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MGIPR-412 NAL/79



**REPORT OF THE**

**COMPTROLLER AND AUDITOR GENERAL  
OF INDIA**

**UNION GOVERNMENT (COMMERCIAL)**

**1979**

**PART VI**

**THE FERTILIZER CORPORATION OF INDIA  
LIMITED**

**(SINDRI UNIT)**

## ERRATA

Page	Reference	<i>For</i>	<i>Read</i>
1	3rd line of second para	pants	plants
3	1st line of para ( f )	(excessive pro- curement)	(excessive pro- curement),
6	1st line of para below table	assessment	assessments
6	item (a) of Sl. No. I in the table	Chemicals	Chemical
15	14th line	in	a
16	8th line	depressuring	depressurising
20	10th line of Ministry's reply of April 1979	plants	plans
45	5th line from bottom of col. 2	93.95	93-95
70	1st line of para (ii)	Phospheric	Phosphoric
71	2nd line	technician	technicians
73	item (iii) below para (a)	Belgian Franc	Belgian Francs
73	item (iv) below para (a)	Non-revision of	Non-provision or
77	3rd line of para(d)	Provision	provision
84	item (iii), 1st line	sypsum	gypsum
105-			
106	1st col. under 1972-73, 1973-74 & 1974-75	tonne	tonnes

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PART VI

THE FERTILIZER CORPORATION OF INDIA  
LIMITED

(INDIAN UNIT)

REPORT OF THE

COMPTROLLER AND AUDITOR GENERAL

OF INDIA

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UNION GOVERNMENT (COMMERCIAL)



PART VI

THE FERTILIZER CORPORATION OF INDIA LIMITED

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## PREFATORY REMARKS

A reference is invited to paragraph 5 of the Prefatory Remarks contained in the Report of the Comptroller and Auditor General of India—Union Government (Commercial), 1978—Part III—the Fertilizer Corporation of India Limited-Trombay Unit wherein it was *inter alia* mentioned that the Reports on the working of other units of the Corporation were under various stages of finalisation.

2. This part contains the results of appraisal undertaken by the Audit Board of the working of Sindri Unit (including Sindri Rationalisation, Sindri Modernisation and Mining Organisation, Jodhpur) of the Fertilizer Corporation of India Limited. The Report has been brought upto date by incorporating data upto 1977-78. In this case, Audit Board consisted of the following members :—

- (1) Shri Y. Krishan, Deputy Comptroller and Auditor General and Chairman, Audit Board upto 10th August 1977.
- (2) Shri T. Rengachari, Chairman, Audit Board and *Ex-officio* Additional Deputy Comptroller and Auditor General (Commercial) with effect from 11th August 1977.
- (3) Shri A. S. Krishnamoorthy, Member, Audit Board and *Er-officio* Director of Commercial Audit (Coal), Calcutta (Subsequently, Director of Audit, Eastern Railway, Calcutta).
- (4) Shri M. P. Singh Jain, Member, Audit Board and *Ex-officio* Director of Commercial Audit, Calcutta upto 31st October 1978.

- (5) Shri A. C. Bose, Member, Audit Board and *Ex-officio* Director of Commercial Audit (Fertilizers and Chemicals), New Delhi upto 8th March 1979.
- (6) Shri P. C. Asthana, Member, Audit Board and *Ex-officio* Director of Commercial Audit (Fertilizers and Chemicals), New Delhi with effect from 9th March 1979.
- (7) Shri Paul Pothen, Managing Director, Indian Farmers Fertilizers Co-operative Limited, New Delhi—Part Time Member.
- (8) Shri T. R. Visvanathan, General Manager (Tech.), Arudra and Company, Madras.
- (9) Dr. P. K. Narayanaswamy, Chairman and Managing Director, the Fertilizers and Chemicals, Travancore Limited, Alwaye—Part Time Member appointed in December 1977 in place of Shri Paul Pothen who ceased to be a member in November 1976 consequent upon his appointment as part time non-official Director of the Fertilizer Corporation of India Limited.

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

- (a) the results of discussion held with the representatives of the Ministry of Chemicals and Fertilizers and the Corporation at its meeting held on 28th August 1979, and
- (b) the additional information furnished by the Ministry in January/March 1980.

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 the members who are not officers of the Indian Audit and Accounts Department.

## 1. Introduction

1.1 This was the first fertilizer factory to come up in the public sector. Originally, the factory was set-up at a capital cost of Rs. 23 crores (approximately) to produce ammonium sulphate, using coal, coke and gypsum as principal raw materials. While the coal and coke were available from mines/coke ovens close to Sindri, gypsum was mainly obtained from mines located in Rajasthan; some quantity of gypsum was also imported from Pakistan (Doudkhel mines) upto 1965-66. The plants in the original factory, mainly comprising Ammonia and Ammonium Sulphate Plants with a Power Plant and a Gas Plant as ancillaries, were supplied by Chemical Construction Corporation of U.S.A. and were installed in 1951.

In 1954 a Coke Oven Plant was also installed to produce coke fed to the Gas Plant; coke was earlier being purchased from the steel plants. Besides coke, the coke Oven Plant produced 10 million cft. of gas per day. In order to utilise effectively the coke oven gas, the Gas Reforming Plant and associated Ammonia Plant, Urea Plant, Nitric Acid Plant and Ammonium Sulphate Nitrate Plant, were also installed. These plants, commissioned in 1959, were to produce urea and double salt.

Coke oven gas being earmarked for processing into ammonia and fertilizers, a substitute fuel gas was required for heating the ovens in the Coke Oven Plant; a Lean Gas Plant was erected and commissioned by the end of 1958. As the output of lean gas was below the designed capacity of the Plant and, therefore, insufficient to meet the entire fuel requirement of the Coke Oven Plant, certain items of ancillary equipment were installed towards the end of 1966 at a cost of Rs. 23.93 lakhs to make up the deficiency in the capacity.

Because of the changing quality of coal blends, less coke oven gas was produced than the rated capacity, resulting in limitation of synthesis gas mixture in the Ammonia Plant installed in 1959 (known as Expansion Ammonia Plant). A small Naphtha Reformation Plant for producing 60 tonnes of ammonia per day was, therefore, commissioned in March 1969 to supplement the supply of synthesis gas mixture.

In addition to the plants mentioned above, an Ammonium Nitrate Plant was installed in 1972-73 to meet the mining industry's requirement of explosive grade ammonium nitrate. A Guanidine Nitrate Plant to meet the requirements of the Department of Defence Production for guanidine nitrate, had been put on trial run in 1977 but has not been able to achieve sustained production on account of technological and other deficiencies referred to in paragraph 4.2.

1.2 The performance of the Sindri Unit has been the subject matter of comment by the Estimates Committee, the Public Accounts Committee and the Committee on Public Undertakings from time to time. The operations of the Sindri Unit for the period ending March 1968 were last examined by the Committee on Public Undertakings in its 43rd Report (Fourth Lok Sabha—April 1969) on the basis of the material contained in Audit Report (Commercial), 1968. The recommendations of the Committee related mainly to the following aspects :—

- (a) Continued shortfall of actual production *vis-a-vis* rated capacity despite so many years of experience in the line (Para 2.22).
- (b) A re-examination of the 'attainable capacity' of Ammonia Plant (original) (Para 3.5).
- (c) Attaining the rated capacity of Expansion Ammonia Plant after installation of Naphtha Gasification Unit by April/May 1969 (Para 4.11).

- (d) To make firm alternate arrangements for high grade coking coal from Jharia coal fields (Para 6.23).
- (e) Inability of the Sindri Unit to make firm assessment of the actual requirement of staff even after a lapse of 17 years, although various committees and specialist firms had been appointed to assess the work load (Para 8.16).
- (f) Lack of inventory control (excessive procurement) accumulation of surplus stores and absence of proper norms for transit losses (Para 10.12, 11.6 and 12.15).

Action taken by Government on the above recommendations is contained in the 57th Report (Fourth Lok Sabha—December 1969) of the Committee on Public Undertakings.

## 2. Production performance

### 2.1. Process

#### 2.1.1. Ammonia, Ammonium Sulphate (Chemico's Plant)

*Ammonia.*—Converted gas produced in the Gas Plant contains 28 per cent carbon dioxide, 51 per cent hydrogen, 17 per cent nitrogen and about 4 per cent carbon monoxide. This gas is purified in the Ammonia Plant at a high pressure for removal of carbon dioxide and carbon monoxide. The purified gas (known as Make-up gas) is fed to Ammonia Synthesis Convertors for producing Ammonia.

*Ammonium Sulphate.*—Ammonia is converted into ammonium carbonate by treating with carbon dioxide and water. The ammonium carbonate solution thus obtained is reacted with powdered gypsum to obtain an ammonium sulphate solution and insoluble chalk. The chalk is separated by filtration and the ammonium sulphate solution is concentrated and crystallised. The chalk obtained as residue is made into a slurry with water and disposed of to the neighbouring cement factory of the Associated Cement Companies of India Ltd.

From 1970-71, ammonium sulphate is also being produced by reacting ammonia with sulphuric acid, produced by the Sulphuric Acid Plant (capacity 400 tonnes per day) set up at Sindri by the Pyrites, Phosphates and Chemicals Limited.

#### 2.1.2. Ammonia, urea and double salt (Montecatini's Plant).

—Coke-oven gas is freed from impurities and the hydrogen recovered from it is then mixed with nitrogen obtained from air and the mixture of nitrogen and hydrogen is converted

into ammonia at a high pressure and temperature. Carbon dioxide obtained as a by-product during the purification of the coke-oven gas is reacted with the ammonia at a specified pressure and temperature to form urea in solution. The solution is further concentrated and prilled into urea.

Double salt is produced by first converting ammonia into nitric acid by oxidation with air. The acid thus obtained is reacted with ammonia to form ammonium nitrate in solution. This solution is concentrated and granulated with ammonium sulphate crystals in a suitable proportion to form the double salt.

2.2. *Rated Capacity.*—The designed capacity of the Ammonia Plant, Ammonium Sulphate Plant, Ammonium Sulphate Nitrate or Double Salt Plant and Urea Plant was as follows :—

S. No.	Name of the Plant	Total capacity of production per annum	Remarks
<i>(i) Ammonia</i>			
(a)	Original Plant—supplied by M/s. Chemical Construction Corporation.	96,000 tonnes with 8 compressors	
(b)	Expansion Plant—supplied by M/s. Montecatini.	62,370 tonnes	189 tonnes per day for 330 days.
<i>(ii) Ammonium Sulphate</i>		3,55,000 tonnes	
<i>(iii) Ammonium Sulphate Nitrate (Double Salt)</i>		1,21,920 tonnes	
<i>(iv) Urea</i>		23,470 tonnes	

As the rated capacities of production could not be achieved in any year from the commencement of production in October 1951, the Corporation set up in April 1961 a Committee (known as Dr. Zahir's Committee) and another committee (Kasturirangan's Committee) in 1964 to examine the achievable capacities of the Sindri Unit. An assessment of capacity was also made by the General Manager of the Sindri Unit in July

1965 at the instance of the Board. The assessments made in 1961, 1964 and 1965 were as follows :—

Sl. No.	Name of the Plant	Dr. Zahir Committee's assessment (1961)	Kasturirangan Committee's assessment (1964)	General Manager's assessment (1965)
(In tonnes)				
1.	<i>Ammonia</i>			
(a)	Original Plant—supplied by Chemicals Construction Corporation	1,10,000	98,000	98,000
(b)	Expansion Plant supplied by Montecatini	60,000	46,200	40,000
2.	<i>Ammonium Sulphate</i>	3,54,000	3,20,000	3,20,000
3.	<i>Double Salt</i>	1,24,000	87,000	71,500
4.	<i>Urea</i>	24,000	20,500	20,000

The Board considered the above assessment in September 1965 and approved the capacities assessed by the General Manager. The wide variations between the capacities determined by Dr. Zahir's Committee and those assessed by the General Manager were attributed to the following factors :—

(1) *Ammonia Plants*

(i) *Ammonia Plant (Original)*.—Out of 8 compressors, originally provided, one was necessarily under general overhaul, thereby leaving 7 compressors for operation. Owing to outage factor being higher than that anticipated on account of faulty maintenance and operation, average availability of compressors worked out to 6. In order to ensure a steady production, an additional 9th compressor was approved in 1954. It was commissioned in 1957. It did not, therefore, increase the plant capacity but only helped maintaining the rated output. There was also limitation of the Gas Plant.

