter, other Batteries will be re-built as per plan. These measures will help improve thermal regime and operation at lowest heat consumption."

(7) On the basis of hours for which the coke ovens actually worked and the projected coking time, the number of ovens which should have been pushed and the number of ovens actually pushed during 1970-71 to 1977-78 are given below :—

Year	Number of ovens that should have been pushed	Number of ovens actually pushed	Shortfall in number of ovens pushed
1970-71	1,50,469	1,07,318	43,151
1971-72	1,30,888	96,954	33,934
1972-73	1,37,516	1,04,525	32,991
1973-74	1,29,492	98,504	30,988
1974-75	1,40,045	1,01,009	39,036
1975-76	1,48,058	1,14,811	33,247
1976-77	1.51,762	1,23,782	27,980
1977-78	1,40,140	1,14,303	25,837

The largest single factor contributing to shortfall in the number of ovens pushed, was the longer coking time taken by the ovens. The table below indicates the actual average coking time (annual average) taken by different batteries as against the projected coking time of 16 hours and the number of ovens thus less pushed during 1970-71 to 1977-78 :—

(Figures in hours and minutes)

Year	Actual (average) coking time in each battery					Yearly average of all batteries	Number of ovens less pushed
	No. 1	No. 2	No. 3	No. 4	No. 5A		
1970-71	23—05	23—49	23—00	19—50	—	22—26	43,151
1971-72	22—05	22—49	21—17	20—14	—	21—36	33,934
1972-73	21—47	22—25	21—38	18—40	—	21—03	32,991
1973-74	23—27	22—06	22—23	18—51	—	21—02	30,988
1974-75	24—11	23—20	23—05	20—29	18—06	22—11	39,036
1975-76	21—52	21—25	22—12	21—14	16—20	20—38	33,247
1976-77	21—03	19—47	20—44	20—00	16—06	19—37	27,980
1977-78	21—08	18—57	20—58	21—00	16—06	19—37	25,837

It will be seen that average coking time showed a downward trend from 1975-76 onwards but it was still higher than the projected coking time.

The excess coking time affects the production of coke and gas apart from causing excess consumption of heat per tonne of coke produced.

The increase in coking time was attributed by the Management (April 1975/April 1981) to the following reasons :—

(a) Lack of adequate equipment *viz.* charging cars, guide and ram cars.

(b) Strained industrial relations from time to time leading to damage of ovens.

(c) Ageing of ovens.

(d) Reduced pushing due to shortage of coal.

(8) *Availability of Coal*

The Plant was not able to attain the designed performance and consistency in the pushing rate of ovens due to depletion of stock of coal for want of supplies from the washeries and coal mines. The supplies of coal were also erratic inasmuch as, on a number of days, one or the other constituent of coal blend was not received in the Plant against its daily requirement of 2,770 tonnes, 2,220 tonnes and 550 tonnes of prime, medium and high volatile coal respectively.

According to the Management, the coal blend and the average ash in the coal blend recommended (August 1969) by the Dutt Committee (see sub-paragraph 9 below) could not be adhered to for want of adequate quantities of coal of requisite quality. In a note submitted to the Board of Directors in February 1974, it was stated as follows :—

> "Inconsistency in the supplies of coal, both quantitatively and qualitatively, due to the poor performance of coal mines and the frequent dislocation of the coal movement due to the troubles in the Railways has adversely affected the life of the coke oven batteries in our Plant. Consequently, this has had the effect on the quality of coke and gas which in turn have affected the production performance of Blast Furnaces, Rolling Mills and the Fertilizer Plant."

(9) *Coal Blend*

The Project Report for 1.8 million tonnes expansion stage envisaged a blend of 25 per cent low volatile and low ash content of Jharia (unwashed) coal and 75 per cent high volatile (washed) coal from Kargali Washery. The Dutt Committee on 'Rational and Equitable Distribution of Coking Coal' had recommended (August 1969) a blend of 50 per cent prime coking coal, 40 per cent medium coking coal and 10 per cent high volatile (blendable) coal from August 1969 to December 1971, and ratio of

45 : 45 : 10 from early 1972. The Chari Committee, in its report of September 1975, however, had recommended a blend ratio of 50 : 40 : 10 from 1976-77.

The actual average blend of coal used during 1970-71 to 1977-78 was as follows :—

(Figures in percentage)

Year	Medium volatile coal (washed)	Medium volatile coal (un-washed)	Total medium coal (washed & (un-washed)	High volatile coal (un-washed)	Average volatile in coal blend	ash and contents
					Ash	Volatile
1970-71	78.7	15.3	94	6	17.00	24.51
1971-72	90.2	0.8	91	9	17.36	24.68
1972-73	90.0	..	90	10	17.78	25.08
1973-74	88.3	2.7	91	9	18.23	25.40
1974-75	90.2	0.8	91	9	18.68	24.88
1975-76	89.3	0.7	90	10	19.11	24.66
1976-77	87.8	1.2	89	11	18.91	24.05
1977-78	85.5	4.1	90	10	19.05	25.10

Except during 1970-71, the average ash content was more than the norm of 17 per cent (average). The volatile content ranged from 24.05 per cent to 25.40 per cent against the project provision of 26 per cent and Norms Committee's recommendation of 25.25 per cent. The Management stated (November 1977) that the requirement of ash content and volatile matter as per various reports could not be adhered to due to non-availability of suitable coal.

(10) *Properties of Blast Furnace Coke*

According to the Project Report, the Blast Furnace Coke should have a fixed carbon of 75 per cent, and ash content of 24 per cent, based on coal feed of 17 per cent ash content (average). The Norms Committee (1968-69) had adopted the ash content in coke as 23.5 per cent (average). The analysis of coke produced by the Plant showed the following average

contents and hardness indices during the eight years ending 31st March 1978 :—

Year	Moisture	Ash	Volatile matter	Fixed carbon	Micum Drum Test	
					Above 40 mm	Below 10 mm
As per Detailed Project Report	..	24	1.30	75.00	..	..
As per Norms Committee Report	..	23.5	..	..	82.00	8.00
Actual						
1970-71	5.85	24.46	0.64	74.90	82.70	9.40
1971-72	6.33	24.38	0.74	74.88	83.40	9.20
1972-73	5.82	24.80	0.65	74.55	83.20	9.30
1973-74	5.69	25.21	0.71	74.08	81.75	10.75
1974-75	5.48	25.87	0.72	73.41	83.00	10.47
1975-76	6.05	27.16	0.67	72.17	84.07	10.29
1976-77	6.35	27.39	0.60	72.01	84.09	9.84
1977-78	5.14	27.08	0.72	72.20	83.68	10.13

The Management stated (October 1979) as follows :—

"The high ash content in B.F. Coke has affected the B.F. productivity as well as iron produced from it. Also due to wide variation in ash content of coal/coke, operation of B.F. is getting adversely affected. As the parameters of coal have undergone complete change over the period, it is not possible to achieve Detailed Project Report figures for Blast Furnaces."

2.02.03 *Utilisation of Tipplers*

Two rotary type wagon tipplers with a capacity of unloading 200 wagons of coal per tippler per day, were imported at a cost of about Rs. 28.02 lakhs (excluding freight, insurance and erection charges) and were installed in February 1966. As provided in the Detailed Project Report, the daily requirement of 7,200 tonnes of coal was expected to be received in 130 Box Wagons or 325 four wheeler open wagons. Although these could be unloaded by one tippler in two shifts, installation of two tipplers was recommended in order to maintain continuity of mechanised operations

in the event of break-down of one of the tipplers and also to unload bunched-up coal rakes.

During the period from February 1966 to March 1972, these tipplers were utilised for unloading 1,12,843 wagons (*i.e.* about 50 wagons per day) only and 1,12,267 wagons were unloaded manually involving an expenditure of **Rs. 11.66 lakhs.**

The Management attributed (May 1971) poor performance of the tipplers to lack of trained personnel in the initial stage, operational difficulties, poor availability of dozers, unsuitability of original track layout and receipt of K.C. Type and C.V. Type wagons not suitable for unloading by tipplers. They further stated that manual unloading became necessary during monsoon when sudden coal slides caused accumulation of moisture. To overcome this, a by-pass conveyor belt system was installed in March 1974 at a cost of Rs. 10.50 lakhs.

In regard to supply of wagons, the Ministry had intimated (February 1975) to Audit that though the Research and Standard Organisation of the Ministry of Railways was consulted about the type of wagons expected to be supplied for carrying coal at the time of designing the tipplers, in actual practice the supply of good wagons had been erratic. Further, one other factor which had been militating against full use of tipplers was the receipt of coal in closed wagons in the earlier years.

The number of coal wagons received, number of wagons unloaded by tipplers as well as manually, and the average number of wagons handled per day during 1973-74 to 1977-78 were as follows :—

Year	No. of coal wagons received			No. of wagons unloaded		Average No. of wagons handled per day	
	Box type	Other type	Total	By tipplers (Box type only)	Manually (Box and other type)	By tipplers	Manually
1973-74	31124	2728	33852	21925	11927	60	33
1974-75	32513	5317	37830	24279	13551	67	37
1975-76	39191	1748	40939	28226	12713	77	35
1976-77	37663	332	37995	25070	12925	69	35
1977-78	36854	1340	38194	25113	13081	69	36

While there was some improvement in tippling the box type wagons received, the average number of wagons handled by the tipplers was generally low. The highest number of box type wagons received in July 1975 was 3,650. The average number of box wagons received per day worked out to 118 against which the average number unloaded with tipplers came to 78 during July 1975.

The Management stated (December 1977) as under :—

> "In order to enable blending, therefore, it is necessary to unload part of the coal directly into slot bunkers. From Plant's experience it is observed that this proportion is roughly 1/3rd of total coal received. The Management, therefore, feels that 65 to 70 per cent of wagons being unloaded in the tipplers is optimum."

2.03 *Blast Furnaces*

2.03.01 The Steel Plant has four blast furnaces out of which three were commissioned under the one million tonne stage and the fourth was commissioned under the 1.8 million tonne stage.

The Detailed Project Report of the 1.8 million tonne stage envisaged that with improved operational techniques like self fluxing sinter, beneficiation of ore, higher blast temperature etc., the production from the existing three furnaces would increase from 1,000 tonnes to 1,200 tonnes per day per furnace. The Project Report also indicated that the fourth blast furnace would be able to produce 1,800 tonnes of hot metal per day with the use of self fluxing sinter and with the help of beneficiated ore and under favourable conditions, against its rated capacity of 1,500 tonnes per day. Thus, the four furnaces would have a capacity of producing 5,400 tonnes per day or 18.36 lakh tonnes of hot metal per year on the basis of 340 working days. However, the total rated production of all the four blast furnaces was estimated in the Project Report at 16 lakh tonnes (15.25 lakh basic grade and 0.75 lakh foundry grade) of hot metal on the basis of the rated production of 4,700 tonnes per day.

The Management stated (December 1977) that the capacity of 5,400 tonnes per day was not achievable as the conditions like total alumina and silica percentages and ash content in blast furnace coke were much higher than the provision in the Project Report. Further, the alumina and silica percentages were fluctuating. The table below indicates the actual production of hot metal vis-a-vis the budgeted production during 1970-71 to 1977-78 :—

(In lakhs of tonnes)

Year	Budgeted production			Actual production			Total
	Basic grade	Foundry grade	Total	Basic grade	Foundry grade	Off grade	
1970-71 .	14.67	0.57	15.24	10.33	1.00	0.13	11.46
1971-72 . .	13.47	0.57	14.04	8.07	1.46	0.17	9.70
1972-73 .	12.38	0.12	12.50	11.60	0.62	0.19	12.41
1973-74 .	13.39	0.11	13.50	10.90	0.47	0.22	11.59
1974-75 .	12.79	..	12.79	10.88	0.48	0.67	12.03
1975-76 .	13.50	..	13.50	12.55	0.55	0.72	13.82
1976-77 .	14.20	..	14.20	*	*	*	14.62
1977-78 .	14.20	..	14.20	*	*	*	13.25

*According to Management (April 1981) since most of the hot metal in liquid or solid state is being used in Steel Melting Shop, break up of the basic grade, foundry grade and off grade is no more maintained.

It will be seen that the Plant could not achieve the budgeted production except during 1975-76 and 1976-77, which was lower than the rated capacity. The shortfall during 1970-71 to 1974-75 was attributed by the Management to :—

— Frequent break-downs of furnaces and labour troubles (1970-71).

— Roof collapse in Steel Melting Shop leading to blanking of furnaces (1971-72).

— Extended shut-down due to re-lining of blast furnace no. 4 and shortage of coal (1972-73).

— Railway strikes and consequential disturbance in the movement of raw materials (1973-74).

— Railway strike and major break-downs (1974-75).

A major break-down resulting in premature collapse of the refractory checker including supports in the stove of Blast Furnace No. 3 occurred in July 1971. In August 1971, the Management informed the Ministry of Steel and Mines that the break-down was of a serious nature and was due to design deficiency rather than any operational failure. Further, the suppliers of these furnaces had been contacted for drawings and also for sending their experts for discussions regarding permanent modifications to be made. The Board of Directors approved, in May 1972, the renovation of stoves of all the three blast furnaces built at the 1 million tonne stage at a total estimated cost of Rs. 6 crores (with foreign exchange component of Rs. 1.8 crores), to be completed in a period of three years. Renovation of seven stoves was completed by December 1978 at a cost of Rs. 4.87 crores. Renovation of remaining two was also taken up, out of which one has been completed in March 1980.

Although the Management had informed the Ministry in August 1971 that the break-down was due to design deficiency, in December 1976 it was stated that, as the million tonne stoves had already been used for about 90 per cent of their life by the time the break-down occurred, these could not be said to have any design deficiency and hence the matter was not taken up with the suppliers.

2.03.02 The Detailed Project Report provided that the occasional off-grade iron coming out from the Blast Furnace would be sent to the Pig Casting Machine (P.C.M.) as it could not be sent to Steel Melting Shop (SMS). But, in actual practice, off-grade hot metal is processed in the Steel Melting Shop alongwith other hot metal and its processing in Steel Melting Shop involves additional cost to avoid total rejection of steel ingots produced therefrom. Increase in the production of off-grade hot metal also adversely affects the life of hot metal ladles (see paragraph 2.03.08).

The Norms Committee appointed by the Company in March 1968 had recommended that hot metal containing more than 0.05 per cent of sulphur may be reported as off-grade. It will

be seen from details given in para 2.03.01 that production of off-grade metal ranged from 0.13 lakh tonnes in 1970-71 to 0.72 lakh tonnes in 1975-76.

In this connection, the Management stated (December 1976) as follows :—

> "It is a fact that fluctuation in the quality of raw-material affects the production of hot metal. Coal which is a major raw material is supplied by outside sources. Qualitative deterioration from year to year has adversely affected the production of hot metal. Even in case of other raw materials obtained from captive mines, there can only be limited scope in quality control as materials are recovered from natural resources However, efforts are being made to improve raw material qualities so that day to day fluctuations are reduced. Qualitative and quantitative improvement in sinter production are expected to improve the situation further. Constant watch is kept on hot metal quality. The use of hot metal which is detrimental to steel making process and equipment is avoided as far as possible".

2.03.03 *Furnace Availability*

According to the Project Report, blast furnaces are expected to work on an average for 340 days in a year on three shift basis, the remaining time being accounted for by relining and downtime from other causes. It will, however, be seen from the details given in Annexure IV that the blast furnaces were operated for less number of hours than envisaged in the Project Report.

The Management attributed (March 1977) the following reasons for the low availability of the furnaces :—

"(i) Steel Melting Shop off-take ;

(ii) Break-downs and scheduled shut downs ;

(iii) Quality and supply of raw materials including coke."

2.03.04 *Efficiency and Productivity Analysis of Blast Furnaces*

(a) *Input-output ratio.*—Annexure V incorporates the data relating to actual consumption of important raw materials per tonne of hot metal produced *vis-a-vis* the norms indicated in the Project Report and those fixed by the Norms Committee etc. It will be seen that, in terms of Fe content, actual consumption of iron ore, sinter, etc. taken together per tonne of hot metal was more than that envisaged in the Detailed Project Report as well as by the Norms Committee in all the years. The quantity of sinter used was, however, very low upto 1974-75 owing to non-availability of sinter and increased thereafter.

The consumption of limestone and coke was more than the projected norm (except in 1972-73 as regards coke) and also varied widely from year to year.

The Management stated (October 1979) as follows :—

> "The quality of raw materials in all categories has changed considerably. The gangue material content in the raw materials have increased, ash in coke has gone up and insoluble content in limestone has gone up. This has necessitated the use of higher quantum of flux and coke. This has direct effect on increase in slag volume. Detailed Project Report has assumed only 7.6 per cent of insoluble content in limestone (B.F. grade) as against this insoluble content has gone up to 12-13 per cent. Similarly ash in coke has gone up and the yearly average was between 27 per cent to 28 per cent against the 24 per cent envisaged in Detailed Project Report. Wide fluctuations in the quality of raw materials on day to day basis affect the smooth operation of furnaces. Due to the factors mentioned above, it is not possible to adhere to the parameters indicated in the Detailed Project Report."

It will further be seen from Annexure V that the arising of slag was more than the project norm as well as the norm fixed by the Norms Committee, except during 1974-75 and 1975-76 when it was less than the norm fixed by the Committee. The slag arisings in each furnace are given below :—

(Figures in Kgs.)

Year	Arising of Slag per tonne of hot metal				
	Blast Furnace I	Blast Furnace II	Blast Furnace III	Blast Furnace IV	Average
1970-71 . .	685	741	742	778	749
1971-72 . .	763	800	751	791	777
1972-73 . .	729	732	748	755	741
1973-74 . .	783	787	828	765	787
1974-75 . .	671	681	696	692	686
1975-76 . .	635	610	689	690	659
1976-77 . .	710	643	716	752	709
1977-78 . .	731	696	703	785	735

The Management stated (February 1974 and July 1977) that higher arising of slag was due to high alumina content in raw materials and ash in coke. It was further stated that higher slag arising in furnace No. 4 was due to the use of higher percentage of sinter as compared to other furnaces.

(b) *Quality of Hot Metal*

Annexure VI indicates the various constituent ingredients of hot metal as envisaged in the Project Report and as actually found during 1970-71 to 1977-78. It is observed therefrom that the percentages of silicon, phosphorous and carbon were more than those envisaged in the Project Report for 1.8 million tonne stage while the Fe content was less than the Project Report stipulation.

2.03.05 The quality of hot metal depends on the quality of raw materials used. An analysis of data in Annexure VII containing the important components of major raw materials used

for the production of hot metal during 1970-71 to 1977-78 *vis-a-vis* the provisions in the Project Report, indicates, the following :—

(a) Ash content in coke was more than that envisaged in the Project Report and the Norms Committee Report.

(b) Lime content in limestone and iron content in sinter was less than the Project Report indication. Silica content in sinter was more than the Project Report norm.

(c) The iron content in iron ore (Bursua captive mines) was less than the project provisions during 1970-71. 1972-73 and 1973-74.

2.03.06 *Productivity of Blast Furnaces*

It will be noticed from the data given below that actual productivity of furnaces was appreciably below the projected norm :—

	Three small furnaces	One big furnace
(*i*) Working Volume per furnace (in Cu.m.).	995	1,448
(*ii*) Projected production per day (tonnes)	1,000*	1,500*
(*iii*) Projected productivity per Cu.m. per day for each furnace (tonnes)	1.01	1.04
(*iv*) Actual productivity per Cu.m. per day for each furnace (tonnes)		
1970-71	0.86	0.84
1971-72	0.81	0.83
1972-73	0.86	0.80
1973-74	0.73	0.89
1974-75	0.78	0.83
1975-76	0.84	0.89
1976-77	0.91	0.88
1977-78	0.82	0.81

NOTE : *If higher production of 1,200 tonnes and 1,800 tonnes respectively as envisaged in the Project Report for 1.8 million tonne stage is taken into account, the productivity per Cu.m. per day works out to 1.2 tonnes both for smaller and bigger furnaces.

2.03.07 *Impact of changes in Operational parameters on Production*

The variation from the Project Report parameters resulted in lower production of hot metal. The shortfall in production attributable to the variances in furnace utilisation and productivity during 1970-71 to 1977-78 was as under :—

(In lakh tonnes)

Year (1)	Utilisation variance (2)	Productivity variance (3)	Total (4)
1970-71	(—)4.02	(—)0.52	(—)4.54
1971-72	(—)5.55	(—)0.75	(—)6.30
1972-73	(—)2.64	(—)0.95	(—)3.59
1973-74	(—)2.82	(—)1.59	(—)4.41
1974-75	(—)1.58	(—)2.39	(—)3.97
1975-76	(—)0.51	(—)1.67	(—)2.18
1976-77	(—)0.10	(—)1.28	(—)1.38
1977-78	(—)0.90	(—)1.85	(—)2.75

The Ministry stated (October 1978) as follows :—

> "The productivity variance is also mainly because of higher ash content in BF Coke than envisaged in the Project Report, leading to higher slag volume and hence lower production of hot metal. Besides, the adverse quality of various raw materials.....also has an adverse effect on productivity".

2.03.08 *Low Lining life of hot metal ladles*

No norms for average life of ladle lining have been fixed. The following data containing the average tonnage of hot metal handled by a hot metal ladle before it was taken out of circulation for re-lining would indicate that the average life of ladle

lining has decreased steadily from 1970-71 to 1977-78 (except in 1975-76) :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Average tonnage handled (in tonnes)	12,519	12,104	7,509	6,472	6,252	7,022	4,832	4,065

Based on the cost of bricks and labour prevailing in March 1975, the cost of re-lining was estimated by the Management at Rs. 15,000 (approx.) per hot metal ladle.

According to Management, the ladle life depended upon various factors, *viz.*, quality of bricks, quality of re-lining work, quickness of moving the ladle from one place to another, preparation of ladle, chemical analysis and temperature of metal and the care with which ladles were handled, etc.

2.04 *Pig Casting Machine*

One pig casting machine with an input capacity of 100 tonnes of hot metal per hour was installed at a cost of Rs. 68.55 lakhs under the one million tonne stage and was commissioned in January 1959 to convert the foundry grade hot metal (75,000 tonnes) into pig iron. On this basis, the production capacity works out to 1,600 tonnes per day even on the basis of two shift working. Another pig casting machine with an input capacity of 1,600 tonnes per day was installed in July 1963 at a cost of Rs. 44.08 lakhs to handle surplus hot metal during the period when the Steel Melting Shop was not in a position to take it.

Annexure VIII indicates the quantity of hot metal handled by the Pig Casting Machines during 1970-71 to 1977-78 and the utilisation/disposal of pig iron produced. Although, according to the Project Report, entire quantity of pig iron is meant for consumption in the Plant's foundry, it will be seen from details given in the Annexure that only a small quantity was used in its own foundry and the rest was sold to outside parties.

The Management stated (November 1977) that the Plant's Blast Furnaces produce only high manganese pig iron and as low manganese pedigree pig iron was used in the foundry with a view to reducing the high consumption of ingot moulds and bottom plates, the same was purchased from sister plants.

The Management further stated (April 1981) that the cold pig from the Pig Casting Machines was used in Steel Melting Shop to augment production of ingot steel and saleable steel. The consumption of cold pig in Steel Melting Shop gradually increased after 1975-76.

2.05 *Sintering Plant*

2.05.01 The Project Report for 1.8 million tonne stage envisaged the use of sinter (having basicity of 1.02 on the basis of the formula :

$$\left.\frac{CaO+MgO}{SiO_2+Al_2O_3}\right\}$$

in the three small blast furnaces to the extent of 53 per cent of total input excluding coke. The consumption of coke was indicated as 900 Kgs. per tonne of hot metal. The Norms Committee indicated (1968) the consumption of sinter, with basicity of 1.90, to the extent of 25 per cent of burden, the formula for basicity being $\frac{CaO+MgO}{SiO_2}$

Iron ore fines are obtained by the Plant from its captive mines at Barsua. In order to convert the ore fines into sinter, a Sintering Plant was installed in February 1965 at a cost of Rs. 5.61 crores.

2.05.02 According to the Project Report for 1.8 million tonne stage, the Sintering Plant is rated to produce 4,000 tonnes of sinter in 16 hours on the basis of 2 shift operation but it was expected to produce an average of 5,000 tonnes a day on the basis of 3 shift operation. On the basis of 2 shifts working for 300 working days, the installed capacity of the Sintering

Plant thus works out to 1.2 million tonnes per annum. It will be seen from the table below that actual production of sinter during 1970-71 to 1977-78 was less than the rated capacity as well as budgeted production (except during 1975-76 and 1976-77 in regard to budgeted production) :—

Year	Budgeted production		Actual production	
	Quantity (in lakh tonnes)	Basicity	Quantity (in lakh tonnes)	Basicity as per formula recommended by the Norms Committee
1970-71	12.00	N.A.	5.49	2.78
1971-72	9.00	N.A.	3.96	2.48
1972-73	8.40	N.A.	6.81	2.77
1973-74	9.20	2.80	5.94	2.73
1974-75	7.20	N.A.	6.34	2.82
1975-76	9.00	2.75	9.40	2.79
1976-77	10.50	2.70	11.47	2.60
1977-78	12.00	2.70	10.51	2.54

N.A.—Not available.

Low production of sinter in the Sintering Plant was attributed (April 1981) by the Management to the following reasons:—

(a) Sinter production was regulated to match the consumption in blast furnaces, since production of blast furnaces was affected due to Steel Melting Shop roof collapse and flame leakage due to crack between roof and burner block of the furnace of Sintering Plant (1971-72).

(b) Conveyor belt break-downs, low Blast Furnace gas pressure and occasional raw material shortage (1972-73).

(c) Although Sintering Plant is designed to produce Sinter of unit basicity, experiments were conducted for using sinter with more than unit basicity—as

use of sinter of unit basicity resulted in difficulty in working of Blast Furnace (1973-74 to 1975-76).

(d) Less availability of limestone crushers and break-downs at sinter machine, conveyor hot and cold screen (1976-77 and 1977-78).

The Management further stated that production of sinter of higher basicity was aimed at by using higher input of limestone fines. Low availability of limestone crushers became a bottleneck for higher sinter production due to hammer-head and higher lump size problems.

2.05.03 About 22 lakh tonnes of iron ore fines had accumulated upto March 1978 at the Barsua Mines. The Management stated (December 1977) that this was partly due to the fact that the mining had commenced much before the starting of the Sintering Plant and the fine to lump ratio was more adverse than anticipated and partly due to poor working of the Sintering Plant.

2.05.04 It will be noticed from the details given in Annexure V that, while consumption of sinter in the blast furnaces was much lower than the project norm during 1970-71 to 1977-78, consumption of coke was more than the project norm in 1970-71 to 1971-72 and 1973-74 to 1977-78. Although the Ministry had informed the Committee on Public Undertakings in October 1972 that the consumption of coke would be gradually reduced with higher usage of sinter, actual consumption of coke per tonne of hot metal increased during 1973-74, 1975-76 and 1977-78 even though the consumption of sinter of higher basicity was also more in these years

As mentioned in paragraph 2.03.04, lower consumption of sinter up to 1974-75 was owing to its non-availability. The higher consumption of coke was attributed by the Management to deterioration in the quality of coal and increase in the ash content in coke.

In this connection, the Ministry stated (October 1978) as follows :—

> ".....an increase of 1 per cent in the ash content in coke would result in an increase in consumption of about 40 Kgs. of coke per tonne of hot metal and the loss of production of hot metal to the extent of 4 per cent."

2.06 *Steel Melting Shop*

2.06.01 *Rated Capacity*

The Steel Melting Shop has four Open hearth (O.H.) furnaces and five L.D. converters. According to the Project Report for the 1.8 million tonne stage, four O.H. furnaces have a production capacity of 3 lakh tonnes and five L.D. converters (out of which three are expected to be in continuous operation) of 15 lakh tonnes of steel ingots per annum. The flow chart forming part of the Project Report for 1.8 million tonne stage, however, indicated that 2.58 lakh tonnes of steel ingots would be produced by open hearth furnaces and 15.96 lakh tonnes by L.D. converters which, after taking into account the processing loss of 18,000 tonnes and pit side scrap of 36,000 tonnes, would yield 18 lakh tonnes of net rollable steel ingots (2.5 lakh tonnes from O.H. furnaces and 15.5 lakh tonnes from L.D. converters).

2.06.02 *Production*

The table below indicates the rated capacity, the budgeted production and the actual production of rollable steel ingots during 1970-71 to 1977-78 :—

(Figures in lakh tonnes)

Year	Budgeted production			Actual production		
	O.H.	L.D.	Total	O.H.	L.D.	Total
[*Rated capacity*—18 lakh tonnes (2.5 lakh tonnes from O.H. furnaces and 15.5 lakh tonnes from L.D. converters)]						
1970-71	2.50	12.50	15.00	1.97	8.41	10.38
1971-72	2.50	11.50	14.00	2.04	6.19	8.23
1972-73	2.28	10.22	12.50	2.24	9.53	11.77
1973-74	2.50	10.50	13.00	1.87	8.94	10.81
1974-75	2.13	9.52	11.65	1.87	8.79	10.66
1975-76	2.50	10.50	13.00	2.38	10.44	12.82
1976-77	2.50	11.00	13.50	3.01	12.02	15.03
1977-78	3.00	12.50	15.50	3.09	11.00	14.09

It will be seen that the shortfall in the total production of steel ingots was more attributable to the L.D. converters than to the O.H. furnaces.

Apart from the main reasons for shortfall in production as mentioned in paragraph 2.01, longer duration of heat as well as lower availability of converters also contributed to the non-attainment of rated production.

The production of steel ingots, also included off-grade production and rejections as per details given in Annexure IX.

2.06.03 *Productivity and Efficiency Analysis*

(1) *Furnace availability*

On the basis of 300 working days, the four open hearth furnaces are expected to work for 28,800 hours per annum with a provision of 6,240 hours for repairs etc. Similarly, the Project Report envisaged that 3 out of 5 L.D. converters would work at a time for 312 days in a year *i.e.* 22,464 hours in a year.

The actual number of hours for which O.H. furnaces/L.D. converters worked during 1970-71 to 1977-78 were less as will be seen from the data given in Annexure X.

The extra time on repairs etc. was spent partly due to the fact that the lining life differed widely from furnace to furnace and converter to converter and also in respect of each furnace/converter. Neither the Project Report prescribed any norm for lining life, nor did the Norms Committee, appointed by the Company in 1968, give any indication in this regard. The actual lining life for each furnace/converter during 1970-71 to 1977-78 is given in Annexure XI.

The Management had stated (March 1974) that the lining life was dependent on the quality of different raw materials used and day-to-day operating conditions prevailing in the Shop. The Management further stated (May 1977) as under :—

> "We have been making various attempts to improve the converter life, discussing with various agencies and

one such agency set to action was the National Metallurgical Laboratory. M/s. National Metallurgical Laboratory executed the first phase of study and submitted their findings. We found the pattern of their studies to be more or less on the lines with which we were not unfamiliar. The deficiencies pointed out by them were generally known to us and the process of rectification was already being implemented. ..... we ourselves entered into a new realm of experiments, one of which was the addition of calcined dolomite, in addition to lime, as flux. On the eve of more effective consideration of implementing our own solution to the problem, the 2nd and 3rd phase of studies were discontinued. Subsequently, we have also brought about facilities for the production of more calcined dolomite in place of lime.

Incidentally, another reason for not encouraging the 2nd and 3rd phase of studies was the emergence of our own R. & D. Department at Ranchi who have taken up the study of lining life of converters.

We have also improved considerably the quality of lime and dolomite and the life of converter has improved at least so far as to ensure the requisite availability of converters which was crippling us earlier."

It was also noticed that the lining life of steel ladles had varied widely as indicated below; no norms have been laid down in this regard also :—

Year	O.H. Ladles (Heats)	L.D. Ladles	
		M.T.P. (Blows)	Expansion (Blows)
1970-71	12.8	16.7	16.8
1971-72	12.0	14.6	15.5
1972-73	11.7	15.9	15.1
1973-74	12.2	20.0	19.2
1974-75	12.2	16.2	14.8
1975-76	13.6	17.7	16.6
1976-77	16.8	21.0	20.0
1977-78	19.6	24.8	23.0

The Ministry stated (October 1978) that the lining life also depended upon the hot metal quality which was not upto the mark due to high ash in coke etc.

(2) *Tap to tap time*

The tap to tap time of open hearth furnaces and L.D. Converters during 1970-71 to 1977-78 and the norms as per the Project Report are campared in Annexure XII. It will be seen that as against the projected norm of 8 hours, the actual average tap to tap time in respect of O.H. furnaces ranged from 8 hours 40 minutes to 12 hours 4 minutes. As regards L.D. Converters, the actual average tap to tap time fluctuated from 54 minutes to 1 hour 1 minute as against the projected norm of 45 minutes.

The Management attributed the following reasons for longer tap to tap time :—

(i) Variations in the quality of raw materials and availability of equipment on day-to-day basis.

(ii) Low mixer balance in Steel Melting Shop due to problems in Blast Furnaces leading to increase in the waiting time for starting blows.

(iii) Low calorific value and low availability of gas resulting in longer heat working time on O.H. furnaces.

(iv) Problems in Rolling Mills.

(3) *Productivity*

As against the productivity of 80 tonnes per heat provided in the Detailed Project Report in the case of Open Hearth Furnaces and between 50 tonnes and 60 tonnes per heat in the

case of L.D. Converters, the actual average productivity during the years 1970-71 to 1977-78 was as follows :—

(Figures in tonnes)

Year	O.H. Furnaces —Average productivity per heat	L.D. Converters	
		Average productivity per blow (smaller)	Average productivity per blow (bigger)
1970-71	77.8	47.2	55.8
1971-72	78.2	46.4	56.2
1972-73	80.7	47.5	57.6
1973-74	79.9	47.4	57.3
1974-75	80.3	47.8	58.8
1975-76	83.5	48.1	58.5
1976-77	88.6	49.1	59.7
1977-78	88.4	49.2	59.7

The Management attributed (February 1977) the following reasons for lower productivity per heat/blow :—

> "The rated capacity in the LD/OH is fixed based upon certain operating conditions and availability of raw materials of specific qualities, which have never been fulfilled. Also restrictions are imposed during initial life of converters/furnaces to tap heat to rated capacity due to lower volume of converter/furnace. Again, when two expansion converters are running simultaneously, it becomes imperative to undercharge one converter due to equipment restriction."

(4) *Impact of changes in Operational Parameters on Production*

The variations from the Project Report parameters resulted in lower production of steel ingots. The shortfall in production attributable to the variances in furnace/converter utilisation and productivity during 1970-71 to 1977-78 aggregated 50.24 lakh tonnes (utilisation variance—31.62 lakh tonnes and productivity variance—18.62 lakh tonnes) as per details in Annexure XIII.

2.06.04 *Transit Loss of Hot Metal*

As per the material flow chart in the Project Report, mixer loss is estimated at 8,000 tonnes which works out to 0.5 per cent of the total production of hot metal.

Actual loss of hot metal in transit (as per details given in Annexure XIV) was, however, more than the Project norm, involving an extra loss of Rs. 223.39 lakhs.

The Management stated (April 1981) that, apart from mixer loss provided in the Detailed Project Report, there are also other transit losses consisting of spillage, ladle skull and slag coming with the hot metal which have not been provided in the Detailed Project Report. Further, based on the norm of 2 per cent as ladle skull loss fixed by the Norms Committee (1978), the total transit and mixer loss could be taken as 2.5 per cent. On this basis, the extra loss worked out to Rs. 66.49 lakhs.

2.06.05 *Metallic Yield*

According to the Detailed Project Report, the ratio of metallic output to input was as follows :—

(In lakh tonnes)

	Metallic input	Output in terms of rollable ingot steel	Percentage of steel 3 to 2
1	2	3	4
L.D. Converters	17.57	15.50	88.20
Open Hearth Furnaces . . .	2.74	2.50	91.17

The actual ratio was, however, much less than the above norm as per details given below :—

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
L.D. Converters	81.75	80.82	80.54	80.48	81.70	80.81	81.67	81.91
Open Hearth Furnaces	83.29	83.73	84.36	83.87	85.82	87.41	87.55	87.46

The actual ratio indicated above was also lower than the norm fixed by the Norms Committee in 1968-69 which was 85.40 per cent for L.D. Converters and 87.56 per cent for Open Hearth Furnaces. After taking into account the metallic content of excess arising of scrap recovered as compared with the Detailed Project Report norm, the lower yield in terms of short recovery of steel worked out to 3.25 lakh tonnes valued at Rs. 35.71 crores during 1970-71 to 1977-78.

As the Norms Committee had not laid down norms for rejection and scrap, the net short recovery of metal could not be worked out with reference to the ratio recommended by the Norms Committee.

The Management stated (February 1978) that the norms for Steel Melting Shop were tentative and subject to change due to changes in the different parameters of the Detailed Project Report.

The Ministry attributed (June 1981) the following reasons for lower gross metallic yield as well as lower net metallic yield as compared to Detailed Project Report norm :—

(i) Reasons for lower gross metallic yield compared to Detailed Project Report :

(a) Use of scrap and hot metal in the LD and Open Hearth Furnace is not identical to the ratio given in the Detailed Project Report/ Norms Committee Report. The use of scrap in LD is around 12 per cent as against 19 per cent envisaged in the Detailed Project Report. Hence, the actual metallic yield cannot be the same as envisaged in the D.P.R./Norms Committee Report. In Open Hearth Furnaces, the scrap consumption is around 60 per cent as envisaged in the Detailed Project Report. The metallic yield, therefore, in Open Hearth Furnace is quite close to metallic yield envisaged in the D.P.R./Norms Committee Report.

(b) Gross metallic yield for liquid steel is very close to D.P.R. while for solid steel it is lower due to process losses during the conversion into solid rollable ingot steel and is reflected accordingly in the gross metallic yield figures.

(c) Metallic yield also depends on rigid hot metal quality which in turn is conditioned by the quality of inputs like ash content in coal, alumina/silicon ratio in iron ore etc. Rourkela Steel Plant being primarily a LD based plant, the effect of hot metal quality as well as scrap hot metal ratio is more pronounced.

(ii) Reasons for lower net metallic yield.

(a) In a Plant manufacturing flat products, different sizes of ingot moulds are used. Heat weights in most of the cases are not in multiples of ingot weights. Also, the size of ingots is very large as a result, difference between gross and melt yield would be higher.

(b) Heat weights also vary during the campaign life of L.D. linings and cannot be always kept as a multiple of ingot weight all through the campaign life.

(c) There is also lack of weighing facilities to know the actual weight of various inputs to calculate the heat weight. Those facilities are being provided now.

(d) Average heat weight being 50—60 tonnes for LD and 80 tonnes for OH, process losses get multiplied as compared to higher heat weights like 100/150 tonnes for LD and upto 300 tonnes or more for Open Hearth.

All the above factors result in the arising of certain butts which are accounted as scrap and, therefore, the net metallic yield as envisaged in the Detailed Project Report cannot be achieved.

2.06.06 *Consumption of raw materials*

The actual consumption of major raw materials per tonne of steel ingot during the years 1970-71 to 1977-78 *vis-a-vis* the provisions in the Project Report and the norms fixed by the Norms Committee (1968) are given in Annexure-XV. The following facts emerge therefrom :—

(a) The consumption of hot metal in open hearth furnaces and L.D. converters was always more than the projected norms and the norms fixed by the Norms Committee, except in the years 1976-77 and 1977-78 when it was within the norms fixed by the Norms Committee in respect of L.D. converters.

(b) The consumption of scrap in open hearth furnaces was also more than the projected norms but was within the norm prescribed by Norms Committee. The consumption of scrap in L.D. converters was, however, lower than the projected norm but was higher than the norm prescribed by the Norms Committee.

(c) The consumption of hot metal and scrap taken together in the open hearth furnaces and L.D. converters was more than the projected norms as well as the norms fixed by Norms Committee (except during 1976-77 in the case of L.D. Converters and during 1971-72 and 1974-75 to 1977-78 in Open Hearth Furnaces) when it was less than the norms fixed by the Norms Committee.

(d) While the consumption of iron ore in the open hearth furnaces was less than the projected norm, it was always more than the norm fixed by the Norms

Committee in the case of both Open Hearth Furnaces and L.D. Converters (except in 1975-76 in the case of L.D. converters).

(e) The consumption of lime stone in the L.D. Converters was always more than the norm fixed by the Norms Committee.

The Management stated (October 1979) that reduction in hot metal consumption in L.D. Converters during 1976-77 and 1977-78 has been possible by bringing in technological changes in operational practices. The increase in hot metal consumption in Open Hearth Furnaces is due to technology of oxygen lancing which calls for more proportion of hot steel charge.

2.06.07 *Excess consumption of Ingot Moulds and Bottom Plates*

The Project Report indicates a total consumption of 30 Kgs. of ingot moulds and bottom plates per tonne of rollable steel. The Norms Committee, however, fixed (1968) the norm of 22 Kgs. of ingot moulds and 14 Kgs. of bottom plates *i.e.* a total consumption of 36 Kgs. for this purpose. As against these norms, actual consumption varied as follows :—

(Figures in Kgs.)

Year	Actual consumption per tonne of rollable steel		
	Ingot Moulds	Bottom Plates	Total
(1)	(2)	(3)	(4)
1970-71	32.9	16.8	49.7
1971-72	36.6	18.0	54.6
1972-73	31.3	17.7	49.0
1973-74	32.9	17.6	50.5
1974-75	23.4	14.2	37.6
1975-76	22.3	13.4	35.7
1976-77	24.1	14.4	38.5
1977-78	22.0	12.8	34.8

Excess consumption of ingot moulds and bottom plates during the above period, after making allowance for lower consumption in certain years, resulted in an extra expenditure of Rs. 3.43 crores (excluding depreciation and interest).

The higher consumption was attributed by the Management (May 1974) to the following factors :—

(a) Hot metal contains higher manganese to make it suitable for further processing in L.D. converters. The hot metal is, therefore, inferior for making moulds.

(b) Long residence time of steel also reduces the life of moulds.

A study made by the Statistical Quality Control Department of the Plant in 1972-73 indicated that silicon and manganese content in pig iron used for making ingot moulds and the circulation time had direct relationship with the mould life.

Pig iron containing 1.2 to 1.4 per cent silicon and 0.5 to 0.6 per cent manganese is considered to be suitable for making moulds but as the plant does not produce pig iron of this quality, it is purchased from Bhilai Steel Plant. It was stated by the Management that with the use of moulds made out of this pig iron the consumption during July 1974 to December 1974 came down by 9.7 Kgs. per tonne of steel. It will also be seen from the above table that the consumption of ingot moulds and bottom plates during 1974-75, 1975-76, 1976-77 and 1977-78 was less by 12.9 Kgs., 14.8 Kgs. 12.0 Kgs. and 15.7 Kgs. respectively as compared to 1973-74.

2.06.08 *Excess consumption of ferro-manganese*

Ferro-manganese is used as one of the finishing and alloy materials in the Steel Melting Shop. The Project Report for the Rourkela Steel Plant does not indicate the norm of consumption of ferro-manganese as in the case of the Project Report for the Bhilai Steel Plant. The Norms Committee, however, fixed (1968) a norm of 15 Kgs. for open hearth furnaces and 5 Kgs. for L.D. converters (percentage of average manganese content not indicated but it was 74.82 per cent in 1968-69) for production of one tonne of rollable steel ingot. The actual consumption of ferro-manganese

during 1970-71 to 1977-78 was, however, higher than the above referred norms, as indicated below :—

Year	Actual consumption of ferro-manganese		
	O.H. (Kgs.)	L.D. (Kgs.)	Manganese content
1970-71	17.54	5.60	74.82 per cent
1971-72	19.13	7.54	74.14 per cent
1972-73	20.08	6.74	74.56 per cent
1973-74	20.03	6.70	73.58 per cent
1974-75	25.17	9.58	73.20 per cent
1975-76	20.94	8.38	74.03 per cent
1976-77	21.39	9.55	74.47 per cent
1977-78	23.37	8.64	75.16 per cent

The consumption of ferro-manganese in excess of the norms resulted in an extra expenditure of about Rs. 5.50 crores during 1970-71 to 1977-78 (upto April 1978).

The Management stated (April 1981) that ferro-manganese addition was necessary to nullify the effect of higher sulpher content in the hot metal, particularly for keeping minimum manganese-sulpher ratio in finished steel. Besides, higher consumption of ferro-manganese was necessary for certain quality steel production such as steel for pipe production and tested plates production from both Plate Mill and Hot Strip Mill in all the qualities except IS : 226 specification.

2.07 *Rolling Mills*

2.07.01 *Millwise performance*

The rolling mills consist of two main sections *viz.* Hot Rolling Mills and Cold Rolling Mills, with various constituent units.

Against the input of 18 lakh tonnes of steel ingots and 11050 tonnes of zinc and tin, the various rolling mills are designed to produce 12.25 lakh tonnes of saleable products. Out of difference of 5.86 lakh tonnes, scrap arisings are of the order of 4.69 lakh tonnes (25.90% of the input) ; the burning and scale losses are about 1.16 lakh tonnes (6.42% of the input).

The actual input, the output, the yield and the scrap arisings/scale and other losses in different mills during 1970-71 to 1977-78 *vis-a-vis* norms indicated in Detailed Project Report as well as by the Norms Committee are given in Annexure XVI.

It will be seen that none of the mills was operated at full capacity (except Plate Mill during 1976-77 and 1977-78) partly on account of non-availability of the feed stock and partly due to other causes as discussed in the succeeding paragraphs. Further, scrap arisings exceeded the projected norms in case of Blooming and Slabbing Mill, Electrical Sheet Mill and Pipe Plant in all the years. In case of Hot Strip Mill, scrap arisings exceeded the projected norm in some of the years. Scale and other losses exceeded the projected norms in case of Plate Mill, Hot Strip Mill, Electrical Sheet Mill and Cold Rolling Mills during the years under review.

2.07.02 *Blooming and Slabbing Mill*

The actual production during 1970-71 to 1977-78 against the rated capacity and the annual targets compared as follows:—

(Figures in lakh tonnes)

Year	Rated capacity as per Project Report	Annual target	Actual prodnction	Percentage of shortfall to	
				Rated Capacity	Annual Target
1970-71 . .	15.30	13.02	8.50	44.5	34.7
1971-72 . .	15.30	12.68	7.35	52.0	42.0
1972-73 . .	15.30	10.15	8.77	42.7	13.6
1973-74 . .	15.30	10.56	8.45	44.8	20.0
1974-75 . .	15.30	10.06	8.97	41.4	10.8
1975-76 . .	15.30	11.05	10.89	28.8	1.5
1976-77 . .	15.30	11.90	11.53	24.6	3.1
1977-78 . .	15.30	13.17	11.77	23.1	10.6

The following reasons have been assigned for shortfall in production :—

1970-71 (*i*) Poor industrial relations.
(*ii*) Frequent breakdowns in coke ovens affecting gas supply to re-heating furnaces.
(*iii*) Orissa Bundhs.
1971-72 (*i*) Roof Collapse in Steel Melting Shop.
1972-73 (*i*) Power restriction/failure.
(*ii*) Poor industrial relations.
(*iii*) Major breakdowns and extended shutdowns.
1973-74 & 1974-75 (*i*) Dislocation in movement of raw materials due to industrial problems in Railways.
(*ii*) Power restriction and power failure.
(*iii*) Poor industrial relations.
1976-77 (*i*) Electrical delays at twin drive upper Motor, Cranes etc.
(*ii*) Fire at Cable duct.
(*iii*) Mechanical delays
(*iv*) Heat stoppages
(*v*) Poor industrial relations.
1977-78 (*i*) Screw down jamming
(*ii*) Fire at shear.
(*iii*) Heat stoppages.
(*iv*) Poor industrial relations.

2.07.03 *Plate Mill*

(a) The actual production during 1970-71 to 1977-78 as compared to the rated capacity and annual targets were as indicated below :—

(Figures in lakh tonnes)

Year	Rated capacity as per Project Report	Annual Target	Actual Production	Percentage of shortfall (—)/excess (+) in production to	
				Rated Capacity	Annual Target
1970-71 . .	2.80	2.80	1.56	(—)44.3	(—)44.3
1971-72 . .	2.80	2.80	1.48	(—)47.1	(—)47.1
1972-73 . .	2.80	1.96	1.82	(—)35.0	(—) 7.1
1973-74 . .	2.80	2.02	1.74	(—)37.9	(—)13.9
1974-75 . .	2.80	2.20	1.93	(—)31.1	(—)12.3
1975-76 . .	2.80	2.20	2.61	(—)6.8	(+)18.6
1976-77 . .	2.80	2.60	3.00	(+)7.1	(+)11.5
1977-78 . .	2.80	2.80	3.01	(+)7.5	(+)7.5

The Management ascribed the following reasons for shortfall :—

1970-71 (*i*) Non-achievement of anticipated production in steel melting Shop and Slabbing Mill.

(*ii*) Non-availability of steel to the Plate Mill.

(*iii*) Poor industrial relations.

(*iv*) Frequent breakdowns in coke ovens affecting gas supply to Re-heating furnace.

(*v*) Orissa Bundhs.

1971-72 (*i*) Roof collapse in Steel Melting Shop.

1972-73 (*i*) Power restriction/failure.

(*ii*) Poor industrial relations.

(*iii*) Major breakdowns and extended shutdowns.

1973-74 (*i*) Dislocation in movement of raw materials due to industrial problems in Railways.

& (*ii*) Power restriction/failure

194-775 (*iii*) Poor industrial relations.

In 1975-76, there was substantial improvement in production and the shortfall with reference to the rated capacity was only 6.8 per cent. The Management stated (December 1977) as under :—

> "The capacity utilisation achieved in 1976-77 was still higher *i.e.* 107 per cent.....even at this level of production, the net realisation does not cover even the cost of production and this is because under the new pricing policy, plates had been treated as Category-I items and no increase in price was allowed. In spite of this, the Plant has been increasing the production of plates in the national interest".

The production during the earlier year also suffered due to poor maintenance of the Mill. In October 1970, a breakdown had occurred in the gear box. The Committee appointed by the General Manager to enquire into the causes of the breakdown pointed out lapses in the maintenance in spite of the experience of previous two breakdowns in 1968 and 1970.

As a result of the breakdown in October 1970 the mill was shut down for 267 hours which led to a loss of production of 10,564 tonnes valued at Rs. 73.44 lakhs (on the basis of standard cost).

(b) *Yield in Plate Mill*

(i) About 7 sizes of steel ingots are rolled in the Mill from which plates of various sizes are manufactured. One of the main criteria to decide the size of the ingot for a particular size of the plate is the estimated loss at different stages of processing. A study made by the Statistical Quality Control Department of the Steel Plant during July 1972 to November 1972 in respect of about 50 sizes of plates, revealed that, by adopting the best ingot size and slab weight, the yiled of plates could be improved in 33 sizes to the extent of 1 to 6 per cent. After making necessary changes in the production pattern during April 1973 to January 1974, it was claimed that overall yield of plates had increased by one per cent.

(ii) *Yield of Boiler Quality Plates*

The Mill produces boiler quality plates, the ingot to plate yield of which was around 27 per cent as against the normal yield of 66 per cent in other qualities of plates.

A study made by the Statistical quality Control Department of the Steel Plant during May 1973 to November 1973, indicated that the low yield of boiler quality plates was due to addition of Heckett Scrap (about 12 per cent) for producing steel ingots in the Steel Melting Shop. It was estimated that by eliminating the use of this scrap, the ingot to plate yield could go up by 5 per cent for boiler quality plates. After implementing the recommendation, the ingot to plate yield increased from 27.47 per cent (May 1972 to May 1973) to 45.01 per cent (October 1973 to March 1974). It was 46.3 per cent in 1976-77 and 48 per cent in 1977-78.

2.07.04 *Hot Strip Mill*

The Mill is designed to roll 11.40 lakh tonnes of slabs into 11.05 lakh tonnes of strips. As envisaged in the Project Report, the Mill is capable of rolling more than the rated capacity if the product mix is favourable and the operation and maintenance are

kept at a good level. The actual production in the Mill was, however, much below the rated capacity and annual targets (except in 1975-76) as indicated in Annexure XVII.

The low production was attributed (April 1981) by the Management to ;

(i) lower availability of mixed gas till 1972-73.

(ii) external power shortage during 1973-74 to 1976-77; and

(iii) lower slab availability from Slabbing Mill than planned during all the years except 1975-76.

2.07.05 *Electrical Sheet Mill*

(a) The Project Report for 1.8 million tonne stage envisaged the setting up of an Electrical Sheet Mill having a capacity of producing 50,000 tonnes of hot rolled electrical sheets of both the transformer grade and dynamo grade; the production of high quality transformer sheets only was considered uneconomical as in actual practice while rolling the transformer sheets with very low watt losses, a portion of the sheets with higher watt losses comes out which cannot be classified as of transformer quality.

When tenders for the setting up of this Mill were considered in November 1962, it was foreseen that dynamo grade Sheets might be produced in the Steel Melting Shop while the production of transformer grade Sheets might be difficult. However, the letter of intent was issued in May 1963 to M/s. Demag of West Germany for the supply of Electrical Sheet Mill capable of rolling both the grades of sheets and the contract was entered on 5th March 1964.

Another contract was simultaneously finalised on 6th March 1964 with M/s. Walzwork Neviges of West Germany for obtaining the knowhow for installation of the annealing plants in the Electrical Sheet Mill and the manufacture of hot rolled electrical sheets, on a payment of DM 35 lakhs (Rs. 41.65 lakhs), *inter*

alia, stipulating that "out of the rated production of 50,000 tonnes a minimum of 45 per cent would be dynamo grade sheets". It was clarified by MECON (March 1975) that the stipulation of minimum 45 per cent of dynamo grade was incorporated in view of the fact that certain facilities were provided exclusively for the production of dynamo grade sheets and could not be used for the production of transformer grade sheets, the balance facilities were mainly intended for the production of transformer grade sheets but these could also be used for the production of dynamo grade sheets. According to the Metallurgical and Engineering Consultants (India) Ltd. (MECON), the product mix could be varied by the Company within the following limitations :—

(1)	Minimum (2)	Maximum (3)
Dynamo grade Sheets	45% (22,500)	100% (50,000)
Transformer grade Sheets	0%	55% (27,500)

The original offer of M/s. Demag (July 1962) indicated that the raw material should have 0.03 per cent maximum carbon content. The contract entered into with them stipulated that the starting material for processing the different types of sheets would contain 0.02 per cent to 0.03 per cent carbon varying with silicon content. In April 1966, however, the Consultants intimated that the maximum carbon content should preferably be 0.02 per cent as otherwise additional decarbonisation process would be necessary. To investigate the suitability of steel with maximum carbon content of 0.03 per cent, samples were supplied to the Consultants in February 1968 whose report, received in April 1968, indicated that the initial carbon content in Steel should be less than 0.02 per cent. In the meantime, the Electrical sheet Mill was installed and commissioned by March 1968 at a cost of Rs. 6.30 crores. The Finishing Mill was, however, commissioned in November 1968.