(ii) *Ammonia Plant (Montecatini)*.—The assumption made by the Committee regarding stream efficiency, blends of coal, pushing of ovens and capacity of Lean Gas Plant did not hold good in day-to-day operation. The capacity of the Ammonia Plant was, however, expected to go up by 6,500 tonnes per annum after the installation of Lean Gas Producer and any further increase in capacity was dependent on supplementing the gas feed which was proposed to be done by installing a Naphtha cracking unit.

### (2) *Ammonium Sulphate Plant*

The capacity assessed by the Committee could not be achieved due to poor quality of gypsum.

### (3) *Double Salt Plant*

Owing to the shortage of ammonia from the Montecatini Plant and also inherent trouble in the Double Salt Plant, it was not possible to achieve the capacity assessed by the Committee.

### (4) *Urea*

The stream efficiency of 340 days assumed by the committee was not achievable.

In December 1972, it was reported to the Board that the Corporation's Technical Committee had assessed in May 1972 the capacity of the Sindri Plant at not more than 75,000 tonnes nitrogen per annum during 1972-73 to 1974-75 and 80,000 tonnes nitrogen per annum during 1975-76 and 1976-77. In fixing the attainable capacity at 75,000 tonnes, the following constraints were mentioned by the Management to the Board :—

(a) Sindri Unit had suffered since inception from the deteriorating quality of coal and gypsum.

- (b) Plants were old and obsolete and imported replacements were costly and difficult to obtain. Indigenisation to the extent brought about had worsened the situation. Indigenous supplies were unreliable and took twice as long to obtain.
- (c) The level of instrumentation provided was very much below the mark all the time and considerable operational work depended on manual control.
- (d) There was frustration in the staff, there being no scope for further advancement. Besides, many qualified staff had been shifted to other Divisions, thereby making it impossible to operate the Plant at higher efficiency.
- (e) The reliability of equipment had declined by ageing and resulted in repeated unforeseen break-downs.

It was suggested to the Board that the capacity should remain derated till the renovation, rationalisation and modernisation schemes were completed and commissioned.

Thus capacity at 75,000 tonnes of nitrogen assessed in May 1972 was less than the capacity (94,990 tonnes) assessed in 1965. The decline would be still higher if increase in capacity visualised in 1965 on the installation of the Lean Gas Producers and Naphtha cracking unit is taken into account. The question of derating the capacity was taken up with the Ministry in June 1973.

The Ministry did not, however, favour the derating of the capacity as the problems for which derating was being asked for, would not continue after Sindri Modernisation was completed. The matter was again taken up by the Corporation in April 1975 but, in the meantime, an explosion took place in the Ammonia Plant resulting in the partial shut down of the Sindri Unit. The Ministry, therefore, asked the Corporation to re-eval

the matter and send the proposals after re-assessing the achievable capacity of the Unit. In December 1977, the Corporation informed the Ministry that, as it would be closing the old Sindri Plant in a phased manner on account of its deteriorating condition, the question of derating the capacity would not arise

Production performance against the capacities fixed from time to time has been analysed in the succeeding paragraphs.

## 2.3 Actual performance

### 2.3.1 Ammonia Plants

#### (1) Original Plant : (Chemical Construction Corporation)

This Plant is based on gas to be made available by the Semi-Water Gas Plant. The table below indicates the rated capacity as well as the actual production during 1969-70 to 1977-78 :—

(Figures in lakhs of tonnes)

Year	Rated capacity		Actual production
	Original	Approved by Board (1965)	
1969-70	0.96 (with 8 compressors)	0.98* (with 9 compressors)	0.93
1970-71	"	"	0.90
1971-72	"	"	0.83
1972-73	"	"	0.77
1973-74	"	"	0.79
1974-75	"	"	0.78
1975-76	"	"	0.69
1976-77	"	"	0.41
1977-78	"	"	0.23

NOTES 1. \*Capacity of the 9th compressor which was installed as a stand by was 12000 tonnes per year. The rated capacity of 98000 tonnes included 2000 tonnes of ammonia for internal use.

2. While the capacity of this Plant is based on the gas to be obtained from the Semi-water Gas Plant, the production is inclusive of the ammonia produced from cracked gas diverted from the Gas Reformation Plant of the Expansion Ammonia Plant to the extent indicated below :—

Year	Ammonia produced from gas diverted from the Expansion Plant
	(In lakhs of tonnes)
1970-71	0.08
1971-72	0.10
1972-73	0.12
1973-74	0.18
1974-75	0.15
1975-76	0.16
1976-77	0.07
1977-78	0.03
<b>TOTAL</b>	<b>0.89</b>

Production at less than the rated capacity upto 1975-76 was ascribed to :

- (i) non-availability of suitable coal due to presence of ash content in the coal more than specified ; (The percentage of ash content was higher during 1971-72 to January 1977 than that specified in the coal blend prepared by the Unit) ;
- (ii) deteriorating condition of coke-oven battery and semi water gas plant ; and
- (iii) serious troubles in the semi-water gas plant because of difficulty in attending to scheduled maintenance, break-downs on account of poor quality or delayed supply of indigenous spares and inadequacy of imported spares.

In regard to lower production during 1976-77 and 1977-78 the Ministry have stated (May 1979) that the production during these two years came down further because in accordance with the closure plan approved by the Board in December 1977, the Semi-Water Gas and C.C.C. Ammonia Plants were to be closed down by 31st December 1977. This closure was necessitated due to ageing of the plants, deterioration in the efficiencies and also for safety reasons.

(2) *Expansion Plant : (Montecatini)*

The Expansion Plant was designed on the basis that 10 million cft. of gas would be available daily from the Coke-Oven Plant. Non-achievement of the rated production of ammonia in this Plant was *inter alia* ascribed to the shortage of coke-oven gas. In order to make good the shortage of gas, it was reported to the Committee on Public Undertakings in para 4.3 of its 43rd Report (Fourth Lok Sabha—April 1969) that the Unit was installing two gasification Units for gasifying naphtha to produce the extra gas, which would be mixed with the coke oven gas to manufacture ammonia. It was also mentioned that the Naphtha Gasification Unit would go into production by April-May 1969.

The contract for the supply of the Naphtha Reformation Plant with a capacity of 60 tonnes a day was awarded to M/s. Hitachi, Japan in April 1967 and the plant was to be put up by the said firm within 22 months *i.e.* February 1969. The initial cost estimate of the scheme was Rs. 112.45 lakhs (including effect of devaluation). The actual expenditure incurred was Rs. 122.10 lakhs.

It was reported to the Board in March 1970 that there was high pressure drop across the heater and some other instruments were also defective. As a result of these, guarantee tests had not been completed, though the last date prescribed under the contract was 17th March 1970. It was also mentioned that it would be necessary to instal a secondary Reformer to process

the entire quantity of gas from the Naphtha Reformation Plant to secure the optimum use of the scheme. The Ministry have explained (January 1980) that the Secondary Reformer was proposed for installation to make the naphtha reformer gas acceptable for blending with the coke based gas, by introducing the necessary nitrogen and at the same time reducing the methane in the primary reformer gas to low limits to eliminate the inerts problems. The proposal was, however, given up because another low cost expedient was found to meet the same need. It has further been stated that guarantee tests had been successfully conducted in March 1971.

To supplement the coke oven gas available, the Unit was also injecting naphtha directly into cracking unit from June 1971.

Notwithstanding the commissioning of the Naphtha Reformation Plant in 1969-70 and injecting of naphtha directly, the production of ammonia did not improve and remained much below capacity, as indicated below :—

(Figures in lakhs of tonnes)

Year	Capacity		Actual
	Original	Capacity approved by the Board (1965)	
1969-70	0.62	0.40	0.35
1970-71	"	"	0.34
1971-72	"	"	0.29
1972-73	"	"	0.26
1973-74	"	"	0.25
1974-75	"	"	0.23
1975-76	"	"	0.22
1976-77	"	"	0.13
1977-78	"	"	0.11

Apart from the shortage of coke oven gas (mentioned below in paragraph 2.5), the main reason for shortfall in production was the lower efficiency of gas boxes through which gas is purified before being converted into ammonia. In fact, one of two gas boxes was not in use from 1973-74.

In this connection, the Ministry have stated (January 1980) as follows :—

- (i) The main reason for shortfall in production since February 1973 was due to explosion in the 2nd cold box whereby the capacity came down to 50 per cent. The second box could not be recommissioned in spite of best efforts.
- (ii) The frequent fluctuations in the quality of coke oven gas due to fast deterioration of coke oven, also affected the performance of the box.
- (iii) Overall efficiency continued to deteriorate with the ageing of the Plant and had further contributed to lower production in spite of higher availability of gas.

The Ministry have further stated (March 1980) that the cause of explosion of the gear box was investigated by an Enquiry Committee. According to the Enquiry Committee, the explosion was only an accident and was not caused due to negligence.

### 2.3.2 Production and utilisation of ammonia

The total quantities of ammonia available from production and stock in hand and utilised from 1970-71 to 1977-78 were as follows :—

(Quantity in lakhs of tonnes)

Year	Total Qty. available	Issues				
		Ammonium Sulphate Plant	Urea Plant	Double Salt & Nitric Acid Plants	Sales to Out side parties	Loss in Ammonia Plants and Gas Reforming Plant
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970-71	1.24	0.78	0.21	0.13	0.09	0.02
1971-72	1.12	0.65	0.24	0.09	0.10	0.03
1972-73	1.03	0.52	0.22	0.15	0.10	0.03
1973-74	1.04	0.53	0.24	0.15	0.10	0.03
1974-75	1.01	0.55	0.18	0.12	0.12	0.03
1975-76	0.91	0.49	0.15	0.12	0.11	0.02
1976-77	0.54	0.32	0.02	0.07	0.10	0.01
1977-78	0.34	0.16	..	0.06	0.09**	0.01

NOTES :—In addition to sale to outside parties, ammonia ranging from 577 tonnes to 1533 tonnes was also supplied to other units and Division of the Corporation during 1970-71 to 1977-78.

\*\*Includes sales to sister units i.e. Durgapur, Barauni and Planning and Development Division.