When the guarantee tests were held during 1968 to 1970, it was found that the use of steel with carbon content ranging from

0.017 per cent to 0.03 per cent gave inconsistant results. The guarantee test failed with the best materials but succeeded with materials having higher carbon content. On account of such inconsistencies, the annealing speed had to be reduced bringing down the rated output to 30,000 to 35,000 tonnes. The Consultants, who were asked (September 1971) to take remedial measures at their cost, suggested (February 1972) that in order to attain the production of 50,000 tonnes per annum, the length of three Neviges furnaces should be extended by 5.9 metres. The suggestion was accepted by the Company. The cost of the work was estimated at Rs. 12 lakhs. The extension to the furnaces was not taken up in view of high cost involved and lack of demand for the product. However, a sum of Rs. 5.65 lakhs (DM 2,50,000) representing a part of the outstanding claim was foregone by the consultants.

(b) *Production*

The actual production *vis-a-vis* the rated capacity and budgeted production during 1970-71 to 1977-78 are given in Annexure XVIII.

Owing to continued low production, the mill could not absorb the fixed expenditure to the extent of Rs. 10.94 crores during 1968-69 to 1977-78 out of the total fixed expenditure of Rs. 15.81 crores (excluding depreciation and interest for the year 1968-69 for which separate figures were not available).

The entire production upto 1977-78 was of dynamo grade quality only. It was stated by the Management (July 1970) that the transformer industry in India was completely geared to use CRGO (cold rolled grain oriented) steel and that only 3,000 to 4,000 tons of hot or cold rolled non-oriented sheets might be required for special type of transformers per year. Thus, the market for hot rolled transformer sheets in the country was not encouraging and the payment of know-how and other facilities for the manufacture of transformer grade sheets had been rendered unproductive.

2.07.06 *Cold Rolling Mills*

The actual production of different units of the Cold Rolling Mills *vis-a-vis* the budgeted production and rated capacity during 1970-71 to 1977-78 are given in Annexure XIX.

The actual production in the various units of the Cold Rolling Mills was less than the rated capacities in all the years and was also less than the budgeted production in most of the years from 1970-71 to 1977-78. The shortfall in production was ascribed by the Management to material shortage, poor industrial relations and frequent power restrictions/failures.

The Management expressed the view (June 1971) that "efforts should be made to increase the production of electrolytic tin plates and keep the production of hot dip tin plates only to such level as is necessary to make up the shortfall in production of electrolytic tin plates and/or to meet the particular needs of the customers. Gradually we are thinking in terms of closing down this unit".

According to the Project Report, there are six Hot Dip Tinning Lines to produce 50,000 tonnes of tin plates and one Electrolytic Tinning Line to produce 1,50,000 tonnes of electrolytic tin plates. The capacity utilisation of Hot Dip Tinning Lines was very low. Further, the cost of production of hot dip tin plates was very high compared to electrolytic process. In view of the non-availability of sufficient quantity of cold rolled sheets to run the Hot Dip Tinning Lines to capacity and also the unfavourable economics of producing hot dip tin plates, the Board of Directors:

(a) approved in May 1975 the proposal to close down three of the hot dip tinning lines (original capital cost Rs. 97.42 lakhs) and write off the written down value of Rs. 11.80 lakhs and

(b) approved in April 1978 the proposal for closing down the remaining three hot dip tinning lines

original capital cost Rs. 48.29 Lakhs not in operation since September 1976 and write off the written down value of Rs. 5.92 lakhs.

The Board also authorised.....the disposal of these items at the best available price. All the six Hot Dip Tinning Lines were disposed of in two lots in August 1979 and March 1980 at a total price of Rs. 10.98 lakhs.

2.07.07 *Special Steel Plates Plant*

(a) Based on the requirements of 2,400 tonnes of heat treated plates (equivalent to 1,539 tonnes in fully machined condition *i.e.* 120 sets) per year, as indicated by Government in 1965, the following facilities were provided :—

(i) At the Alloy Steels Plant, Durgapur for steel making, vacuum degassing and casting into ingots; and

(ii) At the Rourkela Steel Plant, for heat treatment and finishing of 120 sets of special plates.

The steel making facilities at Durgapur were completed and commissioned in December 1968 (cost not available). The heat treatment and finishing facilities at Rourkela were completed in July 1969 at a cost of Rs. 6.41 crores. Expansion to 180 sets was completed in November 1974 at a cost of Rs. 1.14 crores.

(b) *Production*

According to the assessment of Technical Consultants 2.7 tonnes of Alloy steel ingots made in electric arc furnaces and vacuum degassed are required for the manufacture of one tonne of fully machined and finished plate. On this basis, the requirement of spade ingots for making 120 sets (1539 tonnes) of finished plates is 4,155 tonnes and for rolling 180 sets (2,309 tonnes) the requirement is 6,233 tonnes.

The actual production of steel ingots in the Alloy Steels Plant, Durgapur and heat treated plates at Rourkela during 1969-70 to 1977-78 is given in Annexure XX.

Upto 1975-76 the actual production of heat treated plates at Rourkela was low as compared to rated capacity on account of the following factors :—

(i) Low production and supply of spade ingots from Alloy Steels Plant, Durgapur.

(ii) Inferior quality of spade ingots. The spade ingots were found to be ultrasonically unsound because of the use of an indigenously substituted mould additive.

(iii) The production of heat treated plates was completely stopped in 1974-75 (except during March 1975) on account of a major breakdown in the vacuum degassing unit at Durgapur. As a result, fixed expenditure to the extent of Rs. 79 lakhs remained unabsorbed during that year.

The estimated cost of finished plates at the time of setting up the Plant is not available. The actual cost of production during 1970-71, 1971-72, 1972-73 and 1973-74 was Rs. 19,170, Rs. 14,294, Rs. 15,909 and Rs. 58,405 per tonne respectively. The abnormally high cost of production during 1973-74, was due to very low production. As against the cost of production of Rs. 58,405 per tonne, the sales realisation was Rs. 22,400 per tonne. As a result, a loss of Rs. 85.69 lakhs was incurred during 1973-74.

As the requirements were not met in full, orders for the import of 190 sets of plates at a cost of Rs. 3.62 crores were placed by Government during 1970-71, 1973-74 and 1974-75. In addition, because of the inadequate supply of ingots by the Alloy Steels Plant, orders for the import of 1,000 tonnes of spade ingots (equivalent to 30 sets of plates) were placed on a foreign firm in 1974 at a cost of Rs. 55.74 lakhs.

2.07.08 *Measures taken to improve production*

The Management stated (December 1977) that efforts have been/are being made to make improvements in various directions *viz.* :

(i) Identification and removal of technological imbalances and bottlenecks as a result of systematic analysis.

(ii) Greater attention to the maintenance requirements of the equipments and intensive capital repairs in addition to the emphasis on the preventive maintenance.

(iii) Drawing up implementation of three-year rolling plan for capital repairs and a seven-year plan for revamping, repairs and replacements of EOT cranes.

(iv) Implementation of a phased replacement plan for mobile equipments.

(v) Drawing up of a seven-year forecast of heavy spares.

(vi) Development of statistical quality control techniques for improving the production, productivity, etc.

(vii) Association of workers' representatives at shop and apex levels exclusively in production and allied matters.

(viii) Various measures to make improvement in the field of employees' welfare.

(ix) Maximisation of production of special steel e.g., boiler quality plates, weldable quality plates, ship-building quality plates etc.

(x) Undertaking of a concerted drive to develop other special steels, which have hitherto been imported and development of new qualities of steel.

(xi) Development of human resources through training programmes etc.

2.08 *Idle Equipment*

Annexure XXI contains the list of 12 cases of equipment (value in 7 cases being Rs. 98.51 lakhs) received under the one million tonne stage and lying idle. The reasons for non-utilisation of these equipment and action proposed to be taken for their utilisation/disposal are also indicated in the Annexure.

3. *Sources of Raw Materials*

3.01 The Plant obtains its requirements of major raw materials, except raw coal, from its captive mines. The performance of the captive mines for meeting the requirements of iron ore, lime stone, dolomite and manganese ore is discussed in the succeeding paragraphs.

3.02 *Iron Ore*

3.02.01 The requirement of iron ore is mainly met from the mines at Barsua (fully mechanised) and Kalta (manually operated).

The annual requirement of iron ore, as per the Project Report for the 1.8 million tonne stage, was estimated at 24.19 lakh tonnes, comprising 14.11 lakh tonnes of lump ore (12 mm to 80 mm size) and 10.08 lakh tonnes of fines (below 12 mm size) to be converted into sinter. The quantity of iron ore (Lump) and fines actually used and the quantity raised in the mines and received in the Plant from different mines during 1970-71 to

(Figures in lakh tonnes)

Year	Quantity of Iron Ore consumed		Quantity raised by the Captive mines			Quantity received at the Plant	
	Lump	Fines (through (sinter)	Mines	Lump	Fines	Lump	Fines
1	2	3	4	5	6	7	8
1970-71	13.98	4.06	Barsua	5.37	4.15	5.40	4.11
			Kalta	2.08	..	1.54	..
1971-72	12.22	3.28	Barsua	4.81	4.53	4.97	3.29
			Kalta	2.13	..	1.26	..

1	2	3	4	5	6	7	8
1972-73	14.98	5.41	Barsua	7.01	8.34	5.83	5.07
			Kalta	3.90	..	4.33	..
1973-74	14.73	4.87	Barsua	4.65	6.47	5.31	4.64
			Kalta	6.32	..	6.23	..
1974-75	14.82	5.35	Barsua	4.53	8.20	4.14	4.79
			Kalta	5.11	..	5.61	..
1975-76	14.66	8.01	Barsua	5.17	10.56	5.35	7.25
			Kalta	5.41	..	5.90	..
1976-77	14.55	9.81	Barsua	6.22	8.36	5.67	10.07
			Kalta	4.77	..	5.83	..
1977-78	13.31	8.43	Barsua	5.15	8.55	5.28	7.80
			Kalta	5.06	..	5.14	..

On account of low production of lump ore in captive mines, the Palnt had to purchase the following quantities from the

National Mineral Development Corporation Ltd., Bolani Ores and others at higher cost :—

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Quantity purchased (in lakh tonnes) Low grade . .	0.32	0.67	1.09	0.15	3.08	0.22	0.80	0.04
High grade . . .	5.45	4.70	3.80	1.64	2.53	4.63	2.41	4.18
percentage of purchase price as a percentage of the cost of raising (variable cost plus freight in own mines)								
Low grade . . .	..	175.09	198.25	..	..	228.88	..	..
High grade . . .	155.07	185.35	137.85	113.68	124.03	137.09	125.30	117.90

3.02.02 *Barsua Mechanised Mine*

(a) According to the Consultants, (M/s. J. W. Woomers) the mine has a rated capacity of 3 million tonnes per annum on two shift basis and 4 to 4.5 million tonnes on three shift basis. The mine is actually worked for two shifts. Various Committees appointed by Government and Management during 1956 to 1972 to go into the working of these mines indicated different rated capacities ranging between 1.4 and 2.10 million tonnes (2.15 million tonnes with the addition of certain facilities). The Management have, however, been adopting a production capacity of 2.8 million tonnes per annum.

(b) The proportion of lump and fines, as per the Project Report of the mine, was expected to be 47:53. A team of German experts engaged in 1966 for assessing the potentiality of the Barsua Iron Ore deposits, had, however, indicated in its report of February 1973 that achievable lump/fine ratio was 30:70.

The actual production as compared with rated capacity and budgeted production and the actual lump/fine ratio during 1970-71 to 1977-78 were as follows :

(In lakh tonnes)

Year	Rated capacity	Budgeted Production			Actual Production			Percentage of actual production to rated capacity	Lump fine ratio
		Lump	Fines	Total	Lump	Fines	Total		
(1)	(2)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)	(5)	(6)
1970-71 . . .	28.03	9.00	10.20	19.20	5.37	4.15	9.52	34.0	56:44
1971-72 . . .	28.03	7.20	7.20	14.40	4.81	4.53	9.34	33.3	52:48
1972-73 . . .	28.03	7.80	7.80	15.60	7.01	8.34	15.35	54.8	46:54
1973-74 . . .	28.03	6.50	7.36	13.86	4.65	6.47	11.12	39.7	42:58
1974-75 . . .	28.03	5.30	11.00	16.30	4.53	8.20	12.73	45.4	36:64
1975-76 . . .	28.03	4.00	10.50	14.50	5.17	10.56	15.73	56.1	33:67
1976-77 . . .	28.03	4.20	11.00	15.20	6.22	8.36	14.58	52.02	43:57
1977-78 . . .	28.03	4.20	9.60	13.80	5.15	8.55	13.70	48.88	38:62

NOTE : According to the Management April, 1981 revised rated capacity is 20.16 lakh tonnes

Actual production ranged between 33.33 per cent and 56.1 per cent of the rated capacity and lump fines ratio also deteriorated over the years.

The shortfall in production was attributed (January and September 1974 and October 1979) by the Management to the following factors :—

(i) Preference for the use of higher percentage of high grade ore in blast furnace burden.

(ii) Reduced off-take of fines from the mines owing to low sinter production.

(iii) Power cut by the Orissa State Electricity Board during May 1973 and June 1973 and frequent power restrictions.

(iv) Non-availability of mine equipment.

(v) Inadequate and erratic wagon supply by Railways resulting in heavy accumulation of stock of iron ore fines at Barsua siding which restricted the operation of the crushing plant and production of lump ore at the mines.

(vi) Non-release of adequate foreign exchange for import of spare parts and consumables.

(vii) Frequent mechanical and electrical breakdowns.

(c) The actual cost of production of lump ore and fines during 1972-73 to 1977-78 as a percentage of the standard cost introduced from 1972-73 was as under :—

Year	Actual Cost as percentage of standard Cost	
	Lump	Fines
1972-73	104.88	90.95
1973-74	125.64	87.80
1974-75	95.85	95.85
1975-76	88.22	88.22
1976-77	95.16	95.16
1977-78	99.73	99.73

It was observed that the cost of lump ore had increased steeply during 1973-74.

(d) *Fe content in iron ore*

The fe content in lump ore, fines and sinter, (in which fines are used) during 1970-71 to 1977-78 compared as follows with the project provision and the norms fixed by the Norms Committee:—

(Fe contant as percentage)

	Lump	Fines	Sinter
As per project provision	60.00	..	51.00
As per Norms Committee	62.00	..	48.00
1970-71	59.50	57.7	43.30
1971-72	60.25	59.5	45.16
1972-73	59.68	58.4	42.98
1973-74	59.81	59.0	44.23
1974-75	60.90	60.7	44.80
1975-76	61.90	60.5	47.98
1976-77	60.75	59.1	47.40
1977-78	61.17	59.3	47.03

(e) A beneficiation plant was commissioned in 1970 at a cost of Rs. 4.09 crores with a view to improving the quality of iron ore by increasing the fe content in lump ore by 1 to 1.5 per cent and in fines by 3 to 4.5 per cent.

It will be seen from the data given below that the beneficiation plant had operated below the rated capacity *viz.*, 4.22 lakh tonnes for washed lumps and 4.85 lakh tonnes for washed fines :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Quantity washed (in lakh tonnes)								
(*a*) Lump .	3.20	1.93	2.12	1.57	1.95	2.74	2.93	2.9
(*b*) Fine .	2.32	1.59	2.71	2.00	2.88	4.09	3.21	2.69

The lower utilisation of the beneficiation plant was attributed by the Management to the following reasons :—

"(i) Disposition of beneficiable ore to direct ore in the total deposit at Barsua Iron Mines is in the ratio of 60 : 40. For optimum utilisation of the direct ore and keeping to the quality requirement of the Plant, direct running of the plant is required without washing for sending high grade fines to Sintering Plant at Rourkela and to meet fine ore supply to Bokaro.

(ii) Water available during these years was not sufficient to run beneficiation plant for operation. It will only be possible when additional water supply facilities come up."

(f) With a view to improving the quality of ore, the Action Committee appointed by Government had recommended (May 1973) the provision of additional facilities at Barsua Iron Ore Mines for re-sizing lump ore and to provide for additional storage and handling facilities. Facilities for screening and additional make up water for ore Beneficiation Plant were provided between August 1976 and December 1980 at an estimated cost of Rs. 69.90 lakhs.

(g) *Utilisation of Haulpack Dumpers*

As on 31st March 1978, Barsua Iron Ore Mines had 24 Haulpack dumpers purchased at a cost of Rs. 273.26 lakhs. It was noticed that the availability of these dumpers ranged from 54.9 per cent in 1970-71 to 43.8 per cent in 1977-78 of the total available hours during these years. The lower availability was attributed by the Management to manufacturing defects, particularly in the engine, and long delay in supply of spares.

The Management further stated (April 1981) that manufacturing defects in the engine have since been rectified although the spare parts supply position is yet to improve.

3.02.03 *Kalta Iron Ore Mines*

(a) These mines are being operated manually since 1966. The area which is being exploited manually, contains about 101.188 million tonnes of mineable iron ore. Detailed prospecting for final assessment of reserves is yet to be made.

Till October 1972, raising of ore was done departmentally. A contractor was also engaged from November 1972 in order to raise additional quantity of ore. Transporting and loading of ore is done through contractors.

(b) The actual raisings of ore from the mines *vis-a-vis* the budgeted raisings during 1970-71 to 1977-78 were as follows :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Budgeted raisings (in lakh tonnes)	2.54	3.60	3.60	7.20	7.80	7.20	6.00	4.80
Actual raisings (in lakh tonnes)	2.08	2.13	3.90	6.32	5.11	5.41	4.77	5.06

The marked shortfall in production during 1974-75 and 1975-76 was attributed by the Management (September 1975 and November 1976) *inter alia*, to strict quality control, inadequate labour strength, absenteeism due to heavy rain, etc.

(c) The cost of raising the ore showed an upward trend as indicated below :—

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Cost per tonne (in percentage)	100	102.98	109.48	113.94	134.30	137.51	166.72	184.93

3.03 *Limestone*

3.03.01 Low grade limestone is used in Blast Furnaces and Sintering Plant while high grade limestone is required for Steel Melting Shop.

On the basis of the norm of consumption indicated in the Project Report, 5.62 lakh tonnes of low grade and 3.15 lakh tonnes of high grade limestone are required for the production of 1.8 million tonnes of steel ingots. The requirement of low grade limestone is met from the captive mines at Purnapani (at a distance of about 35 Kilometres from the Steel Plant) and that of high grade from Satna Mines of the Steel Plant (at a distance of about 731 Kilometres).

3.03.02 *Purnapani Limestone Mine*

(a) The actual production of limestone from the Purnapani Mine *vis-a-vis* the budgeted production and the rated capacity during 1970-71 to 1977-78 is given below :—

(Figures in lakh tonnes)

Year	Rated capacity *	Budgeted Production			Actual Production			Percentage of actual production to rated capacity	Percentage of actual production to budgeted production
		Lump	Fines	Total	Lump	Fines	Total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1970-71 . . .	6.5	4.68	2.04	6.72	4.17	1.10	5.27	81.1	78.4
1971-72 . . .	6.5	4.25	2.04	6.29	2.61	0.92	3.53	54.3	56.1
1972-73 . . .	6.5	4.25	2.04	6.29	4.25	1.45	5.70	87.7	90.6
1973-74 . . .	6.5	4.37	2.45	6.82	4.12	1.13	5.25	80.8	77.0
1974-75 . . .	6.5	5.22	2.45	7.67	3.30	1.20	4.50	69.2	58.7
1975-76 . . .	6.5	4.06	0.31	4.37	3.18	1.42	4.60	70.8	105.3
1976-77 . . .	6.5	4.09	1.94	6.03	3.69	1.37	5.06	77.8	83.9
1977-78 . . .	6.5	5.16	1.68	6.84	3.97	1.19	5.16	79.4	75.4

NOTE : *According to the Management, the revised rated capacity is 6.19 lakh tonnes.

The Management attributed the shortfall in production to low off-take by the Plant, frequent break-down of shovels, dozers and secondary crusher motor, short supply of wagons, power restrictions, mechanical and electrical break-downs, developmental work etc.

(b) As there was no arrangement at Purnapani to supply—6 mm fines and the Sintering Plant crushers were not ready for crushing the limestone fines available from Purnapani, the following quantities of limestone were purchased from outside sources at a higher cost to meet the requirement of the Steel Plant :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Quantity purchase (in lakh tonnes)	0.46	0.35	0.43	0.27	0.13	0.13	0.08	0.35
Purchase price as a percentage of variable cost of production per tonne of own limestone . .	189.85	176.12	200.42	229.91	138.22	160.35	142.05	137.72

3.03.03 *Satna Limestone Mine*

(a) The mine has a reserve of about 50 million tonnes of high grade limestone and 47 million tonnes of low grade limestone. The raising and transporting of limestone from this mine is done through contractors except a portion which was worked departmentally upto May 1964.

(b) The following table indicates the actual production of limestone *vis-a-vis* the budgeted production and reasons for shortfall in production during the eight years ending 31st March 1978 :—

(Figures in lakh tonnes)

Year	Budgeted Production	Actual Production	Reasons for shortfall
(1)	(2)	(3)	(4)
1970-71 . .	4.32	2.91	Restricted supply of wagons.
1971-72 . .	3.60	1.71	Accumulation of stock at mine, labour troubles and roof collapse of Steel Melting Shop.
1972-73 . .	3.27	2.15	Expiry of mining contracts.
1973-74 . .	3.60	2.30	Poor performance of contractors, short supply of wagons and heavy stock at mines.
1974-75 . .	3.85	2.76	Short supply of wagons.
1975-76 . .	2.75	2.03	Heavy stock at mines and siding
1976-77 . .	3.00	3.27	
1977-78 . .	2.60	2.25	Less off-take by Plant, labour unrest and departmentalisation of mines.

3.04 *Dolomite*

A quantity of 3.32 lakh tonnes of dolomite is required for operating the Blast Furnaces and the Steel Melting Shop at full capacity. The Plant has its captive mines at Bhojpur, Gatitanagar and Baradwar.

The consumption of dolomite in the Steel Plant from 1970-71 to 1977-78 was as follows :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Consumption (in lakh tonnes) .								
(*a*) SMS Grade—Lump ore	0.57	0.51	0.72	0.67	0.69	1.43	1.78	1.76
(*b*) Blast furnace grade :								
(*i*) Lump ore . .	1.18	0.91	0.66	0.48	0.13	..	0.25	0.41
(*ii*) Fines . . .	0.22	0.06	0.22	0.25	0.42	0.47	0.41	0.71
(*c*) Total	1.97	1.48	1.60	1.40	1.24	1.90	2.44	2.88

As against the total consumption of 14.91 lakh tonnes during 1970-71 to 1977-78, a quantity of 6.49 lakh tonnes of dolomite was despatched from the captive mines during February 1973 to March 1978 and balance quantity was purchased from market.

3.05 *Manganese Ore*

3.05.01 Manganese ore is required for use in the Blast Furnaces. A part of the requirement is met from the captive mines at Dengura. The following table indicates the actual production from the mine *vis-a-vis* the budgeted production and consumption during 1970-71 to 1977-78; annual production envisaged in the Project Report was 0.60 lakh tonnes :—

(In lakh tonnes)

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Budgeted Production .	0.28	0.40	0.40	0.24	0.24	0.30	0.35	0.40
Actual Production . .	0.26	0.23	0.11	0.01	0.19	0.21	0.14	0.03
Consumption	1.14	0.90	1.40	1.30	1.64	2.13	2.28	1.99

The shortfall in production was attributed by the Management (January 1975, November 1976 and October 1979) to the following reasons :—

(i) The ore in leasehold areas occurred in pockets and, as a result, exposed ore was gradually exhausted during 1970-71 and 1971-72.

(ii) Towards the end of 1972, 13 quarries were opened, but none behaved well with regard to quantity and quality. Finally, the entire mining operations had to be discontinued.

(iii) Poor labour strength of contractors.

(iv) Heavy overburden removal and low recovery of the manganese ore.

(v) Low yield of manganese ore (1976-77 and 1977-78).

In view of poor performance, mining operations were temporarily suspended with effect from 5th February 1973 for further prospecting and were resumed from 8th January 1974. The operation of Dengura Mines has been stopped from October 1977.

3.05.02 Owing to insignificant production, variable cost of raising manganese ore (f.o.r. Plant) was generally more or equivalent to the average purchase price paid for the manganese ore purchased (f.o.r. Plant) in 1970-71 to 1972-73 and 1974-75 to 1976-77; the production in 1973-74 and 1977-78 was nominal.

4. *Services and Fuel*

4.01 Besides raw materials, various units of the Steel Plant require different types of services and fuel for the production of iron and steel. Major services required are steam, electricity, oxygen, compressed air, water, air blast, refractories, etc.

Fuel requirements comprise gases like coke oven gas and blast furnace gas and liquid fuel such as coal tar (pitch creosote mixture), benzene, naphtha and furnace oil. For the production of some of these services and fuel, separate units have been set up while other items are produced as concomitants of the regular operation of certain other units of the Steel Plant. The production and consumption of major services and fuel are discussed in the succeeding paragraphs.

4.01.01 *Steam*

(a) High pressure steam is required for the captive power Plant and for turbo-blowers which supply air to the Blast Furnaces. The requirement of steam is 425 tonnes per hour for the Power Plant and 195 tonnes per hour for the turbo-blowers. This requirement is met from six boilers of 125 tonnes (minimum) capacity per hour of steam. Of these, five boilers work continuously while the sixth serves as a standby.

Four of the six steam boilers have been designed to use blast furnace gas, coke oven gas and small size coke (below 40 mm) in specified proportions. The other two steam boilers have been designed to utilise either blast furnace gas or coal or combination of both.

(b) In actual practice, fuels were seldom used in the proportion envisaged in the Project Report on account of the following reasons given by the Management in June 1974 :—

(i) The use of coke breeze without adequate gaseous fuel results in incomplete combustion leading to clinker formation.

(ii) High percentage of fines (below 3 mm) in coal received mostly from the collieries in the Central Division of National Coal Development Corporation (Now re-named as Central Coalfields Limited). On certain occasions, the percentage of fines was as

high as 26 to 27 as against 10 stipulated in the contracts with the supplying agencies.

(iii) For effective burning of coke breeze, sandwich firing with coal was essential which called for major changes in the grade and feeding system of the boilers.

The Ministry stated (October 1978) that since no surplus coke breeze was available now (as the entire quantity of available coke breeze was used in the sintering plant), the question of using coke breeze in Power Plant did not arise.

The non-availability of the fuels in the proportion envisaged in the Project Report necessitated the use of other costly fuels which resulted in extra expenditure of Rs. 13.15 crores from 1970-71 to 1977-78 (upto April 1978).

(c) The heat consumption per Kg. of steam during 1970-71 to 1977-78 had increased progressively, thereby resulting in decline in thermal efficiency, as per data given below :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Heat consumption per Kg of steam Produced (*K. Calories*) . .	718	728	735	736	751	748	751	746
Thermal efficiency of boilers (Percentage) . . .	90.5	89.5	88.8	88.7	87.3	87.6	87.3	87.9

(d) *Leakage of steam.*—The following table indicates the actual production and loss of steam due to leakage in steam pipeline etc. during 1970-71 to 1977-78 :—

Year	Production (in lakh tonnes)	Losses (in lakh tonnes)	Percentage	Cost per tonne Rs.	Total value (Rs. in lakhs)
(1)	(2)	(3)	(4)	(5)	(6)
1970-71 . .	39.72	0.59	1.5	18.07	10.63
1971-72 . .	35.98	0.35	1.0	19.56	6.88
1972-73 . .	39.03	0.42	1.1	20.59	8.68
1973-74 . .	40.15	0.51	1.3	23.59	11.94
1974-75 . .	40.02	0.65	1.6	30.86	19.98
1975-76 . .	43.09	0.81	1.9	39.21	31.66
1976-77 . .	45.16	0.80	1.8	44.12	35.08
1977-78 . .	45.22	1.11	2.5	45.82	50.98

On the basis of recommendations made by the Committee appointed by the Management in 1967, certain rectifications had been made in steam pipelines in the By-Product Plant during 1970-71 but leakage still continued.

The Management stated April 1981 as follows :—

> "Steam leakages and condensation of steam resulting in loss are inevitable in the process of steam generation, transportation and consumption. As the equipments get old, leakages are expected to increase. The process of rectification and plugging of leakages is thus a continuous one. Considering these aspects, the loss of 1.1 per cent to 2.5 per cent in the production, distribution and consumption of steam is quite normal as it covers both leakage and condensation loss. Efforts are always there to check and plug the leakages. However, some of the leakages at main distribution system can be attended by taking shut-downs to avoid loss of production in the plant. The shut-downs are taken at opportune time to minimize the loss of production".

4.01.02 *Electricity*

(a) For the operation of the Steel Plant at full capacity (1.8 million tonnes of steel ingots), the peak requirement of electricity (including the requirement for the Fertilizer Plant and the township) was estimated at 156 MW. Out of this, a maximum of 55 MW was to be supplied by the Hirakud grid of Orissa State Electricity Board and 101 MW was to be met from the captive Power Plant having a capacity of 128 MW and installed at a cost of Rs. 10.55 crores. The Power Plant has 5 generators of the capacity of 25 MW each, out of which four are expected to work at a time and the fifth is to serve as a stand-by. In addition, there is a back pressure set of 3,000 KW and two emergency diesel sets of 500 KW each.

The generation during 1970-71 to 1977-78 ranged between 50 and 67 MW only. The Management stated (December 1977) as follows :—

> "With four Turbo-alternators in operation theoretical maximum peak generation that can be achieved is 100 MW. The machines are old and in use for a long period (18 years for 3 generators and 11 years for 2 generators). It is quite but natural that they have been derated to 85 to 90 per cent of the rated capacity. The Turbo-alternators cannot be run at their achievable capacity since they have to take care of the rolling peaks of Hot strip Mill and Tandem Mill. In other words the Turbo-alternators can run at a base load of 18—20 MW thereby keeping a margin of 2—4 MW to take care of the peak loads. Therefore, the achievable maximum generation expected out of the Turbo-alternators would be in the range of 75—80 MW. Considering the steam availability for the Turbo-alternators, the average captive generation on an annual basis will be in the range of 60—65 MW now which is likely to improve to 75—80 MW when the medium pressure

boilers will be commissioned (expected in March 1978). Therefore, considering the capabilities of Boilers and Turbo-alternators, the annual average generation of R.S.P. would be in the range of 75—80 MW. We have not considered the Back-pressure turbine of 3 MW capacity since its effective contribution is only about 1.5 MW or so".

The first medium pressure Boiler was commissioned in April, 1978 and the second one in July 1978.

(b) The table indicates the cost of generation of electricity in the captive power plant *vis-a-vis* the price of power purchased during the years 1970-71 to 1977-78 :—

(Rs. per 10^8 KWH)

Year	Cost of generation in the captive power plant			Purchase price
	Variable	Fixed	Total	
(1)	(2)	(3)	(4)	(5)
1970-71	83.59	37.51	121.10	78.72
1971-72	94.07	40.11	134.18	81.38
1972-73	74.51	56.97	131.48	88.47
1973-74	94.74	50.29	145.03	98.72
1974-75	127.32	43.85	171.17	98.61
1975-76	196.75	46.77	243.52	144.36
1976-77	188.76	45.87	234.63	150.69
1977-78	183.11	57.13	240.24	153.65

The cost of generation was much more as compared to the purchase price and even the variable cost was more except during 1972-73 and 1973-74.

(c) It will be seen from data given below that actual consumption of steam per MWH of electricity generated during

1970-71 to 1977-78 was more than the project norm, except in 1976-77 :—

Year	Requirement of steam per MWH of electricity as per DPR (Tonnes)	Generation of electricity (MWH)	Total requirement of steam on the basis of DPR rate (in lakh tonnes) (Col. 2×3)	Actual input of steam (in lakh tonnes)	Excess consumption of steam (in lakh tonnes) (Col. 5-4)
(1)	(2)	(3)	(4)	(5)	(6)
1970-71 . .	4.56	4,85,205	22.13	24.88	2.75
1971-72 . .	4.56	4,42,991	20.20	22.55	2.35
1972-73 . .	4.56	4,85,458	22.14	23.38	1.24
1973-74 . .	4.56	4,95,181	22.58	23.58	1.00
1974-75 . .	4.56	5,10,427	23.28	23.84	0.56
1975-76 . .	4.56	5,30,566	24.19	24.39	0.20
1976-77 . .	4.56	5,77,825	26.35	26.11	(—)0.24
1977-78 . .	4.56	5,83,747	26.62	26.91	0.29

The excess consumption of steam has been attributed by the Management (February 1977) mainly to load fluctuation and gradual deterioration of equipment.

(d) *Transmission Losses*

In this Plant, the entire quantity of electricity generated and purchased is shown as consumed and the transmission losses are not shown separately, as is done in Bhilai and Durgapur Steel Plants. According to the Management, the available metering arrangements do not permit measurement of line losses separately.

The Ministry stated (June 1981) as follows :—

"Rourkela Steel Plant has also started reporting loss from 1978-79. However, like Bhilai, this is a derived figure. Total transmission loss includes transformer and distribution loss."

(e) *Use of metallurgical coal in Power Plant*

The boilers of the Power Plant are designed to use slack coal. After expansion of the capacity of the Plant from 78 MW to 128 MW (October 1966) under the 1.8 million tonne stage,

substantial quantities of metallurgical coal (details given below) have been consumed, resulting in an extra expenditure of Rs. 1.53 crores during 1969-70 to 1977-78 (upto 30th April 1978) :—

	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Metallurgical coal consumed (in lakh tonnes) . .	0.53	0.43	0.37	0.42	0.33	Nil	0.17	0.47	0.34
Percentage to total consumption .	19.5	17.0	15.3	18.1	12.7	..	6.2	16.8	11.3

In regard to the use of metallurgical coal in the boilers, the Management stated that metallurgical coal was used under compelling circumstances (mentioned below) to keep up the generation vitally needed for plant operation and to take care of shortage of power from external sources :—

> "Since the expansion of the Plant, the average consumption of coal in the Power Plant is 900T/day (approx). The original handling system for incoming coal wagons in the Power Plant has been designed on the assumption of clock work and phased movement of incoming coal rakes. Moreover, limited line capacity was provided to take care of the arrival of extra wagons. Practically, the movement of boiler coal wagons was quite irregular with heavy bunching of rakes on some days and no wagons for other days. In order to avoid detention of wagons causing thereby huge demurrage charges, the wagons were taken away to distant places and had to be unloaded in places away from the boilers. So when there was a gap in the receipt of boiler coal near the boilers, it was not possible to reclaim the coal from places distant away. Hence, we had to use the metallurgical coal, which was lying nearby, so as to avoid interruption in the storage space of boiler. A study has been made to increase the storage space of boiler coal near the power plant bunkers with a bigger line capacity."

It was subsequently intimated that there was no possibility of providing a siding with bigger line capacity near the Power Plant Bunker. However, for the Medium Pressure Boiler Plant Project, a new Boiler Coal Yard had been developed by July 1977 at a cost of Rs. 25.36 lakhs.

(f) *Defective lay-out of Power Plant*

The Committee appointed by the Chairman, Hindustan Steel Limited in May 1970, for preparing the completion report of

1.8 million tonne stage for which Project Report was prepared by the Central Engineering and Design Bureau, had pointed out (August 1973) the following deficiencies in the lay-out of the Power Plant :—

(i) The area around the boilers, turbo-alternators and the turbo-blowers under the expansion scheme was very much cramped.

(ii) The Ash Plant was installed very near the cooling tower resulting in the circulation water getting polluted. Some partition walls were built to avoid flying of dust to cooling towers.

(iii) Storage capacity of the Coal Handling Plant was hardly sufficient for 10 days' requirements.

(iv) Air compressors for ash handling had been installed in a dusty area.

(v) Almost all the cables for power, control and instrumentation of the auxiliaries of the expansion boilers were laid along cable racks erected in a very much congested area between the two boilers. They were also in close vicinity of coal feeders, pulverised coal distributor pipes and hot air pipes. Thus, they were constantly exposed to fire hazards because of high ambient temperature, accumulation of coal dust, etc.

(vi) The layout of the above cables was such that the entire area was not at all accessible to carry out routine inspection and cleaning jobs as well as breakdown jobs.

(vii) The layout of equipment like I.D. and F.D. fans motors was such that it was difficult to dismantle and remove the motors for overhauling and repair.

The Management stated (February 1977) that action had been taken to remedy the deficiency of air compressor for ash handling. Compressed air for Ash Plant was now being drawn

through pipeline from the delivery side of turbo blowers and it was operating satisfactorily. As regards other defects, it was stated that these could not be rectified without major alterations involving something like complete re-location of the expansion boilers which was not practicable.

4.01.03 *Oxygen*

The oxygen and nitrogen required for the operation of the Steel Plant are produced in an oxygen Plant having 4 units (three with a capacity of 3,300 NM^3 per hour of 99.5 per cent purity oxygen and 6,500 NM^3 per hour of 99.99 per cent purity nitrogen each and the 4th unit having a capacity of 6,300 NM^3 per hour of oxygen and 6,500 NM^3 per hour of nitrogen). As against the total requirement of 13,500 NM^3 per hour of oxygen and 19,000 NM^3 per hour of nitrogen for 1.8 million tonne stage, the rated capacity of oxygen plant is 16,200 NM^3 per hour of oxygen and 26,000 NM^3 per hour of nitrogen.

It will be seen from the data given below that, although actual production of oxygen and nitrogen during 1970-71 to 1977-78 was less than the rated capacity, consumption was still less than the production and substantial quantity of oxygen and nitrogen had to be bled out :—

OXYGEN

(Quantity in 10^3 NM^3)

Year	Rated capacity	Actual production*	Actual consumption	Gas bled out	Percentage of bled out gas to production
(1)	(2)	(3)	(4)	(5)	(6)
1970-71 . .	1,41,912	1,02,131	59,348	42,783	41.9
1971-72 . .	,,	88,156	48,272	39,884	45.2
1972-73 . .	,,	1,06,232	66,436	39,796	37.5
1973-74 . .	,,	1,08,903	61,541	47,362	43.5
1974-75 . .	,,	1,02,126	60,353	41,773	40.9
1975-76 . .	,,	1,13,209	72,039	41,170	36.4
1976-77 . .	,,	1,22,959	88,684	34,275	27.9
1977-78 . .	,,	1,21,031	88,111	32,920	27.2

*The effect of small quantity of oxygen in stock has not been taken into account.

NITROGEN

(Quantity in 10^3 NM^3)

1970-71	2,27,760	1,68,850	60,086	108,764	64.4
1971-72	,,	1,48,809	102,359	46,450	31.2
1972-73	,,	1,81,217	100,025	81,192	44.8
1973-74	,,	1,57,688	100,264	57,424	36.4
1974-75	,,	1,54,799	112,813	41,986	27.1
1975-76	,,	1,98,052	153,794	44,258	22.3
1976-77	,,	2,12,339	159,711	52,628	24.8
1977-78	,,	2,01,045	163,024	38,021	18.9

Lower consumption of oxygen and nitrogen was owing to less off-take in L.D. converters and in the Fertilizer Plant.

The Action Committee appointed by Government in December, 1971 to study the working of the Rourkela Steel Plant, had recommended in its report (May 1973) that storage facilities, both for liquid and gaseous oxygen, should be provided in order to meet the requirements of oxygen for the converters and to reduce the loss of oxygen. Accordingly, 4 gaseous oxygen tanks and one liquid oxygen tank were installed and commissioned in April 1976 and July 1976 respectively. The expenditure booked against this scheme upto August 1976 was Rs. 63.10 lakhs.

The Ministry stated (October 1978) that, after the commissioning of storage facilities for liquid and gaseous oxygen in March and July 1976, the bleeding has come down since 1976-77

4.02 *Fuel*

(a) All the units of the Steel Plant which consume fuel for operation, use gas as principal fuel. Gas is a by-product of Coke Ovens and Blast Furnaces.

The production of gas was less than that envisaged in the Project Report as indicated below :—

(Figures in 10^3 NM^3)

Year	Coke Oven Gas		Blast Furnace Gas		Remarks
	D.P.R.	Actual	D.P.R.	Actual	
(1)	(2)	(3)	(4)	(5)	(6)
1970-71 . .	7,53,360	4,87,038	47,47,920	28,00,525	Net after taking in to account losses
1971-72 . .	,,	4,32,738	,,	23,92,871	
1972-73 . .	,,	4,92,737	,,	27,57,378	
1973-74 . .	,,	4,46,172	,,	24,43,400	
1974-75 . .	,,	4,57,415	,,	24,64,643	
1975-76 . .	,,	5,49,782	,,	28,21,775	
1976-77 . .	,,	5,99,547	,,	29,59,116	
1977-78 . .	,,	5,24,851	,,	30,14,864	

The calorific value (K/Cal. per NM^3) of blast furnace gas was also lower than that indicated in the Project Report as will be seen from the following table :—

(K/Cal. per NM^3)

Particulars	As per Project Report	ACTUALS							
		1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Coke Oven Gas	4000	4069	4062	4202	4204	4253	4221	4193	4122
Blast Furnace Gas	1000	945	925	922	907	900	891	905	933

(b) On account of low yield, the requirement of gas in different units of the Steel Plant and the Fertilizer Plant could not be met in full. As a result, the four furnaces of the hot rolling mills were converted to oil firing in 1971 and 1972 at a cost of Rs. 32.97 lakhs (March 1974). The additional expenditure incurred on the consumption of furnace oil *vis-a-vis* coke oven gas in the rolling mills during 1971-72 to 1977-78 amounted to Rs. 9.59 crores.

4.03 *Internal Rail Transport*

The Project Report of 1.8 million tonne stage envisaged the provision of 36 diesel electric locomotives (including three additional locomotives in case the Plant's Railways were required to operate upto the marshalling yard of the Indian Railways at Bondamunda).

The actual number of locomotives with the Plant, requirement on line as assessed by the Management, locomotives under maintenance, repair and overhaul and the actual availability on line during the years 1970-71 to 1977-78 were as follows :—

Year	Requirement on line as assessed by the Management	Actual no. during the year	Under maintenance, repair and overhaul	Actual availability on line
1970-71	35	37	8	29
1971-72	35	35	7	28
1972-73	35	37	10	27
1973-74	35	37	9	28
1974-75	35	41	10	31
1975-76	35	41	6	35
1976-77	35	46	10	36
1977-78	35	46	8	38

Locos were also hired by the Management from the Railways upto 1975-76. The hire charges including hire charges for the "pool through" locos from 1st June, 1975, paid during the period from 1970-71 to 1975-76 amounted to Rs. 130.80 lakhs. The above amount does not include the hire charges of Rs. 15.45 lakhs paid at Barsua Iron Ore Mines during 1970-71 to 1975-76.

In this connection, the Management stated (October 1979) as follows :—

> "Even though the Detailed Project Report envisaged requirement of 36 Nos. of diesel electric locos, the requirement was updated to match the practical working conditions of the plant including the changes in the operating pattern of plant units and railways and the maintenance needs. The National Productivity Council recommended the requirement as 45 Nos. based on above. Consequent to above there had been shortage of locos available for operation which had to be compensated by hiring steam diesel locos to the extent warranted at that time. Payment of charges for railway locos used in "pool through" system introduced following Khandelwal Committee recommendations, has to be viewed from the angle that such a system was necessary to meet the demand pattern of raw materials on Blast Furnace high lines and inability of railways to provide more BOBS wagons in close circuit. While planning internal requirement of locos, this factor of usage of Railway locos has to be taken into consideration and to this extent payment on this account is part of built-in scheme of raw material handling."

The amount of demurrage paid during 1970-71 to 1977-78 together with rate of demurrage charge, number of wagons handled

and the average detention hours per wagon for which demurrage was paid are given below :—

Year	Amount of demurrage paid (Rs. in lakhs)	Rate of demurrage charge (Rs. per wagon)	No. of wagons handled	Average detention hours per wagon for which demurrage was paid
(1)	(2)	(3)	(4)	(5)
1970-71	36.52	16	255826	24
1971-72	39.00	16	241707	26
1972-73	55.31	16	287263	31
1973-74	199.28	50	260361	37
1974-75	146.72	50	277439	26
1975-76	113.83	50	339751	17
1976-77	132.30	50	365796	18
1977-78	116.45	50	349360	17

The Management attributed the following factors for the payment of demurrage :—

(i) The revised free time rules which were made applicable from 1973-74 did not take into consideration the legitimate needs of the steel industry as elaborately presented to the Railways in the form of Memorandum. To this extent, the free time rules were inadequate and, therefore, there is a built-in potential for incidence of higher detention.

(ii) The bunching of wagons by Railways resulted in hold-up of wagons. Railways were not able to synchronise the movement of wagons with the actual requirements of the Plant on a day-to-day basis.

(iii) From May 1973, Railways unilaterally raised the demurrage rate per wagon to Rs. 50 per 4-wheeler from the earlier rate of Rs. 16 per 4-wheeler (an increase by over 300 per cent). The steel industry had approached the Steel Ministry and the Ministry of Railways on the disproportionate increase. The case is still pending.

With a view to reducing the incidence of demurrage, the following steps were taken by the Management from time to time :—

(a) Augmenting the loco power by importing additional locos.

(b) Requesting the Railways to develop the locomotive suitable to meet the requirements of the steel industry, and to increase free time allowed by the Railways.

(c) Instructions were also issued by the Management (July 1973) to the concerned departments with a view to avoiding detention of wagons and other connected matters.

4.04 *Stores and spares*

The value of consumption of stores and spares as compared with the total expenditure incurred on the production of steel during 1970-71 to 1977-78 is given below :—

(Rs. in crores)

Year	Expenditure on stores & spares	Total expenditure	Percentage
(1)	(2)	(3)	(4)
1970-71	12.96	124.54	10.41
1971-72	14.23	126.60	11.24
1972-73	21.40	163.50	13.14
1973-74	24.45	177.30	13.79
1974-75	26.97	220.97	12.21
1975-76	32.14	283.27	11.35
1976-77	54.73	333.01	16.43
1977-78	67.64	397.60	17.01

A committee appointed by Steel Authority of India Limited observed (October 1973) that it should be possible to bring down progressively the consumption of mechanical spares to the extent of 5 to 10 per cent per annum from 1975-76 onwards by introducing systematic forward planning for spares, stores and

tools and regular inspection of machinery, etc. The Management Stated (April 1981) that the desired reduction could be achieved for the years 1975-76 and 1976-77. However reduction in the overall consumption of stores by 5 to 10 per cent per annum could not be achieved due to the following reasons :—

(i) Due to ageing, plant equipment needs more maintenance than in earlier period.

(ii) Additions of new balancing facilities and new units like 5A Battery, Slag Granulation Plant, Spirally welded Pipe Plant, New Soaker Crane and others resulted in additional consumption of spares.

(iii) Price escalation has further increased the cost of spares.

5. *By-Product and other Arisings*

5.01 *By-Products*

5.01.01 In order to recover valuable chemicals from crude coke oven gas and also to remove harmful and corrosive ingredients therefrom, a by-product plant with the following units was installed as part of the main Steel Plant (Cost Rs. 14.58 crores).

Units	Final product produced	Manner of disposal
(1)	(2)	(3)
Ammonium Sulphate Plant	Ammonium Sulphate	Sale
Benzol Rectification Plant	Benzene, Toluene, Xylene, solvent naphtha.	Sale and internal consumption.
Tar Plant	Pitch, Tar-products, Crude Tar oil, Naphthalene, Crude Anthralene, fuel oil, Creosote oil, Wash oil.	Sale and internal consumption.
Sulphuric Acid Plant		Mainly to meet the requirement of sulphuric acid for Ammonium Sulphate Plant and other units of the Steel Plant.

5.01.02 The actual average yield of some principal by-products during 1970-71 to 1977-78 and the norms indicated in the Project Report and those fixed by the Norms Committee appointed by the Company in March 1968 are compared in Annexure XXII. It will be seen that the yield was less (except of coal tar in 1976-77) than the norms prescribed in the Project Report as well as those fixed by the Norms Committee.

The main reasons for low production were as follows :—

(a) Non-availability of coal blend as provided in the Project Report.

(b) Lower availability of gas.

(c) Low volume of gas compressed due to inadequate availability of screw compressors, low yield of ammonium sulphate due to inadequate availability of steam for processing ammonia liquor from the indirect process, and wear and tear of plant and equipment due to corrosion/usage.

5.01.03 *Nephthalene Plant*

The following table indicates the actual production of hot pressed naphthalene and brown naphthalene during 1970-71 to 1977-78 *vis-a-vis* the rated capacity :—

(Figures in tonnes)

Year	Rated capacity		Actual Production		Total
	Hot pressed Naphthalene	Brown Naphthalene	Hot pressed Naphthalene	Brown Naphthalene	
1970-71 . .	5000	2350	875	100	975
1971-72 . .	5000	2350	621	84	705
1972-73 . .	5000	2350	611	152	763
1973-74 . .	5000	2250	897	263	1160
1974-75 . .	5000	2350	1269	44	1313
1975-76 . .	5000	2350	2220	180	2400
1976-77 . .	5000	2350	2927	269	3196
1977-78 . .	5000	2350	2377	309	2686

The Statistical Quality Control Department of the Steel Plant had made a study in May—July 1973, to find out the causes of low production. The Statistical Quality Control Department suggested that (i) attempts should be made to run the re-distillation unit continuously, (ii) arrangements should be made to record and control temperature to avoid production of brown powder, (iii) bagging of finished products should be done daily instead of accumulating it for a few days and (iv) the press should be overhauled.

The Management stated (October 1979) that the suggestions based on the studies have been implemented fully and production has improved considerably.

5.02 *Other arisings*

5.02.01 Scrap is an important arising in the production of steel. It may arise in the form of iron scrap or steel scrap; the former mainly arises in Blast Furnaces, Pig Casting machines, Foundry and in the form of broken moulds and bottom plates in the Steel Melting Shop while the latter mostly arises in the Steel Melting Shop and Rolling Mills. Iron scrap is consumed in the Blast Furnaces and the Steel Melting Shop while steel scrap is mainly consumed in the Steel Melting Shop. According to the Detailed Project Report, the requirement of scrap by the SMS is as follows :—

	(In lakh tonnes)
From Rolling Mills	4.60
Pit side scrap from SMS	0.36
TOTAL	4.96

5.02.02 As stated in paragraph 2.06.01 and paragraph 2.07.01 the arisings of scrap envisaged in the Project Report were as follows :—

	(In lakh tonnes)
(*i*) Pit side scrap at the SMS	0.36
(*ii*) Scrap arising from Rolling Mills	4.69
TOTAL	5.05

The actual arisings of iron and steel scrap in different units of the Steel Plant *vis-a-vis* the quantities indicated in the Project Report for 1.8 million tonne stage, during 1970-71 to 1977-78 are given in Annexure XXIII.

The total arisings of steel scrap in the Steel Melting Shop were more than the quantity envisaged in the Project Report with reference to rated production although the actual production of steel ingots was less than the rated capacity. The Ministry stated (October 1978) that actual scrap arising included scraps recovered from slag by Hecket Process which was not envisaged in the Detailed Project Report. Apart from above, steel scrap arises in the Special Steel Plates Mill also. Till October 1973 these scraps were being despatched to Alloy Steels Plant at Rs. 1,700 p/t (inclusive of excise duty). From November 1973 Alloy Steels Plant refused to take this scrap and, therefore, Management have been trying to dispose it of by sale to outside parties. Some quantity was sold to outside parties and the stock of scrap lying at plant as on 30-4-1978 was about 1,082 tonnes.

5.02.03 *Mill Scale Arisings*

Mill scale is one of the arisings in the rolling mills and is used primarily in the Sintering Plant and Blast Furnace. As stated in paragraph 2.07.01, the quantity of 1,16,260 tonnes represents the mill scale and other loss and this works out to 6.42 per cent of the rollable ingots at full production. The extent of burning loss has not been separately indicated in the Detailed Project Report or by MECON. As mentioned in the Detailed Project Report, 18,000 tonnes were expected to be utilised in the Sintering Plant, 22,000 tonnes in Blast Furnaces and 4,000 tonnes in Steel Melting Shop.

Separate account of mill scale arisings is not kept. Some of the arisings get mixed up with other materials like lubricants etc., thereby making the recovery uneconomical; the removal of such mixed arisings from the shop floor also becomes a problem. Disposal of available mill scale is dependent upon the availability of orders.

The consumption of mill scale arisings during 1970-71 to 1977-78 was, however, of the following order :—

(Figures in tonnes)

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Sintering Plant . . .	9832	2827	3044	2529	1031	4176	9465	30405
Steel Melting Shop . .	615	1065	1472	1372	1590	1522	2773	137
Blast Furnace . . .	2422	162	..	..	..	..	..	7847

The Ministry stated (June 1981) that the consumption of mill scale arising increased considerably in 1977-78.

5.02.04 *Blast Furnace Slag*

(a) The Project Report for 1.8 million tonne stage envisaged the arising of blast furnace slag to the extent of 10.05 lakh tonne annually *i.e.* 63 per cent of hot metal.

The actual arisings of blast furnace slag during 1970-71 to 1977-78 were as follows :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Slag arisings (in lakh tonnes) .	8.58	7.54	9.20	9.12	8.25	9.11	10.36	9.74
Percentage of slag arisings to hot metal	75	78	74	79	69	66	71	73

(b) Blast Furnace slag has different uses in different forms. In the form of granulated slag it can be used for the manufacture of cement while in the form of slag aggregates it can be used as ballast on railway track and for road making.

(c) In February 1968 the Board of Directors of the Company decided to set up a slag granulation plant at Rourkela subject to availability of funds and the Company sought Government's approval for the same. However, in May 1968/November 1968 sale of molten slag was preferred to granulated slag.

In 1970, a contract for the sale of 4.50 lakh to 6 lakh tonnes per annum of molten slag at the rate of Rs. 12 per tonne to Orissa Cement Limited, Rajganjpur for granulation was entered into. As industrial licence was not granted by the Government of India to Orissa Cement Limited for setting up a slag granulation plant, the sale could not materialise.

As Cement Corporation of India Limited—a Government Company—was contemplating to set up a cement plant at Akaltara, the Board of Directors asked the Central Engineering and Design Bureau (now MECON) in February 1972 to prepare a feasibility report for the setting up of a slag granulation plant at Rourkela to meet the estimated annual requirement of 2 to 3 lakh tonnes of granulated slag for the proposed cement plant. In January 1973, the Board approved the proposal to set up a slag granulation plant with a capacity of 9 to 10 lakh tonnes at an estimated cost of Rs. 3.84 crores subject to the following conditions :—

(i) Firm off-take of granulated slag either by the cement factory near Rourkela or by the Cement Corporation of India Limited.

(ii) Feasibility of rail movement of granulated slag.

The proposal was approved by Steel Authority of India Limited in May 1973 and the Slag Granulation Plant was commissioned in 1977 at a cost of Rs. 3.91 crores (April 1978).

The Management stated (October 1979) that, after commissioning of the plant, the utilisation of slag by converting it into granulated form has come up to about two lakh tonnes per year. The major constraint towards higher production was stated to be inadequate availability of railway wagons for its disposal.