In this connection, the following features deserve mention :—

- (a) Production of ammonia from naphtha was of the order of 11,792 tonnes, 17,782 tonnes, 22,883 tonnes, 28,221 tonnes, 25,935 tonnes, 27,673 tonnes, 12,604 tonnes and 9,337 tonnes respectively during 1970-71 to 1977-78 and represented 10 per cent, 16 per cent, 22 per cent, 27 per cent, 26 per cent, 30 per cent, 23 per cent and 28 per cent respectively of the total production in these years. The rest of the production was from semi-water gas and coke oven gas.

- (b) While ammonia was a constraint in the production of fertilizers, ammonia was sold to outside parties. Such sales accounted for more than a tenth of the total production during 1971-72 to 1975-76. Over 90 per cent of the total sales were to one party viz., Indian Explosives Limited, Gomia which were made under specific direction from Government from time to time.

The Ministry have further explained (May 1980) as follows :—

With the setting up of an explosive plant by Indian Explosives Limited at Gomia, a decision was taken that their ammonia requirement should be met from Sindri. Explosive industry is also in high priority industry on account of the use of explosives in coal and other mines. Building of small ammonia capacity of 10,000 tonnes, which was the requirement of the Indian Explosives Limited, was not a viable proposal. It was, therefore, decided that out of the large capacity at Sindri, 10,000 tonnes of ammonia should be set apart for use in explosives.

- (c) Under the notification issued by Government in June 1971, excise duty is leviable on ammonia consumed internally in excess of 2 per cent of the total production. As the consumption of ammonia internally during 1971-72 to 1978-79 was more than 2 per cent, excise duty aggregating Rs. 11.20 lakhs had to be paid. Upto July 1975, the Unit was paying the excise duty calculated with reference to the daily production; it was changed to monthly production from August 1975 and to yearly production from 1977-78. As the excise duty payable on yearly basis is to be computed on the excise duty rate prevailing on the last date of March, the incidence of excise duty payable on yearly basis during 1978-79 was higher than that payable on monthly

basis. Consequently, the Unit has switched over from yearly basis to monthly basis for payment of excise duty on internal consumption of ammonia in excess of 2 per cent of the production from 1979-80.

The Ministry have stated (April 1979) that internal consumption had exceeded the norm of 2 per cent on certain occasions due to various process requirements, such as depressurising of the system for maintenance jobs, depressuring of individual compressors for valve checking and gland packing, lifting of relief valves, chronic gland leakages, isolation of valves, mal-functioning of individual compressors and other allied factors connected with ageing and out-moded machinery.

- (d) It was noticed that the gas transferred from the Gas Reformation Plant could not be utilised in full by the Expansion Ammonia Plant for production of ammonia, thereby resulting in loss of production of ammonia to the extent indicated below :—

Year	Loss (In tonnes)
1971-72	2598
1972-73	1490
1973-74	1662
1974-75	2885
1975-76	2626
1976-77	370
1977-78	Not calculated

In this regard, the Ministry have stated (April 1979) as follows :—

The difference in ammonia, indicated as loss, can be traced to the actual difference in the quantity of synthesis mixture gas supplied from Gas Reformation Plant on the basis of flow recorder and the corresponding actual production in the Ammonia

Plant. It does not take into account the system losses, especially re-circulator gland leakages, gas vented in the Ammonia Plant due to bad ratio and the gas utilised for stabilising convertors.

#### 2.4 Ammonium Sulphate, double salt and urea

2.4.1 The rated capacity, production planned each year and the actual production of these items were as follows :—

Year	Production planned		Actual production
	Original	Revised	
(1)	(2)	(3)	(4)
	(.....In lakhs of tonnes)		
<i>Ammonia sulphate</i>	(designed capacity 3.55 lakh tonnes; capacity as approved by the Board 3.20 lakh tonnes)		
1969-70		2.80	2.91
1970-71	3.00	3.03	2.75
1971-72	3.03	3.12	2.31
1972-73	3.12	1.76	1.72
1973-74	1.86	1.76	1.94
1974-75	1.69	1.71	1.98
1975-76	1.53	1.56	1.77
1976-77	1.45	1.05	1.03
1977-78	1.11	0.48	0.43
<i>Double Salt</i>	(designed capacity 1.22 lakh tonnes; capacity as approved by the Board 0.72 lakh tonnes)		
1969-70		0.44	0.43
1970-71	0.65	0.56	0.42
1971-72	0.50	0.46	0.31
1972-73	0.37	0.63	0.57
1973-74	0.72	0.55	0.48
1974-75	0.60	0.34	0.27
1975-76	0.37	0.33	0.21
1976-77	0.30	0.02	0.02
1977-78			

(1)	(2)	(3)	(4)
Urea	(designed capacity 0.23 lakh tonnes; capacity as approved by the Board 0.20 lakh tonnes)		
1969-70	..	0.15	0.16
1970-71	0.20	0.18	0.15
1971-72	0.18	0.19	0.14
1972-73	0.19	0.11	0.10
1973-74	0.16	0.14	0.12
1974-75	0.15	0.13	0.09
1975-76	0.14	0.14	0.07
1976-77	0.07	0.004	0.004
1977-78	..	..	..

NOTES :—1. The production figures of ammonium sulphate are computed before deducting dust loss assessed ad hoc at 1 per cent.

2. Double Salt and Urea Plants were shut down from July 1976 as mentioned in paragraph 10.

It will be seen that actual production of all the three types of fertilizers was much less than the designed capacity approved by the Board in 1965.

As already mentioned, the Technical Committee appointed by the Board had assessed (May 1972) the capacity of the Plant during 1972-73 to 1974-75 at 75,000 tonnes of nitrogen per annum and 80,000 tonnes of nitrogen per annum in 1975-76 and 1976-77, after taking into account the various constraints under which the Plant was operating. Even this level of production was not achieved; production of three fertilizers in terms of nitrogen was as follows :—

	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
(Production in tonnes)	55710	58011	51630	45,600	22,800	9,028

According to the Unit (April 1974/January 1975), the shortfall in production was attributable to the following :—

### *Ammonium Sulphate*

- (i) Erratic performance and frequent stoppages of the Semi-water Gas Plant.
- (ii) Poor quality of gypsum resulting in loss of substantial quantities of ammonium sulphate with the chalk sludge.
- (iii) Shortfall in production of ammonia in the Ammonia Plant.

### *Double Salt*

- (i) Erratic performance of the Sulphate Section.
- (ii) Non-availability of better grade gypsum.
- (iii) Consumption of ammonia and nitric acid in excess of the prescribed limit.
- (iv) Low ammonia efficiency in Nitric Acid Plant.
- (v) Efficiency in design of the Ammonium Sulphate crystallisation unit which was detected at the commissioning stage as the guarantee tests of production were not fulfilled by the Contractor. The deficiency cropped up inherently in the design of the scheme itself resulting in inadequate capacity which could be known only on full load test of the plant. No corrective measures could be taken to overcome such deficiency for want of adequate quantity of ammonia due to the problem of coal availability.

*Urea*

Low ammonia efficiency and external constraints such as, non-availability of ammonia, carbon dioxide, etc.

It appears that all these constraints were taken into account by the Technical Committee in May 1972 in fixing the achievable capacity of 75,000 tonnes nitrogen.

In this connection, the Ministry have stated (April 1979) as under :—

“In view of the conditions of the older plants at Sindri Unit and the renovation programme, it was very difficult to estimate the performance of the coke oven Plant where even experts gave widely varying figures of plant performance and conditions. In the last year of renovation programme, it was observed that, although many of the items were covered, there were number of newer failures that were cropping up as renovation jobs were progressing. Such practical difficulties completely upset estimates and plants. The extra job of renovation done and improvement brought about during the course of year or two were getting nullified by the poor quality of raw materials especially coal, with the result that the higher production capacity which would normally be expected was not being realised.”

2.4.2 Initially, the ammonium sulphate required for double salt was to be supplied by the Ammonium Sulphate Plant. In August 1969, an Acid Neutralisation Section to prepare ammonia sulphate liquor, by reacting ammonia with sulphuric acid, was installed as an adjunct to the Urea Plant at a cost of Rs. 14.13 lakhs. Sulphuric acid was to be provided by the Sulphuric Acid Plant commissioned in 1969-70. This section was to produce ammonium sulphate liquor equivalent to 250 tonnes of sulphate per day which would suffice to produce 400 tonnes a day of

double salt as designed. From 1969-70, the Double Salt Plant was thus no longer dependent on the Ammonium Sulphate Plant for supply of ammonium sulphate. The utilisation of this section was far below the capacity. Besides, whatever sulphate liquor was produced could not be utilised in the Double Salt Plant and a substantial portion was diverted to Ammonium Sulphate Plant for production of ammonium sulphate.

The Ministry have stated (April 1979) as follows :—

“The utilisation of this unit depended mainly on the availability of Tail gas from Urea Plant. Any shut down of Urea Plant for shortage of liquid ammonia or  $\text{CO}_2$  from Gas Reforming Plant caused shut down of the Unit. Also it depended solely on Sulphuric Acid Plant for its requirement of Sulphuric Acid. The teething troubles of Sulphuric Acid Plant were also prolonged. However, whenever the Unit had fairly good run, the entire available neutralised solution could not be usefully utilised in Double Salt Plant due to increased break-downs and premature ageing of Double Salt equipment and on various occasions due to short supply of Ammonia or Nitric Acid.”

2.4.3 A second acid neutralisation section was commissioned in September 1971 as an adjunct to Ammonium Sulphate Plant at a cost of Rs. 10.09 lakhs. This section was also to produce ammonium sulphate liquor equivalent to 250 tonnes of sulphate per day. Sulphuric acid was to be obtained from the Sulphuric Acid Plant set up by the Pyrites, Phosphates and Chemicals Ltd. This section was also utilised to a negligible extent.

The Ministry have stated (April 1979) that, besides intermittent functioning of Sulphuric Acid Plant, gross under-utilisation of second Neutraliser was caused by low load in Ammonia Plants and frequent failure of lead lining.

2.4.4 The total production of ammonium sulphate, based on sulphuric acid used in the above mentioned two acid neutralisation sections was as follows :—

	(In tonnes)							
	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
(a) From the Acid Neutralisation Section of Ammonium sulphate Plant . . . . .	..	3371	4923	3361	5906	6460	11543	4942
(b) From acid Neutralisation Section of Urea Plant . . . . .	16751	22344	12171	11399	15598	14466	7119	1058
<b>TOTAL . . . . .</b>	<b>16751</b>	<b>25715</b>	<b>17094</b>	<b>14760</b>	<b>21504</b>	<b>20926</b>	<b>18662</b>	<b>6000</b>

The production of ammonium sulphate from gypsum would, therefore, be 2.58 lakh tonnes in 1970-71, 2.05 lakh tonnes in 1971-72, 1.55 lakh tonnes in 1972-73, 1.79 lakh tonnes in 1973-74, 1.76 lakh tonnes in 1974-75, 1.56 lakh tonnes in 1975-76, 0.84 lakh tonnes in 1976-77 and 0.37 lakh tonnes in 1977-78.

As mentioned in paragraph 2.4.2 and 2.4.3, gross under-utilisation of the capacity of both Acid Neutralisation Sections was mainly due to intermittent functioning of the Sulphuric Acid Plant put up at a cost of Rs. 4.19 crores. Had sulphuric acid been sufficient to feed both the Acid Neutralisation Sections to their full capacity, dependence on gypsum to produce ammonium sulphate would have been reduced correspondingly.