6, *Costing system and analysis of cost*

6.01.01 The operations in different units of Rourkela Steel Plant widely differ from one another, extending from extraction of ores and minerals from captive mines to production of iron and steel, recovery of chemicals in by-product plants and manufacturing operations in engineering shops. As a result, unit costing is followed in mines and quarries, process costing in the case of manufacture of iron and steel, by-product costing in by-product plants and job-costing in engineering workshops.

In pursuance of the recommendations made by the Committee on Public Undertakings in its Fifteenth Report (1967-68) standard costing system was introduced in Rourkela Steel Plant from April 1970. Physical norms for consumption of raw materials and services are determined each year. On the basis of budgeted production determined after taking into account the anticipated level of activity and efficiency, cost is estimated for each product at the beginning of the year. The cost so worked out, is treated by the Management as standard cost. Norms are fixed at plant level based on its actual performance and are to be reviewed once in every year so that necessary corrections may be incorporated.

In addition to a monthly cost statement for each unit, an annual cost statement based on financial accounts is prepared. Variance reports analysing the causes of variations on the basis of the standard cost are also prepared every month. In compiling the cost data, expenditure pertaining to abnormal events *e.g.* strike etc. is not segregated (except during SMS roof collapse in 1971-72) but is allocated along with other expenditure to the unit of production.

A comparison of actual cost with the estimated cost indicated that in a number of cases actual cost was higher than the estimated cost.

The extent of variance due to various causes during the years 1973-74 to 1977-78 is indicated in Annexure XXIV.

The increase in actual cost *vis-a-vis* the cost estimated in the beginning of the year has been attributed by the Management (April 1977) to the following reasons :—

(i) Low level of production as compared to standard ;

(ii) Change in machine utilisation; and

(iii) Price variance of raw materials and increase in prices of other items.

6.01.02 *Cost* Vs. *Selling price*

The selling price of standard steel products is fixed from time to time by the Joint Plant Committee, with the approval of Government.

The table below indicates the average net ex-works selling prices of finished products during the years 1970-71 to 1977-78 as a percentage to the cost of production of the relevant year :—

Finished products	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Plates	94.39	76.75	80.92	72.43	69.16	81.01	83.82	75.88
H. R. Coils	120.25	95.95	99.89	102.05	100.67	104.75	104.41	97.02
C. R. Coils	134.31	104.99	112.65	109.45	107.10	109.82	112.29	102.65
C. R. Sheets	127.58	96.99	103.90	103.63	103.47	106.67	101.00	91.64
Galvanised Sheets . . .	126.28	103.23	106.60	114.09	112.97	114.79	109.51	100.28
H. R. Sheets & Plates . .	107.08	87.90	92.60	86.23	98.91	110.76	84.47	78.19
H. R. Silicon Sheets. . .	80.59	61.97	81.93	71.11	81.42	94.11	83.50	820.84

It will be seen that the selling prices fixed by the Joint Plant Committee were less than the cost of production in case of Plates, and H. R. Silicon Sheets in all the years, in H. R. Coils in 1971-72, 1972-73 & 1977-78, in C. R. Sheets in 1971-72 & 1977-78, in H. R. Sheets & Plates in 1971-72 to 1974-75 and 1976-77 to 1977-78. In the case of C. R. Coils and Galvanised Sheets selling prices were higher than the cost of production in all these years.

7. *Manpower Analysis*

7.01 (1) The Detailed Project Report for 1.8 million tonne stage envisaged the employment of 10,600 men in the Works Department but did not indicate the number of men to be employed in other departments. The number of regular men employed in the various departments of the steel plant during 1971-72 to 1977-78 is indicated below :—

No. of men actually in position

Year	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Works Department :							
Executive	1126	1179	1400	1468	1522	1601	1581
Non-executive	19695	20415	21425	21016	22761	23066	23572
TOTAL	20821	21594	22825	22484	24283	24667	25153
Mines/ Quarries							
Executive	78	81	87	94	103	105	101
Non-executive	1945	1965	2043	2106	2164	2694	2637
Total	2023	2046	2130	2200	2267	2799	2738
Administration & Township							
Executive	304	341	352	404	466	478	503
Non-executive	6532	6675	7076	7530	6157	6147	6131
TOTAL	6836	7016	7428	7934	6623	6625	6634

NOTE : The above figures do not include the men employed on construction activities. During 1977-78, 57 executives and 457 non-executives were employed on construction activities.

(2) In November 1968, the staff strength of the Works Department of the Plant was frozen by the Board of Directors at 1,079 executives and 19,573 non-executives. However, the Management intimated (November 1977) that the manpower in the Rourkela Steel Plant was frozen with effect from 31st January, 1969 when the strength in the Works Department was 1998 executives and 19704 non-executives. As a result of study made by the Management in consultation with the Administrative Staff College, Hyderabad, the staff strength of the Works Department was fixed in March 1972 at 20,356 (non-executives). According to subsequent report of the Management submitted to Government (May 1973), the reference to manpower as on 31st December, 1972 was 17950. It will, however, be seen that the actual number of men in position was more than not only the provision in the Detailed Project Report but also the strength fixed in March 1972 and December 1972.

(3) The problem of overstaffing in the Steel Plants was considered by the Committee on Public Undertakings in their First Report (Fifth Lok Sabha September 1971). In June 1972 Government informed the Committee on Public Undertakings that new production incentive scheme which provided sufficient motivations to work with the strength recommended by the Administrative Staff College had been evolved and it was expected that the additional monetary benefits arising therefrom would induce the workers in Works Departments to agree to the shedding of surplus manpower. However, the Management stated (October 1979) that the manpower requirement recommended by the Administrative Staff College could not be implemented due to the fact that revised incentive scheme as suggested by them could not be implemented in the main units of the Steel Plant. As regards General and Township Administration, the Management stated (October 1979) that the manpower is sanctioned on the basis of O&M study and continuous attempts are being made to redeploy the surplus, wherever, they exist.

It will, however, be seen that the staff strength, both in Works Department as well as General and Township

Administration, has been generally increasing except during 1975-76 in the case of Administration and Township.

The increase was attributed by the Management (December 1977) to :—

(i) absorption of temporary and casual workers into the permanent cadre;

(ii) progressive departmentalisation of certain items of work which were hitherto being done through contractors, resulting in an increase in manpower to the extent of 800 as on 30th April, 1978.

(iii) additional activities like expansion of the Special Steel Plant, additional shift in E.R.W. Pipe Plant and expansion of departmental maintenance work-shop; and

(iv) new activities, *e.g.* Capital Repairs Organisation, S.Q.C., Project Engineering, Import Substitution and Market Development.

7.02 *Labour Productivity and Cost*

The Mehtab Committee in its report submitted in 1966 had observed that it should be possible to increase the productivity of works personnel from the then existing level of 55—70 ingot tonnes to about 125 ingot tonnes per man year and above in each steel plant. The Management fixed the target of 95 tonnes per man year for Rourkela Steel Plant. The actual productivity attained during 1970-71 to 1977-78 was 51 tonnes, 41 tonnes, 56 tonnes, 49 tonnes, 48 tonnes, 54 tonnes, 62 tonnes and 56 tonnes per man year respectively.

The cost of labour (direct and indirect) for producing one tonne of ingot steel during 1970-71 to 1977-78 is indicated in Annexure XXV.

8 *Inventory Control*

8.01 Annexure XXVI indicates the inventory holding of the Plant as at the end of 1970-71 to 1977-78.

With a view to improving inventory control, the following action was stated to have been taken by the Plant (December 1977) :—

(a) Setting up planning cells for individual areas to estimate the requirement of items like spares, rolls and refractories.

(b) Setting up a separate cell under the Design Department for standardisation/variety reduction.

(c) Formation of a high level make-buy Committee for proper assessment of quantity required.

(d) Taking up of a micro analysis of all the category of items by the Industrial Engineering Department.

It was also stated that, as a result of the above steps taken by the Management, substantial reduction in inventory holdings had been achieved.

8.02 *Physical verification*

Physical verification of raw materials, stores and spares and finished and semi-finished products is conducted by a separate unit placed under the control of Financial Adviser and Chief Accounts Officer of the Steel Plant. The stores and spares are physically verified on perpetual inventory system so as to cover all the items once in 2 years; the physical verification of raw materials and finished and semi-finished products is conducted on quarterly basis. The results of physical verification conducted during 1970-71 to 1977-78 indicated the following position :—

(Rupees in lakhs)

Year	Stores & Spares		Raw material			Finished/Semi-finished products	
	Excess	Shortage	Excess	Normal shortage	Shortage in excess of norm	Excess	shortage
1970-71	0.37	0.61	..	75.57	14.48	90.09	130.51
1971-72	..	..	32.26	72.60	81.29	73.70	182.41
1972-73	0.26	0.19	..	16.10	13.83	199.85	248.63
1973-74	1.17	0.51	92.19	67.19	5.92	405.59	194.71
1974-75	2.80	0.68	181.70	125.82	189.93	462.72	167.84
1975-76	3.53	1.24	155.79	207.26	117.96	530.17	81.60
1976-77	6.06	2.36	44.51	190.44	54.39	444.39	321. 48
1977-78	7 67	2.82	77.10	237.42	130.27	511.21	175. 89

NOTE : From 1972-73 onwards the excess/shortages found in stockyards and export yards are also included in the above figures.

Shortages in raw materials to the extent indicated below are treated by the Management as normal loss and charged to consumption without further investigation.

	Percentage of total receipt
Coal	5
Iron Ore	4
Other raw materials	2

Shortages in excess of these norms are also charged to consumption during the year but are investigated.

During 1971-72, shortages noticed in coking coal were to the extent of 8 per cent of the quantities received. It was stated by the Management (April 1973) that during the past few years, weighment of wagons containing washed coal was not made due to inadequate weighing facilities ; test weighment has started since April 1975. In the case of bauxite, 20 per cent of incoming wagons are required to be weighed. However, only 9.3 per cent and 25 per cent of the bauxite wagons were weighed in 1970-71 and 1971-72; no weighment was done during 1972-73 and 1973-74 as only four wagons and two wagons were received during these years. No bauxite wagons were received from 1974-75 onwards.

In this connection, it may be mentioned that all the incoming wagons of raw materials are not weighed by the Steel Plant and only test weighment is made. For the purpose of accounting, the receipt of raw materials is adjusted on the basis of Railway receipts. Issues are based on test weighment.

9. *Profitability Trends*

(1) The following table indicates the working results of the Plant for the last eight years ending 30th April 1978 :—

(Rupees in crores)

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Profit (+)/Loss (—) . .	(+)10.20	(—)6.89	(+)1.18	(+)9.74	(+)18.14	(+)28.33	(+)25.99	(+)19.10
Cumulative Loss (—)/Profit (+) up to the end of the year .	(—)22.00	(—)28.89	(—)27.71	(—)17.97	(+) 0.17	(+)28.50	(+)54.49	(+)73.59

As against an investment of Rs. 387.86 crores referred to in paragraph 1, the Plant had earned a cumulative profit of Rs. 73.59 crores upto 30th April, 1978, since its commissioning in November 1962.

The above working results include profit (+)/loss (—) on common trading activities such as canalised imports of steel, export of other than the Hindustan Steel Limited products etc., the data available for these activities for the period 1973-74 to 1977-78 were as follows :—

(Rs. in crores)

Year	1973-74	1974-75	1975-76	1976-77	1977-78
Profit (+)/Loss (—)	(+)2.25	(+)2.49	(+)2–87	(—)0.66	(—)1.45

(2) An analysis of the cost of sales for the last six years ending 30th April, 1978 (given below) indicated that the cost of sales as percentage of net sales showed a downward trend upto 1975-76 and it rose thereafter :—

(Rs. in crores)

Year	Gross sales	Deduction on account of excise duty, freight outward, ocean freight, etc.	Net sales realisation	Add : Loss (—)/ Deduct : Profit (+)	Cost of sales	Percentage of cost of sales to net sales realisation
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1972-73	152.24	41.61	110.63	(+)0.42	110.21	99.6
1973-74	162.86	43.71	119.15	(+)7.42	111.73	93.8
1974-75	221.03	54.12	166.91	(+)15.53	151.38	90.7
1975-76	259.79	69.52	190.27	(+)25.24	165.03	86.7
1976-77	337.49	78.36	259.13	(+)26.19	232.94	89.9
1977-78	396.65	84.03	312.62	(+)19.68	292.94	93.7

10. *Rourkela Fertilizer Plant*

10.01 With a view to making use of hydrogen from coke oven gas and surplus nitrogen from the Oxygen Plant gainfully, the Fertilizer Plant at Rourkela was installed with a designed capacity to produce 5.60 lakh tonnes of Calcium Ammonium Nitrate CAN (with 20.5 per cent nitrogen) and was commissioned in November 1962 at a cost of Rs. 26.22 crores (including township and Naphtha Reforming Plant installed subsequently). With effect from 1st January, 1969 the plant started producing enriched fertilizer having 25 per cent nitrogen with reduced rated capacity of 4.60 lakh tonnes, the total nutrient in the form of nitrogen remaining the same.

The Plant was installed on the expectation that 70,000 NM^3 per hour of coke oven gas with 59.2 per cent hydrogen (42,000 NM^3 of hydrogen per hour) would be available. As the actual supply of coke oven gas from coke oven batteries was far below the requirement, the hydrogen content (51 per cent to 52 per cent) was lower than what was envisaged in the Project Report. A naphtha reforming unit was installed in 1968 at a cost of Rs. 3.84 crores to produce 18,500 NM^3 per hour of reformed gas so as to meet 40 per cent (*i.e.* 16,000 NM^3 per hour) of the requirement of hydrogen, the balance requirement of hydrogen was to be met from 48,500 NM^3 of coke oven gas from coke oven batteries. The Naphtha Reforming Plant had, however, certain initial operational difficulties and on 18th May, 1969 (*i.e.* within 4½ months of its commissioning), there was an explosion in the reforming furnace. The furnace was rebuilt at a cost of Rs. 43.87 lakhs out of which Rs. 29.64 lakhs (equivalent to D.M.—702414.25) was borne by the Contractor M/s. C. Otto and Company Gmbh West Germany. The Naphtha Reforming Plant remained under trial run from August 1970 to February 1971 and commercial production started from 27th February, 1971. The loss arising from the explosion was considered by the Committee on Public Undertakings in para 8.26 to 8.29 of its 1st Report (Fifth Lok Sabha 1971-72).

10.02 *Production Performance*

10.02.01 As against the rated capacity of 4.60 lakh tonnes, actual production during 1971-72 to 1977-78 was as follows :—

(Figures in lakh tonnes)

Year	Actual Production		Total	Percentage of actual production to rated capacity	Remarks
	From coke oven gas	From Naphtha reformed gas			
(1)	(2)	(3)	(4)	(5)	(6)
1971-72	0.58	1.27	1.85	40	The management stated that some non-fertilizer products like ammonium nitrate, ammonia and nitric acid are also sold and the CAN (with 25 per cent nitrogen) equivalent of the above intermediate products can be taken as 20,000 tonnes.
1972-73	0.59	1.37	1.96	43	
1973-74	0.67	1.17	1.84	40	
1974-75	0.90	1.55	2.45	53	
1975-76	1.57	1.52	3.09	67	
1976-77	1.70	1.48	3.18	69	
1977-78	1.43	1.45	2.88	63	

The shortfall in production was attributed by the Management (December 1974, September 1975, December 1976 and October 1979) to the following main reasons :—

(a) Inadequate supply of coke oven gas from coke oven batteries of the Steel Plant.

(b) Intermittent supply of nitrogen from Oxygen plant of the Steel Plant.

(c) Power failures/restrictions.

10.02.02 (1) The actual supply of coke oven gas by the Steel Plant and the reformed gas by the Naphtha Reforming Unit of the Fertilizer Plant are indicated below .—

Year	Supply of coke oven gas by Steel Plant per hour		Supply of reformed gas by Naphtha Reforming Unit per hour	
	Expected supply (NM^3)	Actual supply (NM^3)	Expected supply (NM^3*	Actual supply (NM^3)
(1)	(2)	(3)	(4)	(5)
1971-72	48,500	10,985	18,500	12,948
1972-73	48,500	11,100	18,500	14,265
1973-74	48,500	12,280	18,500	14,200
1974-75	48,500	15,850	18,500	15,070
1975-76	48,500	27,760	18,500	17,427
1976-77	48,500	29,400	18,500	14,700
1977-78	48,500	27,100	18,500	16,100

*The Management stated (October 1979) that the hourly rate of production of Naphtha gas at 100 per cent capacity is 18500 NM^3/hr. However, the Naphtha Plant is designed to run only for 330 days in a year, 35 days being the turn out for the boiler inspection, catalyst changing etc. As such, the expected average hourly supply taking these factors into account on a 365 days basis is $\frac{18500 \times 330}{365}$ or 16700 NM^3.

(2) So far as shortfall in supply of coke oven gas is concerned, a reference is invited to para 2.02.02 where production of gas from the Coke Ovens has been dealt with. The Management stated (December 1976) that consequent on the installation and commissioning of half coke oven battery V-A in September 1974, the supply of coke oven gas to the Fertilizer Plant has improved. However, in some months the average supply of gas was somewhat restricted due to power failures and power restrictions.

The Management further stated (October 1979) that the supply has been steadily stepped up from the earlier years and stabilised around an average of 27000—30000 NM^3/hour which would have been still higher but for the restrictions in coal availability, coal movement, wagons problems, quality of coal, power restrictions etc. during the past couple of years.

10.02.03 Consumption of raw materials

(a) The table below indicates the actual consumption of raw material per tonne of CAN (25 per cent N) as compared to the norms fixed by the Designers as well as the Plant Management, during the period 1971-72 to 1977-78 :—

Raw materials	Unit	Norms fixed by the Designers	Norms fixed by the Plant	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
(1)	(1a)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ammonia	Tonne	0.158	0.160	0.166	0.165	0.164	0.162	0.161	0.160	0.161
Nitric Acid (53 per cent)	Tonne	1.100	1.100	1.148	1.145	1.136	1.127	1.113	1.115	1.120
Lime stone	Tonne	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Power	KWH	N.A.	41	50	46	53	49	43	41	43

The consumption of ammonia and nitric acid was more than both the Designers' norm as well as the Plant's own norm.

The Management stated (October 1979) as follows :—

> "The design norms are achieved only when the other units run at full load all the time. When there are interruptions due to various reasons like power failure, input restrictions etc. the design norm will not be attainable. Whenever units run on full load, we have been able to attain the design norm and in some cases improve upon it. The actual attained given above compared well with the design norms considering various interruptions and constraints in which the production has been achieved."

(b) As a result of excess consumption of ammonia and nitric acid, the extra incidence on cost per tonne of CAN (25 per cent N) during the above period was as follows :—

Year	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Ammonia	3.75	3.69	2.85	1.65	1.02	..	1.23
Nitric Acid	6.33	6.99	5.27	4.30	2.71	3.41	5.20

(c) The specific consumption of raw materials for production of one tonne of ammonia compared to the norms fixed by the Designers as well as the Plant Managemnt during the above period was as indicated in Annexure XXVI.

The consumption of coke oven gas in 1971-72, 1972-73, 1975-76 and 1977-78, of crude naphtha in 1972-73, 1973-74 and 1976-77 and that of power in all the years was more as compared to the norms fixed by the Plant Management and the Designers.

10.02.04 *Working hours and down-time*

It was stated by the Management (December 1977) that the available number of working days indicated by the Designers and accepted by the Plant is 300 days in case of Nitrolime-stone

Plant and 330 days in the case of other units of the Fertilizer Plant.

Annexure XXVIII indicates the total standard hours of working as indicated by the Designers and accepted by the Management, the available hours, the actual working hours, down-time and analysis of the down-time during 1971-72 to 1977-78. It will be seen that the actual working hours were lower than the standard hours in all the years in respect of all the units except Naphtha and Ammonia Plants in 1977-78.

10.02.05 *Cost of Production*

(a) The cost of production was more than the net sales realisation during 1971-72 to 1973-74 and 1977-78. It was, however, less than the net sales realisation during 1974-75 to 1976-77. The high cost of production was attributed by the Management (December 1976) to the following factors :—

(i) escalation in raw material price and working of the Plant below capacity,

(ii) frequent shutdown and change in the heating system of Naphtha Reforming Plant (1973-74).

It will be seen from paragraph 10.02.03 that higher consumption of raw materials as compared with the norms also contributed to increase in the cost of production.

(b) Coke Oven Gas and Naphtha are the main ingredients for the production of CAN ; their cost during above period was as under :—

Year	Coke Oven Gas Rs. per 10^3NM^3		Naphtha (Rs. per tonne)	
	Standard	Actual	Standard	Actual
1971-72	*	128.00	*	236.32
1972-73	173.28	173.28	243.50	245.96
1973-74	155.00	148.00	243.50	318.60
1974-75	148.00	267.33	356.86	562.26
1975-76	258.00	290.95	617.00	667.88
1976-77	308.00	308.00	725.00	726.61
1977-78	308.00	469.84	740.00	730.12

*Standard costing was introduced in the Plant from 1972-73.

(c) The fixed cost per tonne of CAN (at Silo) and the increased incidence on account of difference in capacity utilisation between planned and actual (excluding expenditure variance) during the period 1971-72 to 1977-78 was as follows :—

Year	Fixed cost per tonne of CAN at Silo		
	At planned level (Rs.)	Actual (Rs.)	Extra incidence (Rs.)
1971-72	*	225.04	*
1972-73	181.84	201.79	(+)19.95
1973-74	151.65	236.22	(+)84.57
1974-75	133.85	176.15	(+)42.30
1975-76	159.00	146.05	(—)12.95
1976-77	139.49	144.73	(+)5.24
1977-78	108.92	149.73	(+)40.81

*Standard Costing was introduced in the Plant from 1972-73.

10.02.06 The Plant had been incurring loss since inception upto 1973-74. During 1974-75 to 1977-78, however, it earned profit. The table below indicates the profits/losses earned/incurred during the years 1970-71 to 1977-78 :—

(Rupees in crores)

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Profit (+)/Loss (—)	(—)2.60	(—)1.71	(—)2.12	(—)1.20	(+)2.71	(+)2.41	(+)2.70	(+)2.60

The accumulated loss as on 30th April 1978 amounted to Rs. 9.49 crores.

11. *Overall Summary*

The important features emerging out of the detailed analysis given in the preceding paragraphs are indicated below :—.

1. *Introduction*

The Hindustan Steel Limited (HSL)—a wholly owned Government Company, was registered on 19th January, 1954 for the construction and management of Rourkela Steel Plant. The Plant remained a constituent unit of HSL (which had become a subsidiary of the Steel Authority of India Limited with effect from 21st March, 1973) upto 30th April, 1978. On the enactment of the "Public Sector Iron & Steel Companies (Restructuring) & Miscellaneous Provisions Act 1978", HSL was dissolved and Rourkela Steel Plant became a constituent unit of the Steel Authority of India Limited (SAIL) from 1st May, 1978.

Capital cost incurred on completion of initial as well as expansion stages of the Plant together with production capacity were as follows :—

Capacity	Date of Completion	Capital cost (Rs. in crores)
1 Million tonnes of steel ingots (0.715 Million tonnes of saleable steel) . .	November 1962	220.10
1.8 Million tonnes of steel ingots (1.225 million tonnes of saleable steel) . .	February 1969	160.21
Special Steel Plate Plant with a capacity of 1539 tonnes of fully machined plates, equivalent to 120 sets per year . .	1969-70 (Original)	7.55
(Further expanded to 150 Sets) . .	November 1974 (Expansion)	
		387.86

In addition to the steel plant complex, a Fertilizer Plant based on coke oven gas was also set up by November 1962 at a cost of Rs. 26.22 crores to produce calcium ammonium nitrate.

2. *Production Performance*

1. *Steel Plant Complex*

(i) *Overall analysis*

An analysis of over all production performance for the years 1970-71 to 1977-78 revealed that the production of ;

(a) steel ingots ranged from 45.7 per cent to 83.5 per cent of the capacity of 1.8 million tonnes ; and

(b) that of saleable steel ranged from 48.7 per cent to 96.2 per cent of the capacity of 1.225 million tonnes.

Production of steel ingots and saleable steel was also less than the budgeted production (which was lower than the rated capacity) except in 1976-77 in the case of steel ingots and in 1975-76 to 1977-78 in case of saleable steel.

According to the Plant Management, external (shortage of power and difficulties in movement of raw material and shortage thereof) and internal causes (industrial disputes, break-downs and Shut-downs over the planned down time, etc.) accounted for an output loss of 4.01 lakh tonnes of pig iron and saleable steel valued at Rs. 28.09 crores, during 1973-74 to 1977-78.

(ii) *Unit wise performance*

The performance of main and auxiliary units of the Plant was as follows :—

(A) *Coke Oven Batteries*

There are 4½ coke oven batteries (including ½ battery commissioned in September 1974 to take care of repair programme of the existing batteries without affecting production), having an input capacity of 23.80 lakh tonnes of coal (dry basis) expected to yield 17.36 lakh tonnes of coke of different sizes (dry basis). A productivity and efficiency analysis of these batteries indicated

that, despite charge rate of coal per oven being more than the project norm, the production of coke was below rated capacity as well as budgeted production (except in 1972-73) due to :

— low availability of ovens caused by running (major and capital) repairs and rebuilding programmes and longer coking time.

— lower pushing rate caused mainly by longer coking time which accounted for a loss of production of 25.76 lakh tonnes of blast furnace coke.

— short and erratic supply of coal both quantitatively and qualitatively.

The other important aspects of the operation of the batteries were :

— while yield of blast furnace grade coke during these years was more than the project norm (62 per cent of coal charge) except in 1977-78, it was below the norm (66 per cent of coal charge) fixed by the Norms Committee in 1968.

— yield of coke oven gas per tonne of coal charged was less than the project norm as well as the norm fixed by the Norms Committee, except in 1976-77 when it was equal to the norm fixed by the Committee.

— deterioration in the condition of coke ovens which was ascribed by the various Committees to lack of good house keeping and preventive maintenance as well as lack of observance of proper operating and maintenance practices.

— the coal blend did not conform to the ratio prescribed by the various committees, which affected the operation of Blast furnaces, Rolling Mills and Fertilizer Plant. Besides, average ash content of coal charge was not only higher than the project norm, but also showed a deteriorating trend. This

also resulted in ash content in the blast furnace coke being higher than the project norm as well as norms fixed by Norms Committee.

(B) *Blast Furnaces*

There are 4 blast furnaces (3 small and 1 big) with a production capacity of 16 lakh tonnes of hot metal (15.25 lakh tonnes basic grade, with silicon content upto 1.25 per cent, and 0.75 lakh tonnes of foundry grade with silicon content more than 1.25 per cent). Notable features of hot metal production during 1970-71 to 1977-78 were :

— Total production, though less than the rated capacity, picked up during 1975-76 and reached the peak of 91.4 per cent in 1976-77. It included production of foundry grade hot metal which was more than the rated capacity in 1970-71 and 1971-72 and also more than the budgeted production during 1970-71 to 1973-74. Besides, production included off grade hot metal ranging between 0.13 and 0.72 lakh tonnes upto 1975-76. (Data for basic, foundry and off grade not maintained thereafter).

— There was delay in the completion of renovation of stoves of all the 3 blast furnaces (built in 1 million tonne stage) which was approved by the Board in May 1972 at an estimated cost of Rs. 6 crores following the premature collapse of refractory checker including support of blast furnace No. 3 and was to be completed within 3 years. Work was completed by March 1980. Off grade metal was processed in Steel Melting Shop alongwith the other hot metal instead of the Pig Casting Machine. Apart from involving additional cost to avoid total rejection of steel ingots produced therefrom it also adversely affected the life of hot metal ladles, which, by and large showed a declining trend.