2.4.5 Coal has been a continuous problem with the Unit, as at no single time, the Plant could be stabilised on a mixture of coals, available as a blend, to produce the required quality of coke and quantity of coke oven gas, to satisfy the requirements of the Gas Plant as well as Gas Reforming Plant.

The Unit stated (January 1975) that as the quality of coal, even though mined at the same place, went on changing from seam to seam, the study made by it to establish a suitable blend became a continuous trial without fruitful results. Subsequently, the problem of priorities of allocation of coal came in a big way due to steel plants coming into existence which enjoyed the highest priority as far as coking coal was concerned. Kargali coal which was tried and found to be most suitable, was totally denied many times on account of commissioning of the Bokaro Steel Plant.

2.4.6 The coke oven battery which had started showing signs of deterioration in 1969, was a major constraint responsible for poor production performance. Although, according to the expert opinion obtained in October-November 1970 and in 1971, a thorough renovation of the Plant was necessary to keep it in operation, the renovation was started from April 1973 (also refer to paragraph 2.5).

2.4.7 Proposals for modifying the product pattern of the Sindri Plant, essentially to reduce dependence on Rajasthan gypsum, were considered by the Board from 1960-61 onwards. These mainly related to replacement of gypsum by sulphuric acid or by by-product gypsum. Being unable to continue production with sulphuric acid, the Rationalisation Scheme which would make by-product gypsum available for production of ammonium sulphate, was approved by Government in December 1967. The scheme went into commercial production from October 1979 (also refer paragraph 10).

2.5 *Coke Oven Plant.*—This Plant was set up in 1954 to produce coke required for the Semi-Water Gas Plant. The designed annual capacity of the plant is 2.23 lakh tonnes of coke per annum. Besides coke, it is designed to produce daily 10 million cft. of coke oven gas. The production performance of the Plant for the years 1969-70 to 1977-78 is given below :—

Year	Coke		Coke Oven Gas					
	Rated capacity	Actual Production	Rated capacity	Pro-duction	Utilised for GRP Ammo-nia	For fir-ing of Ovens	Vented	
		Coke						Coke breeze
		(In lakh tonnes)			(In lakh 1000 NM <sup>3</sup> )			
1969-70	2.23	1.86	0.36	1.13	0.74	0.58	0.12	0.04
1970-71	"	1.81	0.35	"	0.69	0.51	0.13	0.05
1971-72	"	1.57	0.31	"	0.59	0.43	0.12	0.04
1972-73	"	1.39	0.27	"	0.47	0.34	0.10	0.03
1973-74	"	1.05	0.46	"	0.45	0.32	0.08	0.05
1974-75	"	0.98	0.49	"	0.47	0.30	0.10	0.07
1975-76	"	1.06	0.45	"	0.49	0.29	0.13	0.07
1976-77	"	1.04	0.45	"	0.45	0.24	0.11	0.10
1977-78	"	0.94	0.40	"	0.42	0.18	0.17	0.07

NOTE :—The figures of coke oven gas shown in the table as utilised in Gas Reformation Plant differ from those shown as consumed by the Gas Reformation Plant. The difference ranged from 0.25 per cent to 4.92 per cent during 1969-70 to 1977-78. The higher percentage of 4.92 per cent in 1974-75 has been ascribed (January 1980) by the Ministry to higher leakages from the gas holder.

2.5.1 It will be seen that the performance of the Coke Oven Plant had been deteriorating continuously. Its poor performance was a major cause of the poor production of ammonia in the Expansion Plant and also why coke had to be purchased from outside to feed the Gas Plant. As already mentioned, the coke oven battery had started showing signs of deterioration in 1969 and the expert opinion obtained in 1970-71 had suggested dire necessity for renovation of the Plant. The renovation work was started in April 1973 and an expenditure of Rs. 49.97 lakhs was incurred upto 31st March 1975. The delay in starting renovation has been explained (April 1979/January 1980) by the Ministry due to the following factors :—

- (a) The original suppliers of plant who were requested to offer their expert opinion, recommended in their Report (September 1970) for the changing of end bricks. The Corporation attempted procurement of silica bricks from indigenous sources but the indigenous manufacturers expressed inability to supply the bricks because of their commitments upto 1974-75. Finally, order for the import of bricks through the Minerals and Metals Trading Corporation of India Limited was placed in December 1971 and the bricks were received by September 1972.
- (b) Meanwhile, the original suppliers were informed of the fast deterioration of the battery and, after assessing the deterioration, they suggested in 1971 renovation of the battery upto 3rd to 5th flue instead of end bricks only as proposed in September 1970. To meet this increased quantum of repairs, more bricks were required but drawings for the same were not available. The plant suppliers were again requested to assess the aggravated deterioration of the battery. The Engineers of plant suppliers came in July 1973 and recommended (September 1978) that (i) partial repair which was envisaged earlier does not hold good and should no longer be made, and

- (ii) entire battery should be reconstructed from the regenerator level.
- (c) To hold up the battery, repairs of damaged oven had already been taken up without waiting for the original suppliers. The handicaps regarding non-availability of drawings and bricks were overcome by preparing the drawings from damaged ovens and by persuading an indigenous manufacturer to supply the silica bricks in small instalments. Thus, by last quarter of 1973 the Unit could get enough bricks to take up planned end repairs upto 3rd to 5th flue besides repair of the damaged ovens.

2.5.2 The quantity of coke oven gas vented ranged between 5.3 per cent and 21.5 per cent of the total production of gas during the years 1969-70 to 1977-78. The value of the gas vented during this period was of the order of Rs. 42.77 lakhs. The quantity of gas vented was higher than the normal wastage of 2 per cent of the total gas produced indicated by the Corporation to the Committee on Public Undertakings in para 4.9 of its 43rd Report (April 1969). The higher venting of the coke oven gas has been ascribed (January 1980) by the Ministry to the following factors :—

- (a) Deterioration in quality of coke oven gas which made its full utilisation impossible in the gas boxes.
- (b) Fluctuations in quality and quantity of coke oven gas due to fast deterioration of the ovens and re-scheduling of pushing of ovens on day-to-day basis to facilitate renovation activities and break-down maintenance.
- (c) Non-availability of the second box from February 1973 onwards on account of explosion.
- (d) Need for substituting naphtha based gas in preference to the coke oven gas to maintain the steady process conditions of the box.

2.5.3 According to the designers, the coke breeze up to 6 per cent of the total production of coke is considered reasonable. The Unit has not, however, computed the coke breeze immediately after the coke is pushed from the oven into the quenching car; instead actual measurements are made thereafter to determine the actual breeze formation from time to time. According to the measurements so taken, the percentage of coke breeze to the total coke produced was 16.4 per cent during 1971-72 to 1972-73, 30.7 per cent in 1973-74, 33 per cent in 1974-75 and 30 per cent in 1975-76 to 1977-78. The Ministry have explained (January 1980) that the breeze formation increases as the coke, after quenching, undergoes further treatment through storage, reclamation, crushing, screening, etc. for various fraction of sizes to be supplied to the consuming points. It has, further, been stated that breeze formation increases when the quality of coal specified for blends goes down, as has been the experience over the years. The Ministry have also stated that no single reliable norm is possible to fix in the prevailing circumstances of varying coal quality, variation in number of handlings the coke undergoes before usage, etc.

2.5.4 The table below indicates the excess consumption of coal for production of coke during the years 1969-70 to 1977-78 :—

Year	Quantity consumed as per belt weighers	Quantity which should have been consumed based on the norm of 1,3971 tonnes of coal per tonne of coke
	(in lakh tonnes)	
1969-70	3.20	3.10
1970-71	3.07	3.01
1971-72	2.64	2.63
1972-73	2.26	2.31
1973-74	2.08	2.11
1974-75	2.10	2.06
1975-76	2.18	2.11
1976-77	2.15	2.08
1977-78	1.95	1.88
	21.63	21.29

It will be seen from above that, while there was excess consumption of coal with reference to the norm during 1969-70 to 1971-72 and 1974-75 to 1977-78, the consumption during 1972-73 and 1973-74 was less than the norm. The overall excess consumption during 1969-70 to 1971-72 and 1974-75 to 1977-78 was of the order of 0.42 lakh tonnes and represented 2.5 per cent of the total coal consumed in these years.

The Ministry have stated (January 1980) that the higher consumption was due to following factors :—

- (a) Coal consumption was a calculated figure based on the coal received through belt weighers.
- (b) Coke production was based on volumetric determination of oven capacities.
- (c) There were also possibilities of errors in measurement on account of the moisture factor, determination of the bulk density and error in survey owing to irregularities in the shape of the heap.

### *2.6 Scheme for recovery of ammonia from coke oven liquor*

The scheme estimated to cost Rs. 2.40 lakhs (Rs. 0.90 lakh in foreign exchange) envisaged diversion of liquor to acid neutralisation section in Urea Plant and partially running the recovery plant to strip off ammonia and cyanide. It was intended to produce 6 to 7 tonnes (approximately) of sulphates per day and was to be commissioned by February 1965.

As sulphuric acid required for recovery of ammonia from coke oven liquor was not available, the recovery plant was actually commissioned in January 1967. It had, however, to be shut down after a few trial runs for the layout to be modified. After modifications, repairs and trial runs, the Planning and Development Division decided (April 1970) to hand over the plant to the Unit but the latter declined to accept it on the plea that it could not be run at a stretch even for a few days despite

the constant attention given to it by the former's staff and that the salt produced was greenish in colour, which might not be favoured in the market.

An attempt was made to run this plant in February 1971 but, on running for a few days, several leaks developed in the saturator and acid lines. These were repaired repeatedly but no improvement was noticed. Ultimately, the Plant was shut down for further modifications. There was, however, no improvement even after modifications were completed by November 1971 and the plant could not be run successfully on account of heavy corrosion. The scheme was ultimately found to be uneconomic and, therefore, abandoned. Rupees 3.07 lakhs were spent.

The Ministry have stated (April 1979) that an attempt was also made during October 1972 to April 1973 on an experimental basis to divert the liquor to the neutralizer section of the Urea Plant but it created more complications in other sections of the plant and hence, the scheme was given up. It has further been stated (January 1980) that it was the first attempt of the Planning and Development Division based on expected concentration and quantum of ammonia in the ammonia liquor as per rated norms which was not borne out in actual realisation.

### 2.7 Power Plant

The plant has an installed capacity of 80 M.W. and consists of seven boilers, six installed in 1948—50 and the seventh in 1958-59. In March 1964, installation of an 8th boiler was proposed which would allow other boilers to be shut down in turn for 3 or 4 months for overhaul and renovation.

The proposal was finally approved by the Board in February 1968 on the condition that new boiler to be provided should take into account higher ash content. The offer received in November 1969 for the new boiler was for Rs. 69.60 lakhs (excluding customs duty, freight and other taxes). Before orders were placed, the General Manager proposed (August 1970) to

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the Managing Director to defer the procurement on the following grounds :—

- (i) The renovation of existing boilers could not wait till the 8th boiler was installed.
- (ii) Sale of extra power to the Damodar Valley Corporation was no longer an economical proposition.
- (iii) There would be no consumption of steam in the Rationalisation Project on account of decision to produce triple superphosphate in powder form.

The proposal of the General Manager was approved by the Managing Director in September 1970. The matter was not, however, reported to the Board.

Meanwhile, the condition of the boilers became worse and their renovation was started from November 1970. Upto March 1979, expenditure of Rs. 201.82 lakhs was incurred on the renovation of 7 boilers.

The question regarding procurement of the 8th boiler was reviewed in August 1974 in the context of power and steam required by the proposed Modernisation Project. It was decided (January 1975) to invite limited tenders from power plant consultants for a techno-economic study on whether it would be more economical to provide for the 8th boiler in the existing Power House or increase the built in capacity of the 3 boilers being procured for the Modernisation Project. The report of the consultants (M/s. Development Consultants Private Limited) was received in January 1976. According to this report, the 8th boiler was necessary to provide steam and power required by the Unit after the Modernisation Project was completed. Finally, a contract for the installation of one boiler was awarded to Bharat Heavy Electricals Limited—a Government Company in May 1977 at a total all inclusive price of Rs. 212.81 lakhs. The boiler was scheduled to be commissioned by

November 1979. Upto March 1979, the progress of work was 10 per cent for civil works.

The Ministry have stated (April 1979) that shortfall in power due to break-down of the existing boilers and consequent curtailment in the generation of power was made good by importing power from D.V.C. as per emergency rate prevalent in the Eastern Region.

### 3. Sulphuric Acid Plant

#### 3.1 Background

To meet the requirement of sulphuric acid of the Sindri Unit and others, the Pyrites, Phosphates and Chemicals Limited set up a Sulphuric Acid Plant at Sindri. The Plant was designed to produce 400 tonnes of sulphuric acid daily from Amjhore Pyrites with an average sulphur content of 40 per cent. The following aspects of the Plant were mentioned in paragraphs 5 and 8 of the Report of the Comptroller and Auditor General of India for the year 1969-70—Central Government (Commercial)—Part VII—relating to the Pyrites, Phosphates and Chemicals Limited :—

- (a) Location of the plant at Sindri.
- (b) Ordering of the plant based on 40 per cent sulphur content of pyrites, whereas actual sulphur content was lower.
- (c) Escalation in the estimates of capital cost from Rs. 261.58 lakhs in 1965 to Rs. 450.50 lakhs in April 1969.
- (d) Delay and defects in the commissioning and operation of the plant.
- (e) Poor production performance of the plant, after commissioning and un-economic cost of production.
- (f) Transfer of the plant by Pyrites, Phosphates and Chemicals Limited to the Fertilizer Corporation.

- (g) Non-settlement of the price of pyrites between Pyrites, Phosphates and Chemicals Limited and the Fertilizer Corporation of India Limited.

The above Report was considered by the Committee on Public Undertakings and its recommendations are contained in its 39th Report (Fifth Lok Sabha—April 1973). The following paragraphs deal with the subsequent developments.

### 3.2 Transfer of the Plant

The Plant was transferred *de facto* by Pyrites, Phosphates and Chemicals Limited to the Fertilizer Corporation of India in April 1968. Its *de jure* transfer in August 1973, was effective from 1st April 1973. The main consideration for the transfer was that the acid produced by the Plant would be utilised only by the Sindri Unit. As against the sanctioned estimate of Rs. 450.50 lakhs, actual expenditure borne by the Corporation amounted to Rs. 419.08 lakhs.

### 3.3 Actual performance

As the sulphur content of Amjhore pyrites was between 33 and 35 per cent as against 40 per cent adopted in the design, the Plant could not be operated successfully.

An expert committee was set up by Government in January 1970 to explore the possibility of operating the plant on ore with less than 40 per cent of sulphur and assess the cost involved in modifications, etc. The committee reported in February 1971 that the Plant could be run with such lean ore, the deficiency being made up by adding elemental sulphur. Plant scale experiments were conducted under the supervision of M/s. Lurgi of West Germany in April 1971. Based on the results as obtained, modifications were incorporated in the Plant. From September 1971, the Plant is being operated on pyrites to which elemental sulphur

is added. The production performance of the Plant from 1970-71 to 1977-78 was as under :—

Year	Rated capacity (based on 330 days operation)	Actual production
	(In lakhs of tonnes)	
1970-71	1.32	0.24
1971-72	„	0.31
1972-73	„	0.41
1973-74	„	0.31
1974-75	„	0.33
1975-76	„	0.33
1976-77	„	0.14
1977-78	„	0.05

It will be seen that, even after modification and use of enriched pyrites, the Plant had not attained the rated capacity. This was ascribed to the following factors :—

- (i) Limitation in crushing capacity.
- (ii) Leakage in boiler tubes.
- (iii) Leakage in steam and acid lines.

In regard to improvement in the performance of the Plant, it was reported to the Board in September 1974 that ;

- (a) a time bound programme had been initiated to make certain modifications, replacements, etc.; and
- (b) a committee had been constituted to undertake an end-to-end survey to identify other major deficiencies for necessary action.

In this connection, the following facts deserve mention :—

- (a) Modifications/replacements were completed by October 1976 at a cost of Rs. 18.50 lakhs as indicated below but the production performance had not improved :—

Item	Scheduled dates for completion	Actual dates of completion
(1) Partial augmentation of crushing system	October 1974	November 1974
(2) Complete augmentation of crushing system	January 1975	October 1976
(3) Replacement of acid cooler pipes	September 1974	November 1975
(4) Commissioning of weak acid settling scheme	October 1974	December 1975
(5) Procurement of spare chain for drag link conveyor	October 1974	November 1975

- (b) The Committee on the end-to-end survey submitted its report in November 1974. The Committee suggested certain modifications to be tackled internally as well as recommended that it was inevitable to consult outside experts for modifications to the major items. It was reported to the Board in February 1975 that, according to the internal technical survey, the Plant had to be derated to 50 to 60 per cent of the capacity and that too, after modifications. The Board thereupon desired that an economic evaluation might be made whether additional costs for modifications would be worthwhile for continuance of operations or the Plant should be closed down. In the mean time, certain minor modifications, as suggested in end-to-end survey report, were implemented.

- (c) The suppliers of the Plant had also agreed to make a survey and their report was received in June

1976, which recommended derating the capacity of the Plant to 50 per cent. This report was examined by the Unit as well as by the Director (Production) of the Corporation and the matter was referred to a Committee of the Directors. The Committee decided in April 1977 that the Plant should be operated at production capacity of 30,000 tonnes per year with maintenance work provided in the budget to the extent of Rs. 18 lakhs. The Committee further desired that the proposal be reviewed after six months when the performance of Bulgarian Sulphuric Acid Plant as well as Phosphoric Acid Plant would be known.

- (d) In view of the deteriorated condition of equipment such as economiser, cold heat exchanger, acid storage tank, boiler, etc., it was proposed that a provision for Rs. 80 lakhs should be made in the non-capital project estimate for 1978-79 to keep the Plant going. It was, however, decided to defer a decision on this till the modifications to the Bulgarian Acid Plant were completed and results evaluated. Because of the bad condition of the equipment, the Plant was shut down with effect from 29th October 1977.
- (e) The working of the Plant was further reviewed by the Board as well as by the Ministry in July 1978. In November 1978, the Board considered the proposals submitted by the Management to arrive at a conclusion regarding the future of the Plant and a possible course of action. After considering the various alternatives, it was agreed in principle that the alternative of converting the Plant to conventional sulphur based process would be advisable in view of the low cost of production and sustained production. Accordingly, proposals for renovating the Plant on conventional sulphur route were put up

to the Board on 29th January 1979 but the Board decided that the matter should be reviewed only after the Bulgarian Sulphuric Acid Plant's performance was known.

#### 3.4 Settlement of the price for pyrites ore

Owing to its low sulphur content, consumption of Amjhere pyrites to produce sulphuric acid was higher than that initially envisaged, thereby affecting the economic working of the Sulphuric Acid Plant. Pyrites, Phosphates and Chemicals Limited had claimed Rs. 224 per tonne for pyrites of  $33 \pm 3$  per cent supplied F.O.R. Dehri-on-Sone as against the economic rate of Rs. 92 per tonne which the Corporation could afford to pay based on the equated price of gypsum. The question of pricing of pyrites was initially referred by Government to Shri S. K. Majumdar (the then Financial Adviser to the Ministry of Petroleum and Chemicals) and thereafter to the Chief Cost Accounts Officer but the prices recommended by both of them were acceptable to neither party. In December 1974, both parties agreed that the pyrites supplied between 1969 and March 1974 should be priced at Rs. 245 per tonne (*i.e.* the average cost of Rs. 207 per tonne recommended by the Chief Cost Accounts Officer plus interest charges of Rs. 38 per tonne) irrespective of the sulphur content. It was further agreed that, for the quantities to be supplied during 1974-75 and 1975-76 or till the Bulgarian Plant was commissioned, whichever was earlier, the fixed and variable cost should be worked out and the Corporation should pay the fixed costs for quantities committed but not lifted and both fixed and variable costs for quantities actually lifted.

The Unit could not lift the committed quantities to the extent of 2.15 lakh tonnes during 1974-75 to 1977-78 but had to incur the liability for payment of fixed cost amounting to Rs. 3.56 crores during the said period.

The Ministry have assigned (January 1980) the following reasons for not lifting the committed quantities :—

- (i) While the P.P.C. had developed the mines for the attainable production of 75,000 tonnes per annum, P.P.C. Sulphuric Acid Plant could not be run on sustained operation even after modifications and use of enriched pyrites; the Plant was shut down from October 1977 (Refer para 3.3).
- (ii) Delay in the commissioning of the Bulgarian Sulphuric Acid Plant on account of deficiencies in the Plant.

It has further been stated that there will be no question of payment of fixed cost during 1979-80, as the Bulgarian Sulphuric Acid Plant, after revamping, has planned to utilise pyrites upto the attainable capacity of 1,20,000 tonnes developed by the P.P.C.L.

#### 4. Diversification Schemes

4.1 *Ammonium Nitrate Plant*.—In March 1967, the Board approved the installation of a plant (capacity 30 tonnes a day) to produce explosive grade ammonium nitrate for the mining industry. The Plant was based on raw materials and utilities (i.e. ammonium nitrate liquor, steam, power and process and cooling water) available from the existing facilities and was to be designed by the Planning and Development Division.

The Plant was to be completed by December 1969 but was actually completed in April 1972. The total cost of the Plant as on 31st March 1978 was Rs. 52.10 lakhs as against the estimated cost of Rs. 27.50 lakhs. The delay was attributed to acute shortage of structural steel and the modifications made in the design to improve marketability of the product.

The Plant was commissioned in May 1972. Actual production upto 1976-77 was less than the annual capacity of 9,000 tonnes based on 300 days operation as given below; in 1977-78 the production exceeded the rated capacity :—

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Year	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Production in tonnes	705	2543	4362	6057	7167	9323

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As the Plant did not achieve more than 50 per cent of the rated capacity up to 1974-75, certain modifications suggested by

the Planning and Development Division were carried out at a cost of Rs. 2.55 lakhs up to March 1978.

The operations of the Plant resulted in a loss of Rs. 0.58 lakh in 1972-73, Rs. 68.19 lakhs in 1976-77 and Rs. 191.90 lakhs in 1977-78. During 1973-74, 1974-75 and 1975-76, there was profit of Rs. 3.13 lakhs, Rs. 11.45 lakhs and Rs. 2.13 lakhs respectively.