— In terms of Fe content, actual consumption of iron ore, sinter etc. taken together, per tonne of hot metal, was more than that envisaged in the project report as well as by the Norms Committee, in all the years. Owing to low availability, the quantity of sinter used was very low upto 1974-75 and increased thereafter.

— Productivity of both the small and big furnaces was less than the project norm.

— Sintering plant was set up in February 1965 with a rated capacity of 1.2 million tonnes of sinter per annum to utilise the iron ore fines produced in the course of mining of iron ore. Actual production of sinter during 1970-71 to 1977-78 was less than the rated capacity as well as the budgeted production (except during 1975-76 and 1976-77 in regard to budgeted production).

— There was accumulation of fines (22 lakh tonnes) at Mines partly due to poor working of the Sintering Plant and partly due to adverse fine to lump ratio.

— Anticipation that with higher use of sinter, consumption of coke would be less, did not materialise during 1975-76 and 1977-78.

(C) *Steel Melting Shop*

The Shop has a rated capacity of producing 18 lakh tonnes of steel ingots [2.5 lakh tonnes in 4 open Hearth Furnaces and 15.5 lakh tonnes in 5 L.D. Converters (out of which 3 are expected to be in continuous operation)]. Actual production during 1970-71 to 1977-78 was below the rated capacity as well as budgeted production (except in 1976-77). Production reached the peak (15.03 lakh tonnes) in 1976-77.

The shortfall in production with reference to rated/budgeted production was more pronounced in the case of L.D. Converters and was caused by :

— Lower availability of furnaces/converters caused by longer tap to tap time and extra time spent on repairs due to wide variance in the lining life. It accounted for a loss of production of 31.62 lakh tonnes (in OH furnaces 3.63 lakh tonnes and in LD converters 27.99 lakh tonnes) during 1970-71 to 1977-78.

— Lower productivity in LD Converters on account of lower weight per below as compared with the project norm, accounting for a loss of production of 20.70 lakh tonnes of steel ingots during 1970-71 to 1977-78.

— While the actual consumption of major raw materials per tonne of steel ingots was generally more than the project report norms as well as norms fixed by the Norms Committee (except in the case of scrap consumed in O.H. Furnaces), the metallic yield was below the norms envisaged in the project report as well as fixed by the Norms Committee. Short recovery in terms of steel (after taking into account excess recovery of scrap recovered) during 1970-71 to 1977-78 worked out to 3.25 lakh tonnes of steel, valued at Rs. 35.71 crores, as compared with project norm.

— Actual loss of hot metal in transit was more than the project norm by 2.86 lakhs tonnes valued at Rs. 2.23 crores during 1970-71 to 1977-78.

— There was excessive consumption of ingot moulds and bottom plates as well as ferro-manganese, with reference to norms, involving an extra expenditure of Rs. 8.93 crores (Rs. 3.43 crores for ingot moulds and bottom plates and Rs. 5.50 crores for ferro-manganese) during 1970-71 to 1977-78.

(D) *Rolling Mills*

As against the input of 18 lakh tonnes of steel ingots and 0.11 lakh tonnes of Zinc and tin, the Rolling Mills are designed to produce 12.25 lakh tonnes of saleable products and the difference 5.86 lakh tonnes represents scrap arising of 4.69 lakh tonnes (25.90 per cent of the input), and the burning and scale losses 1.16 lakh tonnes (6.42 per cent of the input). An analysis of the performance of Rolling Mills (Blooming and Slabbing Mill, Plate Mill, Hot Strip Mill, Electrical Sheet Mill, Cold Rolling Mill) for the years 1970-71 to 1977-78 indicated that none of the mills had operated at full capacity (except Plate Mill during 1976-77 and 1977-78), partly on account of non-availability of the feed stock and partly on account of other reasons. Mill-wise performance was as follows.

— Scrap arisings exceeded the project norms in case of Blooming and Slabbing Mill, Electrical Sheet Mill and Pipe in all the years. Scale and other losses exceeded the project norm in the case of Plate Mill, Hot Strip Mill, Electrical Sheet Mill and Cold Rolling Mills.

— The Committee appointed by the General Manager to enquire into the causes of breakdown in the Plate Mill in October 1970 had pointed out lapses in the maintenance, in spite of the experiences of previous breakdowns in 1968 and 1970.

— An Electrical Sheet Mill, having a capacity of producing 50,000 tonnes of hot rolled electrical sheets of both the transformer grade and dynamo grade, was installed and commissioned by March/ November 1968 at a cost of Rs. 6.30 crores. On account of various inconsistencies, the Mill capacity had to be reduced to 30,000 to 35,000 tonnes. The production was much less than the reduced capacity resulting in fixed expenditure to the extent of Rs. 10.94 crores remaining unabsorbed during 1968-69 to 1977-78. Further, entire production was of dynamo grade quality only, thereby rendering the payment towards know-how and certain facilities (cost not known) provided for manufacture of transformer grade steel as unproductive.

— Six Hot Dip Tinning Lines were installed in one million tonne stage at a cost of Rs. 1.46 crores to produce 50,000 tonnes of tin plates. Owing to capacity being un-economical and non-availability of sufficient cold rolled sheets, 3 lines were closed in May 1975 and the remaining 3 in September 1976. These were disposed of in August 1979 and March 1980 at a price of Rs. 10.98 lakhs.

Special Steel Plates Plant

Upto 1975-76, the actual production of heat treated plates was low as compared to rated capacity (120 sets upto November 1974 and 180 sets from November 1974 onwards). As a result of poor performance of the plant, 190 sets of plates at a cost of Rs. 3.60 crores had to be imported by Government during 1970-71, 1973-74 and 1974-75. In addition, 1,000 tonnes of spade ingots at a cost of Rs. 55.74 lakhs were also imported in 1974.

(E) *Mines*

Plant has its own captive mines for meeting its requirement of raw materials other than coal. The important features noticed in the operation of iron ore and lime stone—two major raw materials—mines were as follows :—

Iron ore mines

— As against the capacity of 2.8 million tonnes of iron ore per year of Barsua Mines (fully mechanised), actual production ranged between 9.34 lakh tonnes and 15.73 lakh tonnes during 1970-71 to 1977-78. Besides, lump and fine ratio of the ore mined had deteriorated over the years.

A beneficiation plant was commissioned in 1970 at a cost of Rs. 4.09 crores with a view to improving quality of iron ore by increasing the Fe content in lump ore by 1 to 1.5 per cent and in fines by 3 to 4.5 per cent. The Plant, however, remained substantially under-utilised because of unfavourable disposition of beneficiable ore to direct ore and lack of water. To improve the performance of the plant additional facilities including those for make-up water were provided between August 1976 and December 1980

— In addition to Barsua mechanised mines, Kalta Iron Ore mine was operated manually. Actual production in this mine ranged from 2.08 lakh tonnes to 6.32 lakh tonnes during 1970-71 to 1977-78.

Owing to low production of lump ore in the mechanised and manual mines, the Plant had to purchase considerable quantities of iron ore from outside sources at a higher cost

Lime stone mine

— Production in the Purnapani and Satna lime stone mines, was below the rated/budgeted production, *inter alia* owing to low off-take of lime stone by the Plant.

Further, supply of —6 mm fines had to be procured from outside sources at a higher cost on account of non-synchronisation of installation of Sintering Plant Crushers.

(F) *Services and Fuel*

Steam.—On account of non-availability of fules in the proportion envisaged in the Project Report, other costly fuels had to be used for the production of steam which resulted in an extra expenditure of Rs. 13.15 crores during the years 1970-71 to 1977-78.

— The heat consumption per kg. of steam during 1970-71 to 1977-78 increased progressively resulting in decline in thermal efficiency of boilers.

— Even after rectifications made in the steam pipeline in 1970-71, the leakage of steam in the steam pipeline continued and that too on an ascending scale. The loss of steam worked out to 5.24 lakh tonnes valued at Rs. 1.76 crores during 1970-71 to 1977-78.

Power generation.—Against the rated capacity of 128 MW (including 25 MW of a standby generator) of the captive Power Plant, the actual generation during 1970-71 to 1977-78 ranged between 50 and 67 MW only.

— The consumption of steam per MWH of electricity generated was more than the project norm except in 1976-77.

— Unlike Bhilai and Durgapur Steel Plants, transmission loss of electricity generated and purchased was not worked out/computed.

— Although the boilers of the power plant are designed to use slack coal, substantial quantities of metallurgical coal involving an extra expenditure of

Rs. 1.53 crores were used during the years 1969-70 to 1977-78 due to space limitation for boiler coal. As a remedial measure, a new boiler coal yard has been developed by July 1977 at a cost of Rs. 25.36 lakhs in a nearby place.

Oxygen and nitrogen.—The oxygen and nitrogen actually produced, though much less than the rated capacity, could not be utilised in full on account of less off-take of oxygen in L.D. Converters and of nitrogen in the Fertilizer Plant. As a result, substantial portion of oxygen (ranging from 27.2 per cent to 45.2 per cent of production) and nitrogen (ranging from 18.9 per cent to 64.4 per cent of production) had to be blend out during 1970-71 to 1977-78. Based on the recommendations of the Action Committee appointed by the Government in December 1971, storage facilities for liquid gaseous oxygen were installed in 1976 at a cost of Rs. 0.63 crore.

Fuel.—On account of low quantum of blast furnace and coke oven gas, the requirement of gas in different units of the Steel Plant and the Fertilizer Plant could not be met in full. As a result, the 4 furnaces of the hot rolling mills were converted into oil firing in 1971-72 at a cost of Rs. 32.97 lakhs. Switch over from coke oven gas to fuel oil involved an extra expenditure of Rs. 9.59 crores during 1970-71 to 1977-78.

By-Products

In order to make use of blast furnace slag, a Slag Granulation Plant with a capacity of 9 lakh tonnes per annum was commissioned in 1977 at a cost of Rs. 3.91 crores. Actual utilisation of the Plant had come upto 2 lakh tonnes; the limiting factor being inadequate availability of railway wagons.

Cost versus *selling prices*

Cost of production of plates and HR silicon sheets was more than the average net ex-works realisation during 1970-71 to

1977-78; it was also more in the case of HR coils during 1971-72, 1972-73 and 1977-78, in the case of CR sheets during 1971-72 and 1977-78 and in the case of HR sheets and plates during 1971-72 to 1974-75 and 1976-77 to 1977-78. However, the cost of production was less in the case of CR coils and galvanised sheets during 1970-71 to 1977-78.

Man Power Analysis

Actual strength in works department of the Plant was not only more than the provision in the Project Report but was also more than that fixed by the Board/Management.

The actual labour productivity during 1970-71 to 1977-78 ranged from 41 tonnes to 62 tonnes per man year as against 125 tonnes fixed by the Mehtab Committee in 1966 and 95 tonnes fixed by the Plant.

Inventory Control

In view of test weighment of incoming raw materials, accountal thereof was made on the basis of weight indicated in the Railway Receipts. Consequently, handling and transit losses could not be ascertained.

The total value of idle equipment awaiting disposal amounted to Rs. 0.99 crore.

Profitability Trends

The Plant had incurred losses in 1970-71 to 1973-74 but earned profits during 1974-75 to 1977-78. As against the total investment of Rs. 387.86 crores, the cumulative profit since its commissioning in November 1962 to 30th April 1978 amounted to Rs. 73.59 crores. This has to be viewed in the context of observations made above.

II. *Rourkela Fertilizer Plant*

With a view to making use of hydrogen from coke oven gas and surplus nitrogen from Oxygen Plant gainfully, the Fertilizer Plant, at Rourkela, with a designed capacity to produce 5.60 lakh tonnes of calcium ammonium nitrate (CAN) with 20.5 per cent nitrogen (reduced to 4.60 lakh tonnes with 25 per cent nitrogen content from 1969) was commissioned in November 1962 at a cost of Rs. 26.22 crores (including township and Naphtha Reforming Unit installed in 1968).

An analysis of the performance of the Plant indicated the following :—

— As the actual supply of coke oven gas from Coke Oven Batteries (quantitatively and qualitatively) was below the anticipation made in the Detailed Project Report, a Naphtha Reforming Unit was installed in 1968 at a cost of Rs. 3.84 crores to produce 18,500 NM^3 per hour of reformed gas so as to meet 40 per cent of the total requirement of hydrogen, the balance 60 per cent to be met from coke oven gas. Notwithstanding this, actual production ranged from 40 per cent to 69 per cent of capacity during 1970-71 to 1977-78. This was mainly due to inadequate supply of coke oven gas even with reference to the reduced requirement. Supply of coke oven gas during this period ranged from 10,985 NM^3 to 29,400 NM^3 as against the reduced requirement of 48,500 NM^3. Thus, a Plant based on coal, had to switch was to naphtha for meeting its major requirement of gas for producing fertilizers.

— The consumption of ammonia and nitric acid was more than both the Designers' norm as well as the Plants' own norm; extra incidence on this account

ranged between Rs. 3.41 and Rs. 10.68 per tonne during the years 1971-72 to 1977-78.

— The cost of production of CAN per tonne was more than the net sales realisation during 1971-72 to 1973-74 and 1977-78. It was, however, less than the net sales realisation during 1974-75 to 1976-77.

— The Plant had been incurring loss since inception upto 1973-74; during 1974-75 to 1977-78, however, it earned profit. The cumulative loss upto 30th April 1978 amounted to Rs. 9.49 crores.

(P. P. GANGADHARAN)
Chairman, Audit Board and Ex-officio Additional Deputy Comptroller and Auditor General (Commercial)

New Delhi
The 30 November, 1981.

Countersigned

(GIAN PRAKASH)
Comptroller and Auditor General of India.

New Delhi
The 30 November, 1981.

ANNEXURE I

(Referred to in paragraph 1)

SUB : *Statement showing the main units of the integrated steel plant, their rated capacities, main inputs and outputs as per DPR and as modified on installation of the Pipe Plant.*

(In lakh tonnes)

Sl. No.	Unit	No.	Rated capacity			Remarks
			Input	Output	Distribution of output	
1	2	3	4	5	6	7
1.	Coke Oven Batteries	4	23.80-Coal (Dry)	17.36—Coke	0.16 (above 100 mm)—for Foundry; to be crushed for use in Blast Furnaces when not required in the Foundry. 14.60 (above 40 mm)—for Blast Furnaces. Out of this 0.20 lakh tonnes of breeze coke arises at the screen in the Blast Furnaces and is used in the Sintering Plant; balance 14.40 lakh tonnes is charged to the Blast Furnaces. 0.52 (20–40 mm)—According to DPR it was proposed to provide facilities to crush this to 0.10 mm size to be used in the Power Plant and in the meantime, this fraction would be utilised partly in the Blast Furnaces and partly for sale to employees for domestic consumption in	

				the township. The Management stated (November 1977) that this is not used in the Power plant. 2.08 (0—20 mm)—Out of this 1.12 lakh tonnes are meant for the Sinter Plant and 0.96 lakh tonnes are meant for the Power Plant. 10–20 mm size coke crushed to 0–10 mm size for use in the Sintering Plant, Power Plant or the Coke Oven Plant for blending.
2. Sintering Plant	1	10.08–Iron or fine (with 2 strands) 1.32–Coke breeze 0.64–Flue dust 0–18–Mill scale 1.65–Lime-stone 1.65–Dolomite	12.00–Sinter	The entire quantity is used in the Blast Furnaces.
3. Blast Furnaces	4	13.93–Iron Ore 12.00 Sinter 3.97–Lime stone 14.40 Coke 1.01 Dolomite 1.36 Manganese Ore 0.63 Quartsite	16.00 Hot Metal	(*i*) 15.25—to Steel Melting Shop (*ii*) 0.75—Pig Casting Machines.
4. Pig Casting Machines	2	0.75 Hot Metal	0.75	To Foundry

1	2	3	4	5	6	7
5. Steel Melting Shop		5 L.D. converters	14.15 Hot Metal 3.37 Scrap	15.50	To Rolling Mills	Out of 15.25 lakh tonnes of hot metal received from the blast furnaces, 8,000 tonnes represent loss at the mixers.
		4 O.H. Furnaces	1.02—Hot metal 1.23—Scrap 0.36—Pit side scrap 0.18—Feed ore	2.50	—do—	
6. Blooming and Slabbing Mill		—	18.0 Steel ingots	15.30 Slabs	To Hot Rolling Mills	15.30 lakh tonnes of slabs are fed into Reheating Furnace and Scale Breaker, out of which 15 lakh tonnes are obtained for further

				processing in subsequent unit.
7. *Hot Rolling Mills*				
(*a*) Plate Mill	—	3.60–Slabs	2.80 Plates	For sale
(*b*) Hot Strip Mill	—	11.40–Slabs	11.06—Strip coils	(*i*) 7.48 for Cold Rolling Mill. (*ii*) 0.84 for Pipe Plant (*iii*) 0.63 for Electrical Sheet Mill (*iv*) 2.11 for Hot Strip Finishing line to be converted into 2.00 lakh tonnes of coil sheets and narrow medium plates for sale.
(*c*) Electrical Sheet Mill	—	0.63 Hot Strip Coils	0.50—Sheets	For sale
(*d*) Pipe Plant	—	0.84 Hot Strip Coils	0.75 Pipes	For sale
8. Cold Rolling Mill	—	7.48–Strip coils 0.09 Zinc* 0.02 Tin@	(*i*) 2.60–CR Sheets Strips (*ii*) 1.60 Galvanised sheets (*iii*) 2.00 Tin Plates	For sale

*Used in Galvanised lines.

@1350 Tonnes used in Electrolytic Tinning Lines and 900 tonnes in H.D. Tinning Lines.

ANNEXURE II

(Referred to in paragraph 2.01)

Statement showing loss in contribution margin

(Qty. in tonnes) (Rs. in lakhs)

	1973-74		1974-75		1975-76		1976-77		1977-78 (13 months)	
	Saleable Steel		Saleable Steel		Saleable Steel		Saleable Steel		Saleable Steel	
	Qty.	Amount Rs.	Qty.	Amount Rs.	Qty.	Amount Rs.	Qty.	Amount Rs.	Qty.	Amount Rs.
External Causes										
(*i*) Shortage of power	57,198	334.92	53,174	416.15	7,492	56.94	43,844	318.75	5,820	46.21
(*ii*) Difficulty in movement of raw materials and shortages	14,860	133.04	8,460	66.21	..	..	..	..	..	..
TOTAL :	72,058	467.96	61,634	482.36	7,492	56.94	43,844	318.75	5,820	46.21
Internal Causes										
(*i*) Industrial disputes.	46,933	274.35	9,052	70.84	2,406	18.29	..	..	13,388	106.30
(*ii*) Breakdowns and shut-downs in excess of planned down time and other causes.	18,232	118.30	14,414	112.81	21,553	163.80	35,891	260.93	35,865	284.76
TOTAL :	65,165	392.65	23,466	183.65	23,959	182.09	35,891	260.93	49,253	391.06
GRAND TOTAL :	1,37,223	860.61	85,100	666.01	31,451	239.03	79,735	579.68	55,073	437.27

Note : In addition, there was loss of contribution margin in respect of saleable pig iron in 1973-74 and 1974-75 as follows :

	1973-74		1974-75	
	Qty.	Rs. in lakhs	Qty.	Rs. in lakhs
External causes				
Difficulty in movement of raw materials and shortages.	7,462	18.71	3,023	4.96
Internal causes				
Breakdowns and shut-downs	..	..	1,492	2.45
	7,462	18.71	4,515	7.41

ANNEXURE III

(Referred to in paragraph 2.02.01)

Statement showing the rated capacity, budgeted production and Actual production of coke

(Qty. in lakh tonnes)

Year	Rated capacity					Total	Budgeted production		Actual input/output					
	Coke output								Coke output (dry)					
	Coal Input (Dry)	B.F. and Foundry grade above 40 mm	Nut coke (20–40 mm)	Pearl coke (10–20 mm)	Breeze coke (0–10 mm)		Coal input (wet)	Coke output	Coal input	B.F. grade	Nut coke	Pearl coke	Breeze coke	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1970-71	23.80	14.76	0.52	2.08		17.36	24.37	17.65	18.44	11.89 (64.5)	0.87 (4.7)	0.34 (1.8)	1.20 (6.5)	14.30
1971-72	23.80	14.76	0.52	2.08		17.36	25.04	17.65	16.62	10.69 (64.3)	0.77 (4.6)	0.36 (2.2)	1.01 (6.1)	12.83
1972-73	23.80	14.76	0.52	2.08		17.36	18.77	12.95	17.95	11.55 (64.3)	0.83 (4.6)	0.35 (1.9)	1.09 (6.1)	13.82
1973-74	23.80	14.76	0.52	2.08		17.36	20.18	14.35	16.64	10.63 (63.9)	0.76 (4.6)	0.40 (2.4)	1.09 (6.6)	12.88
1974-75	23.80	14.76	0.52	2.08		17.36	20.06	14.46	16.97	10.81 (63.7)	0.78 (4.6)	0.43 ((2.5)	1.05 (6.2)	13.07

1975-76	23.80	14.76	0.52	2.08	17.36	20.96	15.11	19.29	12.28	0.85	0.58	1.14	14.85
									(63.7)	(4.4)	(3.0)	(5.9)	
1976-77	23.80	14.76	0.52	2.08	17.36	22.09	15.91	20.80	13.10	0.90	0.53	1.28	15.81
									(63.0)	(4.3)	(2.6)	(6.2)	
1977-78	23.80	14.76	0.52	2.08	17.36	22.64	15.86	19.20	11.82	0.74	0.49	1.11	14.16
									(61.6)	(3.9)	(2.6)	(5.8)	

NGTES : (*i*) Figures in brackets indicate percentage of coke produced to total coal charged.

(*ii*) Production of hard coke used in foundry is not separately reported.

(*iii*) For calculating rated capacity, the fifth coke oven battery (half) commissioned in September 1974 has not been taken into account.

ANNEXURE IV

(Referred to in paragraph 2.03.03)

Statement showing the total number of furnace hours during the year, shut down hours and the number of hours for which the furnaces were used for production

Year	Total Furnace hours	Furnace hours worked	Planned shut down	SHUT DOWN HOURS Unscheduled shut-down	Other causes(*)	Total
1	2	3	4	5	6	7
1970-71	35,040	24,448	4,800	1,920	3,872	10,592
1971-72	35,136	21,315	8,657	1,159	4,005	13,821
1972-73	35,040	27,265	3,288	1,260	3,227	7,775
1973-74	35,040	26,887	3,384		4,769	8,153
1974-75	35,040	29,419	2,728	**	2,893	5,621
1975-76	35,136	31,604	956		2,576	3,532
1976-77	35,040	32,431	884		1,725	2,609
1977-78	35,040	30,812	2,623		1,605	4,228

*Includes maintenance, operation, mechanical delays etc.

**Includes un-Scheduled shut downs as separate figures are not available.

ANNEXURE V

(Referred to in paragraph 2.03.04)

Statement showing the actual consumption of important raw materials per tonne of hot metal produced vis-a-vis the norms indicated in the project report and those fixed by the Norms Committee.

(Figures in kgs.)

	Important raw materials required for producing 1000 kgs of Hot Metal								Slag arisings	Metallic Yield	
	Iron Ore	Sinter	Fe content in Iron Ore, Sinter scale etc.	Lime stone	Manganese	Dolomite	Coke	% of sinter in burden (excluding coke)		percentage	Quantity
1	2	3	4	5	6	7	8	9	10	11	12
As per D.P.R.											
3 Small Furnaces	600	1069	946	175	85	63	900	53	637	98.88	935
One Large Furnace	1506	—	946	420	85		900	—	624		
As per Norms Committee	Separate Figures not indicated		950	350	120	100	900	25	700	N.A.	N.A.
Actuals											
1970-71	1209	440	978	284	100	103	901	20.1	749	94.90	927
1971-72	1251	387	984	362	93	94	928	17.2	777	94.50	929
1972-73	1196	485	978	316	113	53	889	21.7	741	94.40	924
1973-74	1264	424	994	366	112	42	952	18.7	787	92.98	924
1974-75	1227	442	992	277	137	11	925	20.6	686	93.07	924
1975-76	1058	569	973	235	150	—	934	27.8	659	94.83	922
1976-77	993	702	972	215	156	17	919	33.1	709	94.85	922
1977-78	1000	766	1015	278	150	31	940	33.7	735	91.08	925

NOTE : In the DPR use of sinter is contemplated in the three small furnaces only. As regards the fourth furnace the material burden sheet does not contemplate the use of sinter. It has, however, been pointed out in the DPR that the production capacity of the large furnace (1500 tonnes per day) can be increased upto 1800 tonnes per day with the use of sinter.

ANNEXURE VI

[Referred to in paragraph 2.03.04(b)]

Statement showing the various constituents of hot metal as envisaged in the Project Report and as actually found.

(Figures in percentage)

	Year	Fe	Si	Mn	Phos	Sulphur	Carbon
1	2	3	4	5	6	7	8
Hot Metal	1 MT Project Report	93.9	0.7	1.64	0.177	0.10	3.5
Basic Grade	1.8 MT Project Report	93.5	1.14	1.50	0.21	0.04	3.61
	Actuals						
B.F.1.	1970-71	92.822	1.52	1.45	0.23	0.043	3.94
	1971-72	92.996	1.48	1.35	0.24	0.041	3.91
	1972-73	92.455	1.35	1.66	0.25	0.045	4.07
	1973-74	92.416	1.53	1.38	0.28	0.050	4.08
	1974-75	92.515	1.40	1.63	0.26	0.067	3.92
	1975-76	92.282	1.33	1.96	0.28	0.068	3.95
	1976-77	92.239	1.27	2.04	0.28	0.063	3.96
	1977-78	92.462	1.30	2.06	0.26	0.060	3.82
B.F. 2	1970-71	92.885	1.40	1.41	0.23	0.045	4.00
	1971-72	92.895	1.74	1.04	0.24	0.043	3.88
	1972-73	92.542	1.35	1.60	0.25	0.048	4.09
	1973-74	92.543	1.44	1.46	0.28	0.052	4.04
	1974-75	92.235	1.37	1.84	0.26	0.069	4.01
	1975-76	92.416	1.30	1.91	0.28	0.073	3.90
	1976-77	92.248	1.24	2.03	0.28	0.062	4.01
	1977-78	92.476	1.36	1.89	0.27	0.065	3.83
B.F. 3	1970-71	92.697	1.29	1.61	0.23	0.42	4.04
	1971-72	92.869	1.37	1.49	0.24	0.043	3.96
	1972-73	92.489	1.39	1.64	0.25	0.048	4.09
	1973-74	92.467	1.37	1.56	0.28	0.054	4.14
	1974-75	92.379	1.37	1.81	0.27	0.068	3.94
	1975-76	92.219	1.43	1.93	0.28	0.070	3.95
	1976-77	92.083	1.33	2.12	0.28	0.060	3.99
	1977-78	92.407	1.29	1.97	0.27	0.061	3.88

1	2	3	4	5	6	7	8
B.F. 4	1970-71	92.622	1.34	1.62	0.23	0.040	4.11
	1971-72	92.932	1.39	1.49	0.23	0.040	3.98
	1972-73	92.476	1.30	1.68	0.24	0.044	4.12
	1973-74	92.291	1.23	1.74	0.30	0.049	4.24
	1974-75	92.269	1.32	1.83	0.27	0.064	4.09
	1975-76	92.293	1.33	1.96	0.28	0.065	3.97
	1976-77	92.188	1.34	1.97	0.29	0.062	4.04
	1977-78	92.443	1.33	1.95	0.26	0.054	3.86

NOTE : Analysis of foundry grade hot metal is not given either in 1.8 MT Project Report or Annual Statistical Reports prepared by the Plant.