The Ministry have stated (April 1979) that the profitability position for the years 1976-77 and 1977-78 deteriorated due to less production of ammonia (particularly in the original Ammonia Plant) as compared to earlier years thereby increasing the cost abnormally which in turn affected the cost of production of ammonium nitrate.

#### 4.2 Guanidine Nitrate Plant

In the latter half of 1967, Department of Defence production had suggested to the Corporation to take up development work on the manufacture of guanidine nitrate from urea and technical grade ammonium nitrate. It was mentioned by the Department of Defence production that Explosive Research and Development Laboratory had tested and found this route promising on a laboratory scale. In January 1972 the Board approved the installation of this plant (annual capacity 1,000 tonnes) at an estimated cost of Rs. 75.44 lakhs (including foreign exchange component of Rs. 7.72 lakhs). The foreign exchange component was subsequently increased to Rs. 16.83 lakhs as some more items were to be imported and also because additional equipment became necessary with the change in the location of the Plant. The Plant was to meet the requirement of the Department of Defence Production, who were anxious that the production facilities be established in less than two years. The Ministry approved the project in May 1973. The estimate of cost was revised to Rs. 123.99 lakhs (including

foreign exchange component of Rs. 15.23 lakhs) in December 1976. In March 1978 the Board approved the revised estimate of Rs. 147.95 lakhs. Approval of Government is awaited (April 1979). Total expenditure incurred upto 31st March 1978 was Rs. 149.48 lakhs.

The Plant was mechanically completed in August 1976 as against the scheduled date of completion of December 1974. The trial runs were commenced in 1977 but problems had to be encountered and several modifications had to be carried out to make good the design deficiencies. The Plant, though designed to produce 1000 tonnes annually, is now capable of producing 100 tonnes per annum due to several limitations.

The product established is of 95 per cent purity which has been accepted by the Director, General Ordnance Factory upto 1979-80; thereafter product having purity of 99 per cent would be acceptable. According to the Management, further modernisation of this Plant would be necessary to attain purity of 99 per cent.

The Ministry stated (April 1979) as follows :—

(i) The Plant was taken up at the instance of Ministry of Defence and was a developmental type of project. The process was developed on a bench scale and the project was designed and engineered on the basis of data developed in the laboratory. Normally a project of this type should have gone through the pilot plant stage before taking up a commercial plant. As there was great urgency and producers know-how was not available from any quarter, an attempt was made to develop the process and to erect the plant indigenously. It was revealed during the visit of Corporation's engineers to foreign countries that even though some organisations notably in U.K.

had undertaken pilot plant studies on similar process routes, no commercial plant could be set up.

- (ii) The reduction in the capacity of the Plant is due to low conversion efficiency in reactor, inadequate filtration and crystallisation capacities as also inefficient recovery of offgas system. The catalyst (Silicajel) used in the plant is produced indigenously and its activity comes down within a short time which necessitates off-loading and re-charge of fresh catalyst. In regard to the main problem *i.e.* low conversion efficiency in the reactor, the Board of Fertilizer (Planning and Development) India Limited had approved an expenditure of Rs. 3.87 lakhs to set up a pilot plant to try a different type of reactor. On the basis of trials held, further modification of the plant would be taken up.

The Ministry have further stated (January 1980) as follows :—

- (a) Further modification and improvements in the plant were found necessary and these have been under execution. The present status of the plant was reported to the Board in June 1979 and the Board decided as under :—

(i) Capital expenditure account of the Plant be closed.

(ii) The estimated annual revenue expenditure of Rs 12 lakhs towards salaries and wages, cost of raw materials and utilities and interest charges would be borne by the Corporation and the cost of modifications (to be worked out) would be borne by

Fertilizer (Planning and Development) India Limited.

The above expenditure will be treated as research and development expenditure of both the organisations.

- (b) Fertilizer (Planning and Development) India Limited should continue its efforts to develop technology for the manufacture of guanidine nitrate without the use of imported raw materials. Meanwhile, requirement should be met from imports.

### 5. *Efficiency in the usage of raw materials and utilities*

The Bureau of Public Enterprises had requested Administrative Ministries in October 1967 to advise Public Enterprises to fix norms for materials consumption, to investigate instances of over-consumption and to review the norms periodically. The Committee on Public Undertakings in its 55th Report (5th Lok Sabha) had also mentioned that the norms for consumption should be precisely laid down on the basis of best expert advice available so as to obviate any chances of pilferage, wastage, etc. and that losses of a substantive nature should be reported to the Board of Directors and to Government.

The Corporation assigned the fixation of norms for consumption of materials in all the operating units to a Technical Committee under the Chairmanship of a senior Technologist (Shri N. B. Tendolkar). The Committee, after considering guaranteed norms as designed for each plant and the actual consumption trends, recommended certain norms in its report submitted in January 1971. The Committee's Report was subsequently reviewed by another Technical Committee (Mahadevan Committee). The norms of consumption suggested by Tendolkar Committee were accepted (4th July 1972) as norms by the Corporation.

Guaranteed norms, norms recommended by Tendolkar Committee and the actual consumption for the years 1971-72 to 1977-78 were as under :—

Raw material required per tonne of the output	Design norms	Tendolkar Committee's norms	Actuals						
			1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>For Ammonia (Chemical Construction Corporation)</i>									
Coal (tonnes) . . . . .	3.018	..	3.424	3.187	3.750	4.43	5.00	5.057	6.322
Power (KWH) . . . . .	2188	2188	2464	2541	2553	2480	2631	2765	3732
<i>For Ammonia (Expansion)</i>									
Coke Oven Gas (NM <sup>3</sup> ) . . . . .	1420	1600	1920	1979	1880	2187	2190	3016	3795
Power (KWH) . . . . .	1885	2953	3609	3490	4082	3410	4407	5261	6710
<i>For Nitric Acid</i>									
Ammonia (tonnes) . . . . .	0.154	..	0.151	0.155	0.160	0.154	0.156	0.163	0.160
<i>For Ammonium Sulphate</i>									
Ammonia (tonnes) . . . . .	0.273	0.300	0.319	0.329	0.305	0.312	0.315	0.329	0.377
Gypsum (tonnes) . . . . .	1.64 (93.95 per cent purity)	1.900 (81.6 per cent purity)	1.895	1.913	1.850	1.919	1.694	1.915	1.939
<i>For Double Salt</i>									
Ammonia (tonnes) . . . . .	0.340	0.390	0.326	0.351	0.328	0.465	0.506	0.940	..
<i>For Urea</i>									
Ammonia (tonnes) . . . . .	0.590	0.650	0.644	0.66	0.671	0.662	0.688	0.651	..

It will be noticed that :—

- (a) The consumption of raw materials and utilities was much higher than the design norms ; it was generally higher than the norms recommended by the Tendolkar Committee. The value of excess consumption over norms fixed by Tendolkar Committee and/or designed norms (where norms were not fixed by Tendolkar Committee) as reported to the Board amounted to Rs. 222.88 lakhs during 1974-75.
- (b) The actual average purity of gypsum used during the period from 1971-72 to 1977-78 was higher (about 83 per cent in 1971-72 and 1974-75 and 85 per cent or above in other years) than that of 81.6 per cent adopted by the Tendolkar Committee for fixing norms of consumption of gypsum at 1.9 tonnes per tonne of ammonium sulphate. Even though the purity was higher, actual consumption of gypsum was more than the norm in 1972-73, 1974-75, 1976-77 and 1977-78.
- (c) Mahadevan Committee had made certain observations regarding justification for fixation of norms proposed by it and measures needed for improvement in norms. Some of the important observations are summed up below :—

*Coke Oven Gas per tonne of Ammonia (Expansion)*

A figure of 1700 NM<sup>3</sup> may have to be tolerated till the quality of coke oven gas is improved. This norm would have to be revised after the chilling Unit for raw gas in Gas Reformation Plant was commissioned which would reduce the deriming frequencies and improve the heat balance of boxes.

*Ammonia per tonne of Sulphate*

Test runs indicated that the losses of ammonia was mainly through chalk.

*Ammonia per tonne of Double Salt*

The major loss of efficiency was in the concentrated vent which was imperfect in design and the neutraliser where the control of the operation was manual.

*Ammonia per tonne of Urea*

Significant losses were in the tail gas absorption system through which 3.5 tonnes of ammonia was lost per day.

*General*

The Units may have reasons to propose a revision of norms suggested by the Committee. Any justifiable revision would have to be considered, especially as the intermediate and final products, in many cases, were not accurately weighed.

- (d) As against the efficiency of 94.7 per cent guaranteed by the designer and 90 per cent as anticipated by the Management in 1965, the ammonia efficiency in the Urea Plant during 1971-72 to 1976-77 was as under :—

(In percentage)

	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
Ammonia efficiency	87.93	85.91	84.68	85.59	82.37	87.05

- (e) Ammonium Nitrate Plant was commissioned in 1972-73. As against the consumption norm of 0.2740 tonne of ammonia and 1.700 tonnes of nitric

acid per tonne of ammonium nitrate, actual consumption was substantially higher, as indicated below :—

Year	Consumption per tonne of ammonium nitrate	
	Ammonia	Nitric Acid
1974-75 . . . . .	0.323 tonne	2.181 tonnes
1975-76 . . . . .	0.310 „	1.987 „
1976-77 . . . . .	0.269 „	1.980 „
1977-78 . . . . .	0.273 „	1.944 „
1978-79 . . . . .	0.318 „	1.821 „

The incidence of excess consumption of these raw materials amounted to Rs. 10.10 lakhs in 1974-75 alone.

(f) No norms were laid down in respect of a number of raw materials, chemicals, etc. as for instance :—

(i) Naphtha per tonne of ammonia.

(ii) Power and steam per tonne of ammonium nitrate and nitric acid.

However, estimates of consumption for these items are drawn up for the purpose of preparing budget estimates.

The Ministry have given (April 1979) the following reasons for excessive consumption of raw materials :—

(a) *General*

Ageing of the plants in spite of all efforts for renovation and replacements.

(b) *Specific*

(i) *Coal per tonne of ammonia.*—Increased amount of leakages in the system and increased number of shut

downs and start-ups as well as deteriorating quality of coke.

- (ii) *Power*.—Running of the plants on low load due to limitations caused by ageing of the plants.
- (iii) *Ammonia per tonne of urea and double salt*.—Intermittent/reduced load from time to time and deterioration in equipment performance.
- (iv) *Gypsum per tonne of ammonium sulphate*.—Deterioration in the quality of gypsum, low load necessitated by non-availability of CO<sub>2</sub> and ammonia.

The Ministry have further stated (January 1980) that Kachwaha Committee was set up in 1975 to review the norms based on the conditions prevalent at present. The norms suggested by this Committee are under review.

## 6. Profitability

6.1 Details of profits earned and losses incurred by the Unit and the quantity of fertilizers produced from its inception (1952-53) to 1977-78 are mentioned in Appendix I. It will be seen that the Unit earned profit from 1952-53 to 1967-68 except in 1959-60 when a loss of Rs. 15.34 lakhs was incurred. Thereafter, it incurred losses totalling Rs. 82.68 crores from 1968-69 to 1977-78. After taking into account the past period adjustments, the net loss aggregated Rs. 74.32 crores since inception to 1977-78. This would be higher by Rs. 3.40 crores if account is taken of differential duty levied by the Excise Authorities on diversion of raw naphtha during the period from 1st April 1969 to 30th November 1974 for purposes other than manufacture of fertilizers which has been contested by the Corporation. According to the Ministry, the matter is still (April 1979) under examination of the Excise Department.

6.2 The Unit does not compile product-wise profit or loss and reconcile it with the overall profit or loss shown in the Annual Accounts. On the basis of the cost of production and net realisation per tonne, the product-wise contribution during 1972-73, to 1977-78 was as follows :—

Products	(In lakhs of rupees)					
	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Ammonium Sulphate	(-)444	(-)565	(-)891	(-)1211	(-)1429	(-)1128
Double Salt	(-)175	(-)190	(-)158	(-)261	(-)110	(-)1
Urea	(-)26	(-)33	(-)30	(-)80	(-)18	..
Ammonium Nitrate	(-)1	(+)3	(+)11	(+)2	(-)68	(-)192
Ammonia	(+)36	(+)35	(+)84	(+)12	(-)88	(-)251
Nitric Acid	(+)29	(+)28	(+)80	(+)78	(+)18	(+)2
Others	(+)1	(+)4	(+)11	(-)18	(-)90	(-)674
<b>TOTAL LOSS</b>	<b>(-)580</b>	<b>(-)718</b>	<b>(-)893</b>	<b>(-)1478</b>	<b>(-)1785</b>	<b>(-)2244</b>

NOTE : The production of double salt and urea was negligible in 1976-77; double salt and urea plants having been closed down in July 1976.

The Ministry have stated (April 1979) that the following factors had contributed to the losses incurred from 1969-70 onwards :—

- (i) Increase in price of raw materials and utilities.
- (ii) Rise in labour cost.
- (iii) Increase in maintenance cost due to ageing of the plant.
- (iv) Imposition/enhancement of duties (excise duty and electricity duty).
- (v) Uneconomic sale price of fertilizers fixed by the Government.
- (vi) Low production/capacity utilisation mainly due to sudden deterioration in the condition of the coke oven batteries.
- (vii) Take over of PPC Sulphuric Acid Plant and the high cost of acid produced in that Plant for use in sulphate production.
- (viii) Non-availability of right type of gypsum and coal.
- (ix) The Unit's technology using a number of steps to process coal into synthesis gas for production of ammonia involving use of costly coking coal and high losses in the form of coke breeze.
- (x) Poor consumption efficiencies owing to leakage, breakdowns, etc. due to ageing and consequent deterioration of the Plants.

In this connection, the following facts deserve mention :—

- (1) As mentioned in the preceding paragraphs, the Unit had taken the following remedial measures to stabilise or increase the production of ammonia as well as that of ammonium sulphate :—
  - (a) To augment the production of ammonia in the Expansion Ammonia Plant, a Naphtha Reformation Plant was installed in 1969 at a cost of Rs. 1.22 crores.
  - (b) A Sulphuric Acid Plant based on pyrites was commissioned in 1969-70 at a cost of Rs. 4.19 crores for production of sulphuric acid to be used in the manufacture of ammonium sulphate instead of gypsum. For this, two acid neutralisation sections were also set up at a total cost of Rs. 0.24 crore in 1969—71.
  - (c) Short-term renovation of the original Sindri Plant (coke oven etc.) at an actual cost of Rs. 1.53 crores.

The above investments did not, however, yield the expected results in full on account of the following factors :—

- (i) Deterioration in the performance of coke oven battery as a result of which production of ammonia in the original Ammonia Plant could not be maintained. Besides, production in the Naphtha Reformation Plant was affected due to non-operation of one of the cold boxes since February 1973 on account of explosion.
- (ii) Failure to run the Sulphuric Acid Plant on sustained load based on the use of indigenous pyrites and on account of other deficiencies in the Plant.

- (2) Owing to the intermittent functioning of the Sulphuric Acid Plant, the Unit could not lift the committed quantities of pyrites from Pyrites, Phosphates and Chemicals Limited during 1974-75 to 1977-78 but it had to incur a liability of Rs. 3.56 crores to the latter by way of fixed charges for the quantities not lifted.
- (3) Ammonium Sulphate is the main fertilizer produced at Sindri with the use of ammonia and indigenous gypsum. Owing to lack of ammonia as well as poor quality of gypsum, the production of this fertilizer became more and more uneconomical. In order to improve the profitability of this product, the Corporation launched the following schemes :—
- (a) Sindri Rationalisation Project in December 1967 which was aimed at producing tripple super phosphate and yield by-product gypsum to replace the natural gypsum in the manufacture of ammonium sulphate.
- (b) Sindri Modernisation Project in November 1973 to ensure stable supply of ammonia at a cost fairly comparable with that of newer competitive installations.

The projects at (a) and (b) above went into commercial production from October 1979. Even after implementation of these schemes, the Sindri Unit is expected to suffer losses as mentioned in paragraph 10.4.

## 7. Material Management and Inventory Control

### 7.1 Inventory holdings

The table below indicates the inventory at the close of each of the last nine years upto 1977-78 :

(In crores of rupees)

	As on								
	31-3-70	31-3-71	31-3-72	31-3-73	31-3-74	31-3-75	31-3-76	31-3-77	31-3-78
Finished goods	3.85	2.39	0.67	0.56	1.31	1.50	1.23	0.91	0.59
Raw materials (including in transit)	1.10	0.76	0.71	1.25	0.78	1.64	2.93	4.23	5.32
Packing materials	0.08	0.25	0.06	0.10	0.04	0.09	0.05	0.07	0.03
Stores & spares (including in transit)	5.40	5.49	6.20	6.52	6.96	8.00	8.39	8.34	9.81
	10.43	8.89	7.64	8.43	9.09	11.23	12.60	13.55	15.75

7.2 The Unit had no purchase manual. Items costing substantial amounts were not purchased through a Tender Committee. Delays in processing purchase orders were noticed ; according to an analysis by the internal audit wing of the Corporation, delays ranged from 47 days to 192 days from the date of receipt of quotations.

In this connection, the Ministry have clarified (April 1979/ January 1980) as follows :—

- (a) “.....general guidelines of the purchase procedure contained in the financial book and the Accounts Manual were being followed by the Unit. A purchase manual was, however, framed in June 1976 and this is being followed at present”.
- (b) “..... presently all tenders for purchase of stores ..... the estimated value of which exceeds Rs. 25,000 are scrutinised by a Tender Committee”.
- (c) Although a proper tender committee did not function earlier to 1976, the basic principles in regard to checking of quotations and evaluation of tenders by independent agencies were in vogue.

7.3 An analysis of the inventory holdings as on 31st March 1978 indicated the following :—

- (a) The stocks of raw materials included stocks of gypsum, pyrites, sulphur and rock phosphate valued at Rs. 4.91 crores. Accumulation of heavy stock of these materials except gypsum was due to delay in implementation of the Rationalisation Project.
- (b) The stores and spares included items valued at Rs. 3.05 crores relating to Retiring Plants. The total value of surplus/obsolete stores as on 31st March 1978 stood at Rs. 3.64 crores.

The Ministry have stated (April 1979) that a list of all these spares was circulated to all the Units and Divisions of FCI, FPDIL, HFC, RCF and NFL in January 1978 and though various units evinced interest in different spares, only Namrup, Gorakhpur and Ramagundam units have indented for spares worth Rs. 1.80 lakhs. It is proposed to sell the items to other Public Sector Companies also.

- (c) The value of stores and spares which had not moved for 3 years or more as on 31st March 1978, amounted to Rs. 2.75 crores (including Rs. 2.56 crores in respect of regular consumable spares).

7.4 The Unit is stated to have fixed from 1970-71, ordering and safety levels in respect of 75 per cent of the moving items to control holdings. However, no item-wise norms have been fixed for insurance spares ; instead these are computed in terms of value at 3 per cent of the capital cost of the plant and machinery.

A departmental committee constituted to review the existing norms made the following observations in its report which was considered by the Corporation in July 1975 :—

- (i) In respect of regular spares, detailed information regarding periodicity of use was not available and as such the Committee found it difficult to recommend workable norm. Meanwhile, the Committee recommended a norm of 15 months' holdings as against the existing norm of 24 months' holdings.

The Ministry have stated (April 1979) that "Sindri Unit is keeping a complete record of all the issues of spares and other stores. However, the actual difficulty felt in fixing norm for spares is the erratic consumption of spares".

- (ii) A detailed study by the Norms Committee in collaboration with the Bureau of Public Enterprises was proposed in respect of insurance spares, imported spares, non-moving items, etc.

In this connection, the Ministry have stated (April 1979) as follows :—

“..... norms for holding of inventories under various categories of stores and spares were framed by a Committee appointed by Director (Production) and were finalised and tentatively fixed for adoption. This Committee checked up with the Bureau of Public Enterprises about the specific norms separately fixed for this industry and it was understood that no specific norms as such have been fixed by B.P.E. separately for each industry.”

7.5 *Physical verification.*—Physical verification of raw materials, semi-finished and finished goods and stores and spares is being conducted by the stock verifiers working under the Materials Management Department.

The results of physical verification of raw materials and finished products for the years 1972-73 to 1977-78 where excesses and shortages were significant, are given in Appendix II. These shortages and excesses were ascribed by the Management *inter alia* to the factors mentioned below :—

- (a) Errors in measurement on account of adoption of volumetric basis for stock charging.
- (b) Errors in survey measurements.
- (c) Computation of production on the basis of random test or accuracy of the weighing instrument getting affected on account of lower production.
- (d) Errors in consumption on account of belt-weigher being inaccurate or computation of consumption figures in the absence of weighment facility.
- (e) Loss due to moisture content, seepage of water and leakage of silo in respect of double salt, urea and ammonium sulphate.

- (f) Formation of coke breeze in case of coke.
- (g) Deterioration in storage of pyrites, occurrence of frequent fire which is an unique feature of this material and computation of consumption on theoretical basis.
- (h) Absence of provision for measuring receipt and consumption in respect of Sulphur.

The operational efficiency as revealed by production, consumption data, etc. is, therefore, subject to errors in measurement.

Physical verification of stores and spare parts during 1972-73 to 1977-78 covered between 16.33 per cent and 57.11 per cent of the total items.

*7.6 Inferior quality of coking coal.*—In 1970-71 and 1971-72, 0.17 lakh tonnes of coking coal were used in the Power Plant as the material was unsuitable for use in the Coke Oven Plant. On the basis of the price of non-coking coal which is used in the Power Plant, this resulted in an additional cost of Rs. 3.92 lakhs.

In this regard, the Unit stated (October 1972) as follows :—

“Payment for supplies of coking coal were being made on the basis of grades awarded by the Coal Board from time to time and the suppliers were not prepared to accept any pro-rata reduction on account of the results of analysis at the destination. This was a problem faced not only by Sindri but by all the coking coal consumers. To solve this problem, Government of India had appointed a Committee known as Chari Committee which recommended a joint sampling method by which the prices were increased and the payment was based as per the revised grades depending upon the ash percentage determined both at the loading point and at destination.”

The Corporation has stated (January 1977) that efforts are being made to conclude an agreement with Bharat Coking Coal Limited whereby the price will be linked with the quality of coal purchased.