ANNEXURE VII

(Referred to in paragraph 2.03.05)

Statement showing the important components of major raw materials used for the production of hot metal.

(Figures in percentage)

	SiO_2 in iron ore & sinter	AL_2O_3 in iron ore & sinter	Fe in iron ore and sinter	CaO in lime stone	Ash in coke
1	2	3	4	5	6
As per DPR (1.8 million tonne stage)					
Iron Ore	2.00	5.00	60.0	..	..
Coke	..	..	..	..	24.0
Lime stone	..	..	..	46.0	..
Sinter	6.5	6.5	51.0	..	..
As per Norms Cammittee					
Iron Ore	2.30	5.00	62.00	..	..
Coke	..	..	..	..	23.5
Limestone	..	2.30	..	44.00	..
Sinter	..	..	48.00	..	..
Actuals					
1970-71 Iron Ore (Barsua Captive Mines)	3.10	5.90	59.50	..	..
Iron Ore (Others)	1.90	2.40	65.10	..	..
Coke	..	..	..	..	24.46
Limestone	..	..	..	44.70	..
Sinter	8.50	5.60	43.30	..	..
1971-72 Iron Ore (Barsua Captive Mines)	2.72	5.52	60.25	..	..
Iron Ore (Others)	1.59	1.95	65.94	..	..
Coke	..	..	..	..	24.38
Limestone	..	..	..	43.65	..
Sinter	8.86	5.12	45.16	..	..

1	2	3	4	5	6
1972-73 Iron Ore (Barsua Captive Mines)	2.58	6.44	59.68	..	..
Iron Ore (Others)	1.40	2.85	64.62	..	..
Coke	..	..	..	..	24.80
Limestone	..	..	..	44.85	..
Sinter	8.43	5.65	42.98	..	..
1973-74 Iron Ore (Barsua Captive Mines)	2.47	6.44	59.81	..	..
Iron Ore (Others)	1.49	3.42	63.88	..	..
Coke	..	..	..	..	25.21
Lime stone	..	..	..	43.97	..
Sinter	8.16	5.43	44.23	..	..
1974-75 Iron Ore (Barsua Captive Mines)	2.20	5.10	60.90	..	..
Iron Ore (Others)	1.50	3.80	62.90	..	..
Coke	..	..	..	..	25.87
Limestone	..	..	..	43.60	..
Sinter	8.10	4.80	44.80	..	..
1975-76 Iron Ore (Barsua Captive Mines)	1.93	4.14	61.90	..	..
Iron Ore (Others)	1.54	3.41	62.95	..	..
Coke	..	..	..	..	27.16
Limestone.	..	..	..	44.58	..
Sinter	7.46	3.68	47.98	..	..
1976-77 Iron Ore (Barsua Captive Mines)	2.29	4.50	60.75	..	..
Iron Ore (Others)	1.68	3.32	62.53	..	..
Coke	..	..	..	..	27.39
Limestone	..	..	..	44.39	..
Sinter	7.80	4.76	47.40	..	..
1977-78 Iron Ore (Barsua Captive Mines)	2.03	4.13	61.17	..	..
Iron Ore (Others)	1.59	3.07	63.20	..	..
Coke	..	..	..		27.08
Limestone.	..	..	..	44.24	..
Sinter	8.07	4.94	47.03	..	..

ANNEXURE VIII

(Referred to in paragraph 2.04)

Statement showing the quantity of hot metal handled by the Pig Casting Machines

(Figures in lakh tonnes)

Year	Hot metal actually poured	Pig iron produced				Actual production for sale	Actual Sale	Quantity of Pig Iron consumed in plant's own Foundry	
		Foundry grade	Basic grade	Off grade	Total			Total quantity consumed	Quantity onsumed out of own production
1	2	3	4	5	6	7	8	9	10
1970-71 . . .	1.38	0.87	0.22	0.12	1.21	0.95	0.92	0.41	0.24
1971-72 . . .	1.86	1.27	0.21	0.15	1.63	1.27	1.06	0.46	0.35
1972-73 . . .	0.97	0.55	0.13	0.17	0.85	0.70	0.60	0.47	0.13
1973-74 . . .	0.77	0.42	0.07	0.19	0.68	0.46	0.44	0.48	0.19
1974-75 . . .	1.23	0.42	0.07	0.58	1.07	1.01	0.89	0.55	0.07
1975-76 . . .	1.39	0.48	0.10	0.63	1.21	1.17	0.85	0.50	0.02
1976-77 . . .	1.02	N.A.	N.A.	N.A.	0.89	0.63	0.41	0.48	0.01
1977-78 . . .	0.71	N.A.	N.A.	N.A.	0.62	(*)	0.07	0.51	..

(*)Management has since discontinued reporting of 'Pig Iron Production for sale':

NOTE — Production of pig iron gradewise i.e. Foundry grade, Basic grade and Off-grade separately not available.

ANNEXURE IX

(Referred to in paragraph 2.06.02)

Statement showing off-grade production and rejections

(Figures in lakh tonnes)

Year	O. H. Furnaces					L. D. Converters				
	Total production of rollable steel including off-grade	Off-grade production of rollable steel	Rejections	Percentage or rejections as per Norms Committee	Actual percentage of rejections in relation to total production	Total production of rollable steel including off-grade	Off grade production of rollable steel	Rejections	Percentage of rejection as per Norms Committee	Actual percentage of rejections as compared to production
1	2	3	4	5	6	7	8	9	10	11
1970-71 .	1.97	0.07	0.01	0.5	0.6	8.41	0.20	0.08	0.7	1.0
1971-72 .	2.04	0.06	0.02	0.5	0.9	6.19	0.14	0.05	0.7	0.8
1972-73 .	2.24	0.05	0.02	0.5	0.9	9.53	0.13	0.08	0.7	0.8
1973-74 .	1.87	0.05	0.02	0.5	1.1	8.94	0.28	0.08	0.7	0.9

1	2	3	4	5	6	7	8	9	10	11
1974-75 .	1.87	0.06	0.01	0.5	0.6	8.79	0.17	0.07	0.7	0.8
1975-76 .	2.38	0.11	0.01	0.5	0.4	10.44	0.19	0.08	0.7	0.7
1976-77 .	3.01	0.10	0.01	0.5	0.3	12.02	0.22	0.10	0.7	0.8
1977-78 .	3.09	0.08	0.01	0.5	0.5	11.00	0.17	0.08	0.7	0.6

ANNEXURE X (i)

(Referred to in paragraph 2.06.03)

Statement showing the Actual Number of Hours for which O.H. Furnaces/L.D. Converters worked

L.D Converters

Year	Calendar hours	Available hours	Downtime (difference between columns 2 and 3)			hours worked	Delay (hours not operated due to other reasons)								Total
			Downtime for re-lining and maintenance	Other downtime	Total		Blast Furnace	Operational	Mechanical	Electrical	Oxygen	Refractory	Crane maintenance	Others	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1970-71 . . .	43800	24716	15755	3329	19084	16287	2032	2033	328	547	..	..	..	3489	8429
1971-72 . . .	43920	19934	12967	11019	23986	11119	513	1830	404	225	464	41	380	4958	8815
1972-73 . . .	43800	25516	16537	1747	18284	17730	1350	3053	769	294	332	24	869	1095	7786
1973-74 . . .	43800	25623	16775	1402	18177	17270	2354	3217	468	172	225	249	573	1095	8353
1974-75 . . .	43800	25884	17095	821	17916	17159	2064	2401	383	247	1041	256	562	1771	8725
1975-76 . . .	43920	26882	15886	1152	17038	19056	1023	3485	816	304	576	74	552	996	7826
1976-77 . . .	43800	27688	15321	791	16112	20651	1133	3400	609	236	567	58	465	569	7037
1977-78 . . .	43800	27360	15923	517	16440	19875	1804	3456	520	264	260	295	370	516	7485

ANNEXURE X (ii)

Open Hearth Furnaces

Year	Calendar Hours	Down time	Available	Hours worked	Delays due to									
					Blast furnace	Operational	Mechanical	Electrical	Oxygen	Refractory	Crane maintenance	Energy & Economy	Others	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1970-71	35,040	5,794	29,246	22,259	..	853	199	605	..	291	..	1819	3,220	6,987
1971-72	35,136	6,415	28,721	23,386	..	1,912	517	107	..	598	579	1,139	483	5,335
1972-73	35,040	6,878	28,162	24,111	..	1,236	471	33	..	1,038	198	383	692	4,051
1973-74	35,040	6,509	28,531	20,827	..	1,866	549	20	..	534	393	3,458	884	7,704
1974-75	35,040	7,050	27,990	21,310	..	687	646	25	..	1,350	208	1,964	1,800	6,680
1975-76	35,136	6,743	28,393	24,134	..	859	475	70	..	1,161	560	180	954	4,259
1976-77	35,040	4,903	30,137	26,435	..	700	373	83	..	1,081	359	169	937	3,702
1977-78	35,040	4,811	30,229	26,180	..	813	452	88	..	955	426	243	1,072	4,049

ANNEXURE XI (i)

(Referred to in paragraph 2.06.03)

Statement showing actual lining life for each furnace/converter

Year	L. D. Converters														
	Converter No. I			Converter No. II			Converter No. III			Converter No. IV			Converter No. V		
	Minimum no. of blows	Maximum no. of blows	Average no. of blows	Minimum no. of blows	Maximum no. of blows	Average no. of blows	Minimum no. of blows	Maximum no. of blows	Average no. of blows	Minimum no. of blows	Maximum no. of blows	Average no. of blows	Minimum no. of blows	Maximum no. of blows	Average no. of blows
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1970-71 . . .	116	201	153	147	211	167	113	201	153	114	193	151	123	192	151
1971-72 . . .	71	210	145	117	178	152	74	187	142	12	178	138	98	174	136
1972-73 . . .	109	186	154	117	202	162	108	173	146	105	165	135	113	191	144
1973-74 . . .	103	170	135	109	185	138	88	161	138	85	165	122	84	186	135
1974-75 . . .	115	166	135	85	175	130	85	174	121	75	277	118	91	167	120
1975-76 . . .	100	200	159	96	202	147	96	243	155	100	169	127	97	158	127
1976-77 . . .	139	252	189	109	257	173	124	244	177	100	223	153	118	218	175
1977-78 . . .	128	268	175	99	218	165	104	211	156	88	212	154	145	202	175

ANNEXURE XI (ii)

Open Hearth Furnaces

Year	O. H. No. A			O. H. No. B			O. H. No. C			O. H. No. D		
	Minimum no. of heats	Maximum no. of heats	Average no. of heats	Minimum no. of heats	Maximum no. of heats	Average no. of heats	Minimum no. of heats	Maximum no. of heats	Average no. of heats	Minimum no. of heats	Maximum no. of heats	Average no. of heats
1	2	3	4	5	6	7	8	9	10	11	12	13
1970-71	386	411	399	..	409	409	241	424	333	239	504	372
1971-72	383	383	383	356	423	390	388	388	388	223	414	319
1972-73	326	381	354	418	418	418	386	519	453	354	422	388
1973-74	343	348	346	318	361	340	152	388	291	331	366	349
1974-75	289	385	337	354	419	387	187	381	284	189	216	203
1975-76	400	400	400	231	382	307	354	397	376	367	402	385
1976-77	424	433	429	432	447	440	402	431	417	428	472	450
1977-78	373	437	405	390	409	400	398	434	416	392	411	399

ANNEXURE XII

[Referred to in paragraph 2.06.03(2)]

Statement showing the tap to tap time of open hearth furnaces and L. D. Converters

(Figures in hours and minutes)

Year	Norms as per Project Report	O. H. Furnaces					L. D. Converters	
		A	B	C	D	Average	Norms as per Project Report	Actual average time for all converters
1	2	3	4	5	6	7	8	9
1970-71	8—00	11—10	11—14	10—19	11—16	11—31	0—45	0—59
1971-72	8—00	11—31	12—02	10—12	11—07	11—00	0—45	0—54
1972-73	8—00	9—10	10—42	10—00	10—12	10—10	0—45	0—57
1973-74	8—00	11—56	10—41	10—27	11—24	10—49	0—45	1—00
1974-75	8—00	11—52	12—05	11—36	12—16	12—04	0—45	1—01
1975-76	8—00	10—03	9—49	10—11	9—51	9—59	0—45	0—58
1976-77	8—00	9—34	8—56	8—47	8—16	8—52	0—45	0—55
1977-78	8—00	9—29	9—02	8—59	7—51	8—40	0—45	0—58

ANNEXURE XIII

[Referred to in paragraph 2.06.03(4)]

Statement showing the short fall in production attributable to the variances in furnace converter utilisation and productivity

(In lakh tonnes)

Year	Utilisation variance		Productivity variance		Total		Grand Total	Remarks
	O.H.	L.D.	O.H.	L.D.	O.H.	L.D.		
1	2	3	4	5	6	7	8	9
1970-71	(—)0.57	(—)4.26	(+)0.04	(—)2.83	(—)0.53	(—)7.09	(—)7.62	(—) Adverse
1971-72	(—)0.47	(—)7.83	(+)0.01	(—)1.49	(—)0.46	(—)9.32	(—)9.78	(+) Favourable
1972-73	(—)0.41	(—)3.27	(+)0.14	(—)2.70	(—)0.27	(—)5.97	(—)6.24	
1973-74	(—)0.69	(—)3.58	(+)0.06	(—)2.98	(—)0.63	(—)6.56	(—)7.19	
1974-75	(—)0.65	(—)3.66	(+)0.02	(—)3.05	(—)0.63	(—)6.71	(—)7.34	
1975-76	(—)0.40	(—)2.35	(+)0.28	(—)2.71	(—)0.12	(—)5.06	(—)5.18	
1976-77	(—)0.21	(—)1.25	(+)0.72	(—)2.23	(+)0.51	(—)3.48	(—)2.97	
1977-78	(—)0.23	(—)1.79	(+)0.81	(—)2.71	(+)0.58	(—)4.50	(—)3.92	

ANNEXURE XIV

(Referred to in paragraph 2.06.04)

Statement showing actual transit loss of hot metal

(Figures in lakh tonnes)

Year	Despatch from Blast Furnaces	Consumption in O.H. Furnaces & L.D. Converters	Loss		Loss at 0.5% as provided in the Project report	Excess loss	Cost per tonne of hot metal as per annual cost sheet	Rate at which credit has been given for scrap in annual cost sheet	Net loss per tonne Col. (8–9)	Value of net Loss (Rs. in lakhs)	Remarks
			Quantity	Percentage to Col. 2			Rs.	Rs.	Rs.		
1	2	3	4	5	6	7	8	9	10	11	12
1970-71	10.08	9.81	0.28	2.7	0.05	0.23	275.60	150.00	125.60	28.34	Credit for scrap value has been given for entire quantity of hot metal shown in column 7.
1971-72	7.83	7.59	0.26	3.0	0.04	0.20	328.93	200.00	128.93	25.73	
1972-73	11.44	11.13	0.31	2.7	0.06	0.25	319.56	200.00	119.56	30.44	
1973-74	10.82	10.41	0.41	3.8	0.05	0.36	392.78	329.18	63.60	22.77	
1974-75	10.80	10.21	0.59	5.5	0.05	0.54	455.58	440.00	15.58	8.35	

1975-76	12.43	11.90	0.53	4.2	0.06	0.47	488.04	440.00	48.04	22.35
1976-77	13.60	13.10	0.50	3.7	0.07	0.43	516.73	440.00	76.73	33.08
1977-78	12.53	12.09	0.44	3.5	0.06	0.38	598.88	460.00	138.88	52.33
										223.39

NOTE : Effect of opening and closing balance in the mixers has not been taken into account in the absence of figures.

ANNEXURE XV

(Referred to in paragraph 2.06.06)

Statement showing the actual consumption of major raw materials per tonne of steel ingots vis-a-vis the provisions in the project report & norms fixed by the Norms Committee.

(Kgs. per tonne of Steel Ingots)

Year	Hot Metal		Scrap		Iron Ore		Limestone	
	O.H.	L.D.	O.H.	L.D.	O.H.	L.D.	O.H.	L.D.
1	2	3	4	5	6	7	8	9
As per Detailed Project Report	408	913	636	217	72	..	72	30.3
As per Norms Committee	400	995	745	140	6	4	..	4
Actuals :								
1970-71	440	1063	727	144	14.8	11.2	..	13.8
1971-72	413	1091	692	144	12.2	10.0	..	12.1
1972-73	457	1060	696	162	13.3	10.6	..	11.9
1973-74	462	1067	701	156	10.7	6.7	..	11.9
1974-75	457	1064	675	143	7.0	5.8	..	6.5
1975-76	420	1044	689	175	7.7	2.7	..	8.3
1976-77	426	983	684	145	10.0	4.4	..	12.2
1977-78	462	970	639	172	20.1	17.0	..	10.2

ANNEXURE XVI

(Referred to in paragraph 2.07.01)

(*Statement showing input, output, yield, etc. of rolling mills*)

Scrap Arising

(Figures in lakh tonnes)

	Year	Input	Output	Percentage of yield	Norms as per		Actuals		Scale and other losses			
									Norms as per		Actuals	
					DPR (Percentage of Input)	Norms Committee	Quantity	Percentage to input	DPR (Percentage of input	Norms Committee	Quantity Col. (3—4—8)	Percentage to input
1	2	3	4	5	6	7	8	9	10	11	12	13
Blooming and Slabing Mill	1970-71	9.86	8.50	86.2	10.7	Not indicated	1.29	13.1	4.3	Not indicated	0.07	0.7
	1971-72	8.58	7.35	85.7	,,	,,	1.09	12.7	,,	,,	0.14	1.6
	1972-73	10.29	8.77	85.2	,,	,,	1.32	12.8	,,	,,	0.20	2.0
	1973-74	9.93	8.45	85.1	,,	,,	1.38	13.9	,,	,,	0.10	1.0
	1974-75	10.67	8.97	84.1	,,	,,	1.38	12.9	,,	,,	0.32	3.0
	1975-76	12.92	10.89	84.3	,,	,,	N.A.	N.A.	,,	,,	N.A.	N.A.
	1976-77	13.58	11.53	84.9	,,	,,	1.82	13.4	4.3	,,	0.23	1.7
	1977-78	14.19	11.77	82.9	,,	,,	1.95	13.8	,,	,,	0.47	3.3
Plate Mill	1970-71	1.94	1.56	80.4	22.0	,,	0.31	16.0	0.2	,,	0.07	3.6
	1971-72	1.86	1.48	79.6	,,	,,	0.33	17.7	,,	,,	0.05	2.7
	1972-73	2.31	1.82	78.8	,,	,,	0.40	17.3	,,	,,	0.09	3.9
	1973-74	2.16	1.74	80.6	,,	,,	0.37	17.1	,,	,,	0.05	2.3
	1974-75	2.35	1.93	82.1	,,	,,	0.32	13.6	,,	,,	0.10	4.3
	1975-76	3.19	2.61	81.8	,,	,,	N.A.	N.A.	,,	,,	N.A.	N.A.
	1976-77	3.69	3.00	81.4	,,	,,	0.52	14.1	,,	,,	0.17	4.5
	1977-78	3.63	3.01	83.1	,,	,,	0.50	13.7	,,	,,	0.12	3.2
Hot Strip Mill	1970-71	6.34	6.05	95.4	2.8	,,	0.25	4.0	0.2	,,	0.04	0.6
	1971-72	5.20	4.97	95.6	,,	,,	0.13	2.5	,,	,,	0.10	1.9
	1972-73	6.87	6.52	94.9	,,	,,	0.18	2.6	,,	,,	0.17	2.5
	1973-74	6.31	5.99	94.9	,,	,,	0.22	3.5	,,	,,	0.10	1.6
	1974-75	6.40	6.07	94.8	,,	,,	0.14	2.2	,,	,,	0.19	3.0
	1975-76	8.72	8.34	95.6	,,	,,	N.A.	N.A.	,,	,,	N.A.	N.A.
	1976-77	8.95	8.57	95.8	,,	,,	0.24	2.7	,,	,,	0.14	1.5
	1977-78	9.07	8.67	95.6	,,	,,	0.48	5.3	,,	,,	N.A.	N.A.

1	2	3	4	5	6	7	8	9	10	11	12	13
Electrical Sheet Mill . .	1970-71	0.19	0.12	63.1	17.8	Not indicated	0.06	31.6	2.8	Not indicated	0.01	5.3
	1971-72	0.13	0.08	61.5	,,	,,	0.05	38.5	,,	,,	..	..
	1972-73	0.20	0.12	60.0	,,	,,	0.07	35.0	,,	,,	0.01	5.0
	1973-74	0.19	0.11	57.9	,,	,,	0.07	36.5	,,	,,	0.01	5.3
	1974-75	0.22	0.13	59.1	,,	,,	0.08	36.4	,,	,,	0.01	4.5
	1975-76	0.30	0.18	60.0	,,	,,	N.A.	N.A.	,,	,,	N.A.	N.A.
	1976-77	0.24	0.15	62.5	,,	,,	0.08	33.3	,,	,,	0.01	4.2
	1977-78	0.28	0.21	75.1	,,	,,	0.09	32.1	,,	,,	..	..
Pipe Plant	1970-71	0.44	0.39	88.6	10.7	,,	0.05	11.4	..	,,	..	
	1971-72	0.40	0.35	87.5	,,	,,	0.05	12.5	..	,,	..	
	1972-73	0.45	0.39	86.7	,,	,,	0.06	13.3	..	,,	..	
	1973-74	0.42	0.36	85.7	,,	,,	0.05	11.9	..	,,	0.01	2.4
	1974-75	0.45	0.37	82.2	,,	,,	0.07	15.6	..	,,	0.01	2.2
	1975-76	0.47	0.39	83.0	,,	,,	N.A.	N.A.	..	,,	N.A.	N.A.
	1976-77	0.59	0.52	88.1	,,	,,	0.07	11.9	..	,,	..	..
	1977-78	0.50	0.42	84.0	,,	,,	0.07	14.0	..	,,	0.1	2.0
Cold Rolling Mill . . .	1970-71	3.63	3.10	85.4	17.8	,,	0.50	13.8	0.5	,,	0.03	0.8
	1971-72	3.04	2.65	87.2	,,	,,	0.37	12.2	,,	,,	0.02	0.6
(Total of Galvanised Sheet, CR Sheets, Tin Plates & Electrical Tin Plates)	1972-73	3.50	3.01	86.0	,,	,,	0.44	12.6	,,	,,	0.05	1.4
	1973-74	3.38	3.07	90.8	,,	,,	0.46	13.6	,,	,,		
	1974-75	3.34	3.13	93.7	,,	,,	0.42	12.6	,,	,,		
	1975-76	4.13	3.52	85.2	,,	,,	N.A.	N.A.	,,	,,	N.A.	N.A.
	1976-77	5.22	4.37	83.7	,,	,,	0.53	10.2	,,	,,	0.32	6.1
	1977-78	5.00	4.32	86.4	,,	,,	0.54	10.8	,,	,,	0.14	2.8

Notes 1. The input figures for Cold Rolling Mill represent the input of hot strip coils to the pickling line.

2. The scrap arising reported by the Management for Cold Rolling Mill during 1973-74 and 1974-75 is more than the difference between input and output.

3. Figures in columns 12 and 13 are derived figures.

4. Actual inputs are exclusive of tin and zinc.

ANNEXURE — XVII

(Referred to in paragraph 2.07.04)

Statement showing the rated capacity Annual targets and Actual production of Hot Strip Mill

(Figures in lakh tonnes)

Year	Rated capacity as per Project Report	Annual target	Actual production	Percentage of short-fall(—) Excess (+) to	
				Rated capacity	Annual target
1	2	3	4	5	6
1970-71 . .	11.06	9.14	6.5	(—)45.3	(—)33.8
1971-72 . .	11.06	8.81	4.97	(—)55.1	(—)43.6
1972-73 . .	11.06	7.40	6.52	(—)41.0	(—)11.9
1973-74 . .	11.06	7.53	5.99	(—)45.8	(—)20.5
1974-75 . .	11.06	6.94	6.07	(—)45.1	(—)12.5
1975-76 . .	11.06	7.63	8.34	(—)24.6	(+)9.3
1976-77 . .	11.06	8.85	8.57	(—)22.5	(—)3.2
1977-78 .	11.06	9.46	8.67	(—)21.6	(—)8.4

ANNEXURE XVIII

(Referred to in paragraph 2.07.05)

Statement showing actual production vis-a-vis the rated capacity & budgeted production of electrical sheet mill

Year	Rated capacity (tonnes)	Budgeted production (tonnes)	Actual production (tonnes)	Percentage of Actual production to		Remarks
				Budgeted production	Rated capacity	
1	2	3	4	5	6	7
1970-71 . .	50,000	22,500	12,353	55	25	There was a
1971-72 . .	50,000	22,500	8,207	36	16	roof collapse
1972-73 . .	50,000	12,500	12,071	97	24	in SMS in
1973-74 . .	50,000	18,000	11,174	62	22	July, 1971
1974-75 . .	50,000	15,000	12,775	85	26	
1975-76 . .	50,000	18,000	18,306	102	37	
1976-77 . .	50,000	30,000	15,279	51	31	
1977-78 . .	50,000	18,000	21,115	117	42	

NOTE : (*i*) The Mill was under guarantee tests, during August, 1968 to November, 1970. The actual production during this period was only 2,500 tonnes (1968-69) and 10,895 tonnes (1969-70).

(*ii*) The capacity of this unit has been re-examined by consultants M/s. MECON and indicated as 35,000 T/year.

ANNEXURE XIX

(Referred to in paragraph 2.07.06)

Statement showing the actual production of different units of the Cold Rolling Mill vis-a-vis the budgeted production and rated capacity

(Figures in lakh tonnes)

Year	Rated capacity	Budgeted production	Actual production
1	2	3	4
(i) C.R. Sheets and Strips			
1970-71	2.60	2.60	1.53
1971-72	2.60	2.40	1.53
1972-73	2.60	2.18	1.61
1973-74	2.60	1.72	1.76
1974-75	2.60	1.86	1.78
1975-76	2.60	2.00	1.85
1976-77	2.60	2.40	2.53
1977-78	2.60@	2.80	2.28
(ii) Galvanised Sheets			
1970-71	1.60	1.40	0.90
1971-72	1.60	1.44	0.72
1972-73	1.60	0.94	0.95
1973-74	1.60	0.94	0.97
1974-75	1.60	0.94	1.04
1975-76	1.60	1.00	1.19
1976-77	1.60	1.60	1.29
1977-78	1.60	1.50	1.45
(iii) Hot Dip Tinning Lines			
1970-71	0.50	0.12	0.14
1971-72	0.50	0.12	0.06
1972-73	0.50	0.16	0.08
1973-74	0.50	0.16	0.04
1974-75	0.50	0.06	0.03
1975-76	0.50	0.06	0.04
1976-77	0.25*	0.05	0.01
1977-78	..	..	..
(iv) Electrolytic Tinning Lines			
1970-71	1.50	0.60	0.52
1971-72	1.50	0.84	0.34
1972-73	1.50	0.90	0.37
1973-74	1.50	0.60	0.31
1974-75	1.50	0.50	0.27
1975-76	1.50	0.60	0.44
1976-77	1.50	0.75	0.53
1977-78	1.50	0.70	0.59

@Since revised to 3.12 lakh tonnes.

*Rated capacity has been taken proportionately for 6 months from April to September 1976 as the lines were not in operation since September 1976.

ANNEXURE XX

[Referred in paragraph 2.07.07(b)]

Statement showing the Actual Production of Steel Ingots in the Alloy Steels Plant, Durgapur and Heat Treated Plates at Rourkela

Year	Production of ingots at Durgapur (tonnes)		Ingots actually rolled at Rourkela (Tonnes)	Production of heat-treated plates at Rourkela		
	Production	Despatches to Rourkela		Rated capacity (sets)	Budgeted production (sets)	Actual production (sets)
1	2	3	4	5	6	7
1969-70 . . .	1,944	2,147	1,927	90*	70 (898)	48 (615)
1970-71 . . .	2,378	1,885	1,747	120 (1,539)	120 (1,539)	77 (984)
1971-72 . . .	3,720	3,523	3,304	120 (1,539)	100 (1,283)	79 sets +47 tonnes of plates (1060)
1972-73 . . .	4,381	3,952	3,647	120 (1,539)	110 (1,411)	111 sets +67 tonnes of plates (1491)
1973-74 . . .	1,155	1,108	1,555	120 (1,539)	145 (1,858)	21 sets +19 tonnes of plates (286)
1974-75 . . .	313	119	368	140**(1,796)	Not fixed	2 sets +73 tonnes of plates (97)

1975-76 . . .	4,845	4,788	4,876	180 (2,309)	101 (1,296)	120 sets + 98 tonnes o plates (1637)
1976-77 . . .	7,375	6,952	5,704	180 (2,309)	180 (2,309)	198 sets + 216 tons (2,757)
1977-78 . . .	5,597	5,555	6,708	180 (2,309)	180 (2,309)	209 sets + 254 tons (2,935)

NOTE : (*i*) Figures in brackets in columns 5 to 7 indicate tonnage.

(*ii*) *The mill was commissioned in July 1969. The rated capacity has been taken proportionately.

(*iii*) The weight per set has been taken as 12.826 tonnes.

(*iv*) **The rated capacity of the unit was increased to 180 sets per annum from November, 1974. The rated capacity has been taken proportionately.

(*v*) @Due to uncertain availability and quality deterioration of spade ingots from ASP, no budget estimate was made.

ANNEXURE XXI

(Referred to in paragraph 2.08.)

Statement showing the list of idle Equipment

Particulars of equipment	Date of commissioning	Cost of equipment	Purpose for which procured	Reasons for non-utilisation	Action proposed
1	2	3	4	5	6
1. Pitch Granulation Plant.	1959-60	Cost of equipment Rs. 5.65 lakhs. Overall cost Rs. 13.14 lakhs.	To convert hard pitch into granules to make it saleable as per international practice.	1. Granules, when filled in bags, fuse together forming lumps during storage due to high ambient temperature. The purpose of converting lump into granules is thus defeated. 2. Operating conditions in the plant are not satisfactory from consideration of health hazards. This can be avoided by elaborate arrangements, such as remote control, special ventilation system etc. The customers mostly aluminium manufacturers, accept pitch in lump form and, hence, question of its conversion does not arise.	Some components of the equipment are being used for making hard pitch. The following components (value Rs. 7.67 lakhs) are to be disposed of : 1. Granulating tank—2 nos. 2. Screw Conveyor—1 no. 3. Screw Motor—1 no. 4. Bucket Elevator—1 no. 5. Bucket Motor—1 no.

2. Bitumen Melting Plant.	Not put to use at all from the very beginning.	Cost of equipment Rs. 1.88 lakhs. Overall cost Rs. 4.38 lakhs.	The equipment was meant for mixing butumen from Petroleum industries with the tar pitch for making road tar.	Road tar is made directly from hard pitch. It will not be required for use in future as well. In view of high demand for hard pitch, production of road tar is limited.	Some components such as mixing tank with agitators, buffer tank agitators and pumps are being utilised for manufacturing dolomite tar, thinning medium for gas holders creosote oil etc. The following parts (value Rs. 2.53 lakhs) are to be disposed of : 1. Vertical Furnace. 2. Barrel drain. 3. Barrel heating equipment. 4. Barrel tipping equipment.
3. Flying Shear (Hot Strip Mill)	Date of commissioning is not available. The equipment was tried for the first time in 1962 and twice or thrice thereafter.	Cost of equipment Rs. 36.72 lakhs. Overall cost Rs. 68.40 lakhs.	To cut the strip, coming from the finishing stand into equal lengths to be further divided to required lengths in the subsequent strip shearing units to suit customers' needs.	In case this flying shear is used, the sheets will be again divided in lines no. 3 or 4 to suit the requirement of customers involving more cutting loss. Further difficulties encountered in operating the equipment were as under :— 1. Erratic operation due to electrical troubles. 2. Variance in drum	Except electric control equipment and some of the motors of the piler equipment following equipment costing Rs. 53.52 lakhs are to be disposed of : 1. Rotary flying shear. 2. Pinch roll unit before the sheet piler.

1	2	3	4	5	6
				speed. 3. Improper separation of sheets on the run out table. 4. The shear cannot remain in line if strips are coiled in coiler. 5. Malfunctioning of flying shear resulting in cobbles etc.	3. Automatic sheet piler.
4. Flame Cutting Machines (Plate Mill).	Not commissioned at all though the plate finishing line went on stream on 15th November, 1960.	Written down value as on 1st April 1969 Rs. 4.22 lakhs.	To shear the plates (40 mm and above).	Uneconomical use.	The value of the machine has been written off but the machine is awaiting disposal.
5. Two Disc-loaders.	June 1964	Rs. 17.51 lakhs	For maintaining steady supply of coal to Coke Oven Plant.	(*a*) Difficulty in keeping them in working order due to intricacies of hydraulic and electric systems and for want of spares. (*b*) The loaders required sufficient space for free movement in the stockyard and were not mobile as was originally specified.	

(c)	For the movement of loaders, which are electrically operated, power points were required to be provided all along the yard. Laying of high tension underground power lines was found extremely expensive.	
(d)	Due to grinding action of the disc-loaders, materials handled, particularly those for the Steel Melting Shop, got fragmented and were not acceptable to the unit.	
(e)	Design of the loaders, particularly of the second loader, was faulty.	
(f)	Due to immobility of these loaders, one locomotive was exclusively required for shunting the wagons during loading time which was uneconomical.	One of the disc-loaders has since been disposed of and other one is awaiting disposal.

1	2	3	4	5	6
6. One pre-heating furnace.	March 1968	Rs. 4.62 lakh (including custom duty).	For heating electrical sheets.	Transformer grade sheets required shearing in hot condition and these were not being manufactured, the furnace was idle.	No decision has been taken.
7. One unit for Fractional cystallisation of yellow salt (in Potash Plant).	1959-60	N.A.	For removal of hydrogen sulphide from coke oven gas.	Due to use of sodium carbonate instead of potassium carbonate.	Awaiting disposal.
8. One Naphthalene Oil Dephenolisation Unit.	1959-60	N.A.	For dealing with carbolic oil that comes alongwith naphthalene fraction.	Operation was found to be combersome and expensive.	Awaiting disposal.
9. One Sulphuric Acid Plant (wet process).	1960	Rs. 16.67 lakhs plus Rs. 3.81 lakhs for modification.	For producing 25 tonnes of sulphuric acid per day.	Low content of hydrogen sulphide in the coke oven gas.	Awaiting disposal.
10. Two generators (Acetylene Plant).	Not yet commissioned.	Rs. C.98 lakh F.O.R. Varanasi	For taking care of the maintenance, breakdowns and shut-down jobs of the existing generators.	Non-acceptance of the expansion of Acetylene Plant by the C.E.D.B.	It is proposed to relocate the Acetylene Plant for installation of these generators.

11. A Potash Plant	Plant was ready in 1965-66 but not put to use at all from the very beginning.	Cost not available.	For removal of hydrogen sulphide from coke oven gas produced in coke oven battery no IV.	Non-availability of adequate gas on account of the Commissioning of only half the coke oven battery. Even after commissioning of coke oven battery no. IV in February, 1969 this plant could not be utilised due to corrosion problem in Primary coolers.	Awaiting disposal.
12. Caustification unit of carbolic Plant.	1959-60	Cost not available.	For the purpose of regenerating sodium hydroxide from the spent sodium carbonate solution.	Due to low production of carbolic oil enough salt was not available for reprocessing in this unit to regenerate sodium hydroxide from the spent salt.	The plant was overhauled in February, 1977 at a cost of Rs. 25,000. The unit is likely to be put in operation after procuring better quality of burnt lime for which procurement action has been initiated.

NOTE : The action proposed as indicated above in respect of items 1 to 4 was recommended by a Committee appointed by the General Manager of the Steel Plant in September, 1970 to examine and report as to how best the machineries could be used. The present position regarding disposal of these equipments as intimated by the Management (Oct., '79) was as follows :—

(*i*) Items No. 1 and 2 : Disposal action through public auction has been tried several times. However, no party came up for bidding.

(*ii*) Items No. 3 and 4 : Awaiting disposal.

ANNEXURE XXII

(Referred to in paragraph 5.01.02)

Statement showing the actual average yield of some principal by-products and the norms indicated in the Project Report and those fixed by the Norms Committee

	Norms of yield as per Project Report	Norms of yield as per Norms Committee**	ACTUAL YIELD							
			1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
1	2	3	4	5	6	7	8	9	10	11
Crude Tar (as percentage of dry coal charge).	3.00	3.00	2.75	2.67	2.80	2.61	2.62	2.94	3.03	2.96
Crude Benzol (as percentage of dry coal charge).	0.82	0.50 (for 1 MT Units) 0.80 (for expansion unit)	0.24	0.13	0.21	0.22	0.19	0.30	0.40	0.41
Ammonium Sulphate (as percentage of dry coal charge).	1.01	1.10	0.45	0.43	0.63	0.65	0.70	0.73	0.78	0.86

NOTE : **Two departmental Committees appointed by the Company in 1967 and 1972 to review the performance of the By-products Plant had fixed the following norms of yield :—

	1967 Committee (Raju Committee)	1972 Committee (Nagarkatti Committee)
Crude Tar . .	3	2.6
Crude Benzol . .	0.5 for 1 MT Unit 0.8 for exapnsion unit	0.5
Ammonium Sulphate	1.1	0.6 for 1 MT unit 0.9 for exapnsion units

ANNEXURE XXIII

(Referred to in paragraph 5.02.02)

Statement showing the quantities of scrap arising as envisaged in the Project Preport and actual arisings and the consumption thereof

(*i*) Iron Scrap — Qty. envisaged in the DPR — Not available

Year		Quantity recovered/consumed			Total
		B.F.	S.M.S.	Other shops	
1	2	3	4	5	6
1970-71	Qty. recovered	12,598	6,654	57,718	76,970
	Qty. consumed	8,163	391	17,747	26,301
1971-72	Qty. recovered	12,773	5,032	46,518	64,323
	Qty. consumed	10,358	671	19,691	30,720
1972-73	Qty. recovered	15,709	10,064	57,183	82,956
	Qty. consumed	23,903	613	15,778	40,294
1973-74	Qty. recovered	25,100	17,029	59,919	1,02,048
	Qty. consumed	13,882	1,385	10,024	25,291
1974-75	Qty. recovered	12,424	7,118	34,947	54,489
	Qty. consumed	16,556	..	12,035	28,591
1975-76	Qty. recovered	11,130	6,429	44,711	62,270
	Qty. consumed	18,186	2,375	16,109	36,670
1976-77	Qty. recovered	20,604		56,725	77,365
	Qty. consumed	4,740	5,314	19,143	29,197
1977-78	Qty. recovered	29,109		66,986	96,095
	Qty. consumed	9,824	18,690	17,122	45,636

NOTE : During the eight years a quantity of 40,820 tonnes, 46,320 tonnes, 61,803 tonnes, 47,623 tonnes, 51,780 tonnes, 52,866 tonnes, 71,984 tonnes and 60,401 tonnes were despatched to other parties in addition to the quantity consumed within the Plant.

Steel Scrap

Quantity envisaged in the DPR—Rolling Mills 4,69,000 — 26.1% of Steel ingot input.
S.M.S. 36,000—2% of Steel ingot input.
Total 5,05,000

Consumption of scrap in the SMS as per DPR — 4,96,000

Year		Quantity recovered/consumed			
		Rolling Mills	S.M.S.	Rejected Rolls	Total
1	2	3	4	5	6
1970-71	Qty. recovered	2,46,532 (25.0)	71,412 (7.2)	1,673	3,19,617
	Qty. consumed	..	2,64,946	773	2,65,719
1971-72	Qty. recovered	2,01,764 (23.5)	53,279 (6.2)	791	2,55,834
	Qty. consumed	..	2,30,275	798	2,31,073
1972-73	Qty. recovered	2,46,603 (24.0)	88,660 (8.6)	388	3,35,651
	Qty. consumed	..	3,09,650	1,186	3,10,836
1973-74	Qty. recovered	2,56,059 (25.8)	63,451 (6.4)	384	3,19,894
	Qty. consumed	..	2,70,718	3,057	2,73,775
1974-75	Qty. recovered	2,41,468 (22.6)	92,557 (8.7)	788	3,34,813
	Qty. consumed	..	2,52,066	2,746	2,54,812

1975-76	Qty. recovered	3,10,416	82,173	635	3,93,224
		(24.0)	(6.4)		
	Qty. consumed	..	3,46,517	3,686	3,50,203
1976-77	Qty. recovered	3,27,126	1,05,807	3,916	4,36,849
		(21.8)	(7.0)		
	Qty. consumed	2,94,512	89,137	..	3,83,649
1977-78	Qty. recovered	3,69,623	84,271	2 991	4,56,885
		(26.3)	(6.0)		
	Qty. consumed	3,26,166	62,244	..	3,88,408

NOTES : (1) Figures in brackets indicate percentage of recovery.

(2) In addition to consumption within the plant a quantity of 26,812 tonnes, 27,376 tonnes, 30,480 tonnes, 36,388 tonnes, 44,337 tonnes, 72,630 tonnes, 80,899 tonnes and 54,214 tonnes was despatched during these years.

(3) Out of total consumption of 4,96,000 tonnes of steel scrap 3,37,000 tonnes were expected to be consumed in L.D. converters and balance 1,59,000 tonnes in open hearth furnaces.

(4) The actual recovery in the Steel Melting Shop includes recovery of scrap from slag by the Heckett process.

ANNEXURE XXIV

(Referred to in paragraph 6.01.01)

Statement showing the extent of variance in cost per tonne due to different causes

Favourable (+)
Adverse (—)

(In Rupees)

Sl. No.	Name of Product	Year	Coal blend variance	Material usage variance	Capacity utilisation variance	Variance due to change in rate and other causes	Total
1	2	3	4	5	6	7	8
1.	B.F. Coke & Nut Coke	1973–74	(+) 0.96	(+) 0.45	(—) 5.15	(—) 25.43	(—) 29.17
		1974–75	(+) 3.84	(+) 2.74	(—) 8.92	(+) 1.96	(—) 0.38
		1975–76	(+) 0.55	(+) 2.41	(—) 0.95	(—) 51.70	(—) 49.69
		1976–77	(+) 2.30	(+) 4.10	(—) 0.58	(+) 19.19	(+) 25.01
		1977–78	(+) 4.23	(+) 5.50	(—) 4.66	(—) 15.55	(—) 10.48
2.	Hot Metal	1973–74	..	(—) 6.82	(—) 8.75	(—) 50.11	(—) 65.68
		1974–75	..	(+) 16.95	(—) 8.02	(—) 22.83	(—) 13.90
		1975–76	..	(+) 10.91	(+) 1.34	(—) 46.55	(—) 34.30
		1976–77	..	(—) 3.61	(+) 1.49	(+) 16.43	(+) 14.31
		1977–78	..	(—) 20.72	(—) 3.47	(—) 33.51	(—) 57.70
3.	(*a*) Steel Ingots OH	1973–74	..	(—) 6.42	(—) 42.17	(—) 106.99	(—) 155.58
		1974–75	..	(—) 0.49	(—) 48.26	(+) 7.19	(—) 41.56
		1975–76	..	(+) 22.15	(—) 6.86	(+) 1.38	(+) 16.67
		1976–77	..	(—) 3.51	(+) 22.41	(+) 11 68	(+) 30.58
		1977–78	..	(—) 35.42	(+) 2.15	(—) 102.43	(—) 135.70

3. (*b*) Steel Ingots LD	1973–74	.. (—)	3.17	(—) 12.37	(—) 120.91	(—) 136.45
	1974–75	.. (—)	7.93	(—) 12.86	(—) 30.19	(—) 50.98
	1975–76	.. (—)	12.52	(—) 0.56	(—) 33.45	(—) 46.53
	1976–77	.. (—)	13.59	(+) 7.34	(+) 24.75	(+) 18.50
	1977–78	.. (—)	14.64	(—) 10.12	(—) 78.35	(—) 103.11
4. Plates	1973–74	.. (+)	13.03	(—) 30.47	(—) 221.81	(—) 239.25
	1974–75	.. (+)	14.80	(—) 20.62	(—) 106.59	(—) 112.41
	1975–76	.. (+)	13.27	(+) 30.37	(—) 15.51	(+) 28.13
	1976–77	.. (+)	1.52	(+) 20.29	(+) 58.55	(+) 80.36
	1977–78	.. (+)	17.06	(+) 5.71	(—) 200.85	(—) 178.08
5. H.R. Coils	1973–74	.. (+)	0.14	(—) 29.70	(—) 181.43	(—) 210.99
	1974–75	.. (—)	0.51	(—) 22.33	(—) 110.76	(—) 133.60
	1975–76	.. (—)	29.46	(+) 8.17	(—) 56.70	(—) 77.99
	1976–77	.. (—)	3.17	(+) 1.48	(+) 5.18	(+) 3.49
	1977–78	.. (—)	9.12	(—) 9.34	(—) 132.14	(—) 150.60
6. H.R. Sheets & Plates	1973–74	.. (+)	17.43	(—) 35.16	(—) 224.13	(—) 241.86
	1974–75	.. (+)	22.35	(—) 44.13	(—) 176.96	(—) 198.74
	1975–76	.. (+)	12.75	(+) 28.01	(—) 101.58	(—) 60.82
	1976–77	.. (—)	87.76	(+) 28.91	(+) 25.12	(—) 33.73
	1977–78	.. (+)	18.09	(—) 18.44	(—) 114.46	(—) 114.81
7. H.R. Silicon Sheets.	1973–74	.. (—)	93.60	(—) 491.21	(—) 522.64	(—) 1107.45
	1974–75	.. (—)	65.06	(—) 294.45	(—) 509.91	(—) 869.42
	1975–76	.. (+)	1.09	(+) 23.69	(—) 194.38	(—) 169.60
	1976–77	.. (+)	52.42	(—) 727.12	(—) 244.32	(—) 919.02
	1977–78	.. (+)	119.60	(+) 67.45	(—) 517.04	(—) 329.99

1	2	3	4	5	6	7	8
8. C.R. Coils		1973–74	..	(+) 4.71	(—) 24.49	(—) 222.49	(—) 242.27
		1974–75	..	(+) 6.25	(—) 25.08	(—) 207.09	(—) 225.92
		1975–76	..	(+) 4.57	(—) 23.53	(—) 86.12	(—) 105.08
		1976–77	..	(+) 9.34	(+) 34.49	(—) 25.57	(+) 18.26
		1977–78	..	(+) NA	NA	NA	NA
9. C.R. Sheets		1973–74	..	(+) 5.24	(—) 34.74	(—) 279.15	(—) 308.65
		1974–75	..	(+) 13.95	(—) 46.59	(—) 243.99	(—) 276.63
		1975–76	..	(+) 22.23	(—) 40.43	(—) 98.40	(—) 116.60
		1976–77	..	(—) 82.08	(+) 22.81	(—) 32.33	(—) 91.60
		1977–78	..	NA	NA	NA	NA
10. Galvanised Sheets		1973–74	..	(+) 18.07	(+) 3.61	(—) 376.06	(—) 354.38
		1974–75	..	(—) 54.04	(+) 42.70	(—) 258.99	(—) 270.33
		1975–76	..	(+) 4.66	(+) 50.83	(—) 47.96	(+) 7.53
		1976–77	..	(+) 147.89	(—) 58.63	(—) 58.97	(+) 30.29
		1977–78	..	NA	NA	NA	NA

ANNEXURE XXV

(Referred to in paragraph 7.02)

Statement showing cost of labour for producing one tonne of ingot steel

(Figures in Rupees)

Departments	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
1	2	3	4	5	6	7	8	9
Works Department								
Wages and Salaries . .	86.65	116.30	100.30	119.75	139.40	141.78	127.44	141.91
Overtime . . .	4.59	7.15	8.59	9.35	14.40	12.26	9.63	16.82
Incentive Bonus . .	7.50	5.04	9.17	10.88	12.95	22.69	22.58	22.71
Total . . .	98.74	128.49	113.06	139.98	166.75	176.73	159.65	181.44
Administration & Township								
Wages and Salaries . .	30.47	41.15	26.19	28.75	33.35	34.66	30.76	32.06
Overtime . . .	0.69	1.78	1.36	1.66	2.20	1.63	0.90	1.45
Incentive Bonus . .	..	..	..	..	..	..	0.61	1.02
Total . . .	31.16	42.93	27.55	30.41	35.55	36.29	32.27	34.53
Grand Total . . .	129.90	171.42	145.61	170.39	202.30	213.02	191.92	215.97

ANNEXURE XXVI

(Referred to in paragraph 8.01)

Statement showing inventory holding of the Plant at the end of the year

(Rupees in lakhs)

Year	Total inventories of raw materials, stores and spares (excluding in transit) finished, semi-finished products and other miscellaneous stores at the end of the year	Stores and Spares (excluding in transit)	Raw materials (excluding in transit)	Finished semi-finished products (including in transit)	Total consumption of Stores & spares during the year (including expenditure during construction)	Total consumption of raw materials during the year (including expdr. during construction)	Year end inventories as no. of months' consumption		Total sales excluding excise duty, freight etc.	Finished and Semi-finished stock as no. of months' sales
							Stores & spares	Raw materials		
1	2	3	4	5	6	7	8	9	10	11
1970–71	6,337.59	3,382.74	577.23	2351.69	1296.40	3538.98	31.31	1.96	9926.11	2.84
1971–72	7,147.21	3,885.97	788.74	2458.31	1428.28	3311.88	32.65	2.86	8761.87	3.37
1972–73	8,751.88	4,979.79	812.77	2944.56	2153.09	4237.75	27.75	2.30	11063.04	3.19
1973–74	10,434.28	5,106.53	809.02	4506.03	2454.79	4679.74	24.96	2.07	11914.70	4.54
1974–75	11,758.61	5,605.48	901.55	5231.76	2703.57	6563.82	24.88	1.65	16691.02	3.76
1975–76	15,272.32	5,761.71	1057.28	8431.22	3248.25	9864.45	21.29	1.29	19027.32	5.32
1976–77	17,001.19	6,090.75	1386.07	9500.46	5475.95	11673.67	13.35	1.42	25912.45	4.40
1977–78 (13 months)	15,618.17	8,279.35*	1137.62	6159.20	6771.39	12746.10	15.89	1.16	31262.35	2.56

*It includes stock of ingot moulds & bottom plates which were earlier included under the head "Finished/semi-finished products" upto 1976-77.

ANNEXURE XXVII

(Referred to in paragraph 10.02.03)

Statement showing consumption of raw materials for production of one tonne of ammonia, norms fixed by the designers as well as the Plant Management

Raw Materials	Unit	Norms fixed by the		Actuals						
		Designers	Plant Management	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
1	2	3	4	5	6	7	8	9	10	11
(*i*) Coke Oven Gas	NM^3	3630@	4130@@	4140@@	4174@@	4130@@	4122@@	4190@@	4103@@	4144@@
(*ii*) Crude Naptha .	Tonne	0.744*	0.744*	0.740	0.771	0.801	..	..	..	..
		1.122**	1.122**	..	..	1.127	1.107	1.121	1.155	NA
(*iii*) Power . .	KWH	1016	1016	1310	1311	1270	1074	1083	1077	1161

@ At 59.2% hydrogen in coke oven gas.

@@ At 52.0% hydrogen in coke oven gas, which is normally available in coke oven gas supply by the Steel Plant.

*Before conversion of heating system of Naphtha Plant. During this period rich gas was used as the heating medium.

**After conversion of heating system, system changed over to Naphtha in Oct., 1973.

ANNEXURE XXVIII

(Referred to in paragraph 10.02.04)

Statement showing the total standard hours of working as indicated by the Designers, and accepted by the Management, the available hours, the actual working hours and downtime

Unit	Year	Calendar hours	Standard hours	Planned shut down hours	Available hours (3—5)	Actual working hours	Analysis of down time			
							Mech. Maint. hours	Elect. Maint. hours	Inst. Maint. hours	Spare hours
1	2	3	4	5	6	7	8	9	10	11
Naphtha Plant	1971–72	8784	7920	268.8	8515.2	7351.2	887.8	..		276.2
	1972–73	8760	7920	295.3	8464.7	7035.5	1053.7	6.9	7.5	361.1
	1973–74	8760	7920	1410.1	7349.9	6747.1	242.0	1.8	0.8	358.2
	1974–75	8760	7920	119.8	8640.2	7656.2	205.5	1.5	..	777.0
	1975–76	8784	7920	909.3	7874.7	7697.2	151.3	5.2	0.7	20.3
	1976–77	8760	7920	780.3	7979.7	7790.8	126.9	1.0	..	61.0
	1977–78	8760	7920	752.9	8007.1	7989.7	6.2	..	..	11.2
Ammonia Plant	1971–72	35136	31680	2265.6	32870.4	21786.1	2595.3	1482.2	24.6	6982.2
	1972–73	35040	31680	2159.6	32880.4	21973.6	4242.6	238.1	13.3	6412.8
	1973–74	35040	31680	3878.3	31161.7	22273.5	1130.0	9.4	11.3	7737.5
	1974–75	35040	31680	3574.8	31465.2	23723.1	1582.0	346.0	65.1	5749.0
	1975–76	35136	31680	2671.9	32464.1	29182.3	86.3	111.6	..	3083.9
	1976–77	35040	31680	1088.7	33951.3	31585.3	343.8	213.1	0.3	1808.8
	1977–78	35040	31680	1691.6	33348.4	31806.4	82.5	64.6	..	1394.9

Nitric Acid Plant	1971–72	35136	31680	3107.8	32028.2	14730.8	5632.9	4.2	2.8	11657.5
	1972–73	35040	31680	1636.8	33403.2	15080.8	6171.9	454.8	5.0	11690.7
	1973–74	35040	31680	3164.5	31875.5	14785.2	4484.2	4090.7	2.9	8512.5
	1974–75	35040	31680	9395.7	25644.3	18036.1	2232.6	54.0	13.3	5308.3
	1975–76	35136	31680	4601.3	30534.7	23918.3	3312.4	66.6	8.1	3229.3
	1976–77	35040	31680	5026.3	30013.7	25033.2	2419.0	95.8	16.5	2449.2
	1977–78	35040	31680	4641.2	30398.8	24626.5	1954.8	67.6	34.8	3715.1
Nitrolime Stone Plant	1971–72	35136	28800	1954.3	33181.7	13387.8	10092.4	214.1	28.2	9459.2
	1972–73	35040	28800	4833.0	30207.0	13761.6	5387.7	263.1	41.5	10753.1
	1973–74	35040	28800	10264.8	24775.2	12618.4	2637.3	219.7	30.0	9269.8
	1974–75	35040	28800	9276.3	25763.7	16622.9	1760.2	205.1	19.9	7155.6
	1975–76	35136	28800	6508.9	28627.1	20930.9	2481.6	254.2	32.2	4928.2
	1976–77	35040	28800	4857.5	30182.5	20298.8	2562.6	239.1	6.8	7075.2
	1977–78	35040	28800	6557.8	28482.2	19033.0	2530.9	320.5	12.8	6585.0

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