The Ministry have stated (April 1979) that pending finalisation of an agreement, understanding has been reached with the Bharat Coking Coal Limited about the quality and related prices of the coking coal. It has further been stated that there has been no occasion after 1971-72 for using coking coal in the Power Plant.

**7.7 Transit losses.**—The loss (difference between the weight shown in the railway receipts and the weight as measured by the weighbridge or computed on the basis of volumetric ratio at the destination) of coking coal in transit during the eight years upto 1977-78 was as under :—

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Quantity (in Tonnes)	8936	10878	10936	2360	1580	4536	6686	3200
Value (Rs. in lakhs)	5.19	7.34	7.85	2.59	1.82	6.72	11.15	4.79

The percentage of transit loss ranged between 0.71 and 6.7 per cent of the total supplies received during the year. According to the Unit Management, there are no facilities for weighment of box wagons and standard wagons also cannot always be weighed. The transit losses are, therefore, based mostly on calculated figures arrived on volumetric ratio at a fixed bulk density whereas the bulk density of coal depends on the nature of coal and varies from colliery to colliery, seam to seam, etc. However, certain losses are un-avoidable due to :—

- (i) dryage of moisture *enroute* ;
- (ii) weighment errors in the weigh bridges ;
- (iii) pilferage *enroute*, coal being a common commodity ;  
and
- (iv) spillage *enroute* due to defective wagons.

### 7.8 Demurrage charges.

The table below indicates the incidence of demurrage incurred by the Unit from 1969-70 to 1978-79, on detention of railway wagons beyond the permissible period :—

Year	Wagons handled (No.)	Demurrage incurred (after taking into account the demurrage waived)	Demurrage per wagon handled
		(Rupees in lakhs)	Rs.
1969-70	65,551	3.84	5.85
1970-71	62,742	5.82	9.28
1971-72	51,843	7.86	15.15
1972-73	43,903	5.24	11.92
1973-74	33,028	6.67	20.20
1974-75	34,806	9.46	27.05
1975-76	37,318	9.03	24.19
1976-77	26,211	2.18	8.28
1977-78	15,512	1.92	12.30
1978-79	8,649	1.98	22.80
		<b>Total</b>	<b>54.00</b>

The main reasons attributed by the Unit for incurring of demurrage were deterioration in the performance of tippers, non-availability of factory's own engines and ash wagons, reduction in the free time allowed by the Railways and increase in demurrage rates effective from 1st May 1973, etc.

It may be mentioned here that the reason, 'deterioration in the performance of tippers' was not applicable from 1973 onwards. The Unit had 2 wagon tippers for unloading 4 wheeler wagons. As the coal and coke started coming in box-wagons or trucks w.e.f. January 1973, one of the tippers was rendered idle. The second tippler had to be dismantled in November 1973 as

the site was required for the Rationalisation Project. Thus both the tipplers and weigh-bridges attached to them, have been lying idle since January/November 1973.

The Ministry have stated (April 1979) that the box wagon tippler for rock phosphate had been commissioned in 1975 and, after taking a number of steps to reduce detention time of wagons, the demurrage payment has been presently reduced. It will, however, be seen from data given in the table that, although the incidence of demurrage per wagon handled came down in 1976-77, it showed an upward trend in 1977-78 and 1978-79.

The Unit has not, however, introduced a system of standard costing based on the attainable capacity and norms of consumption of raw materials, utilities, etc. for purposes of analysing variances with tolerance to estimated and actual costs so as to serve as a more effective managerial tool for purposes of cost control.

The historical costs as compiled are divided into two main groups viz. variable and fixed costs. While variable cost represents the costs of the basic raw materials and utilities directly entering into the product, the fixed costs include all other elements, viz. direct labour, indirect charges, factory and administrative expenses, depreciation, interest, etc.

8.2 Cost of Production.—A comparative study of the budgeted cost so determined and the actual costs in the years 1969-70 to 1977-78 indicated that the latter was higher than the former in all the years. The increase was due to the following factors:

- (a) Higher consumption of inputs due to inferior quality of raw materials and ageing of plants.
- (b) Sharp increase in the price of raw materials and packing materials.
- (c) Increased consumption of stores and spares.
- (d) Increase in the salaries and wages.

## 8. Costing

### 8.1 System

A system of process costing has been introduced to ascertain the cost of end products as well as intermediate products. Under this system, costs are compiled on historical basis. After taking into consideration the actual operating conditions of the plant and the past performance, an estimate of cost on the basis of anticipated production and the corresponding budget is framed annually and actual costs are compared therewith.

The Unit has not, however, introduced a system of standard costing, based on the attainable capacity and norms of consumption of raw materials, utilities, etc. for purposes of analysing variances with reference to estimated and actual costs so as to serve as a more effective managerial tool for purposes of cost control.

The historical costs as compiled are divided into two main groups *viz.* variable and fixed costs. While variable cost represents the costs of the basic raw materials and utilities directly entering into the product, the fixed costs include all other elements, *e.g.*, direct labour, indirect charges, factory and administrative expenses, depreciation, interest, etc.

**8.2 Cost of Production.**—A comparative study of the budgeted cost so determined and the actual costs in the years 1969-70 to 1977-78 indicated that the latter was higher than the former in all the years. The increase was due to the following factors :—

- (a) Higher consumption of inputs due to inferior quality of raw materials and ageing of plants.
- (b) Sharp increase in the price of raw materials and packing materials.
- (c) Increased consumption of stores and spares.
- (d) Increase in the salaries and wages.

- (e) Higher incidence of interest on loans, provision for obsolete spares and payment of fixed charges for non-lifting of committed quantities of pyrites.

The impact of each factor had not been analysed except in respect of raw materials for which consumption in excess of the standards is worked out (details are mentioned in Paragraph 5). Apart from the reasons mentioned above, it will be seen from paragraph 2 that the plants had been operated at sub-optimal levels primarily due to shortage and poor quality of coke-oven gas and non-availability of 2nd cold box in the Expansion Ammonia Plant on account of explosion in February 1973; the operation of the Sulphuric Acid Plant was also un-satisfactory. The process efficiencies, too, of the other plants were not up to the desired level.

Variable costs (comprising cost of raw materials, bags, power and steam less credit for by-products) and the average sales realisation in the six years upto 1977-78 were as follows :—

Product	Variable Costs						Average Sales realisation					
	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
	(Rupees per tonne)											
Ammonium Sulphate	386	412	592	718	956	1106	428	448	553	596	617	604 (including subsidy)
Double Salt	465	458	701	978	2339	Not in Operation	561	592	867	946	949	Not in Operation
Urea	373	456	697	978	1138	-do-	737	796	1074	1124	1357	-do-

It will be seen that the average sales realisation of ammonium sulphate was lower than the variable cost in 1974-75 to 1977-78 and that of double salt in 1975-76 and 1976-77. Although the average sales realisation of ammonium sulphate was higher than variable cost in 1972-73 and 1973-74 and that of double salt in 1974-75, the margin left was inadequate to cover even the element of labour and establishment (Rs. 47 in 1972-73 and Rs. 57 in 1973-74 for ammonium sulphate and Rs. 425 for double salt) included under fixed cost.

The margin of urea, though substantial, did not cover the entire fixed cost. It covered about 58,54,43,11 and 5 per cent of the fixed cost in 1972-73, 1973-74, 1974-75, 1975-76 and 1976-77 respectively.

Year	Ammonium Sulphate	Double Salt	Urea
1972-73	1100	101	101
1973-74	1100	101	101
1974-75	1100	101	101
1975-76	1100	101	101
1976-77	1100	101	101
1977-78	1100	101	101

## 9. Sindri Rationalisation Project

### 9.1 Introduction

The deteriorating quality of gypsum, increase in its cost because of increasing expenditure on mining, freight rates and its lower efficiency in generating ammonia was affecting the economics of the Sindri Unit. Proposals to modify the production pattern were considered by the Board of Directors on several occasions from 1960-61 onwards. These schemes were aimed at decreasing dependence on gypsum, fully or partially, either through acid neutralisation or production of phosphatic fertilizers which would make gypsum available, as a by-product, for sulphate production.

After considering alternative schemes, the Board of the Corporation decided in February 1967 that :—

- (a) the size of the Sulphuric Acid Plant should be such as to meet the entire gypsum requirement of Ammonium Sulphate and Double Salt Plants, thereby eliminating use of natural gypsum ; and
- (b) the entire phosphoric acid produced from the sulphuric acid should be used for production of triple super phosphate to be sold either as such or as N.P.K. mixtures. Suitable plants for making such mixtures should be set up at Sindri itself for Sindri's economic Zone or other Units of the Corporation.

Consequently, a feasibility report was prepared by the Planning and Development Division in March 1967 for the setting up of :—

- (i) Sulphuric Acid Plant with a capacity of 795 tonnes per day based on Amjhore pyrites with an average of 43 per cent of sulphur.

- (ii) Phosphoric Acid Plant with a capacity of 361 tonnes per day of  $P_2O_5$  based on imported rock phosphate and sulphuric acid.
- (iii) Triple-super-phosphate Plant with a capacity of 1153 tonnes per day.
- (vi) Granulation Plant for producing N.P.K. mixtures.

The capacities of plants at (i), (ii) and (iii) above were determined by the requirement of by-product gypsum to replace natural gypsum in the Ammonium Sulphate and Double Salt Plants operated at maximum practicable capacities. With the rationalisation scheme, certain existing facilities and equipment would become redundant, these were to be utilised to the extent possible.

Government approved in principle, the Rationalisation Project in December 1967 at a total estimated cost not exceeding Rs. 22.96 crores (including Rs. 5.94 crores in foreign exchange).

Subsequent to the submission of the Feasibility Report, the Corporation decided (July 1970) that the Sulphuric Acid Plant should be provided with facilities for burning both sulphur and pyrites as only pyrites with 33 to 36 per cent sulphur content would be available as against the initial contemplation of 43 per cent. It was further decided to change the product pattern from granulated material to powdered triple-super-phosphate, thereby eliminating installation of the Granulation Plant. Plant complex to be installed, therefore, comprised ;

- (i) Sulphuric Acid Plant (capacity 880 tonnes daily).
- (ii) Phosphoric Acid Plant (capacity 360 tonnes only).
- (iii) Triple-super-phosphate Plant (capacity 1145 tonnes daily).

## 9.2 Capital expenditure decisions

### 9.2.1 Technical know-how etc.

Technical know-how, including basic design, for the complete Sulphuric Acid Plant and detailed design and engineering of the more important components, were provided by Techno-export of Bulgaria and technical know-how, including designing and engineering of the Phosphoric Acid Plant within battery limits, was provided by Engineering and Design Organisation of the Fertilizers & Chemicals Travancore Limited in collaboration with Engineering and Industrial Corporation of Belgium.

All other plants and services were designed and engineered by the Planning and Development Division of the Corporation.

### 9.2.2 Contracts

(i) *Contract for Sulphuric Acid Plant.*—In March 1968 the Corporation entered into a contract with Techno-export for the supply of technical know-how, equipment, etc. for the Sulphuric Acid Plant; Rs. 2.16 crores were payable to the foreign firm for the supply of equipment, spares, technical know-how, etc., as per details given below :—

	(In lakhs of rupees)
(a) For equipment	138.53
(b) For auxiliaries	39.00
(c) For spares	6.00
(d) As licence and technical know-how fee and for detailed engineering, documentation and basic and final technical Reports	24.00
(e) For technical assistance	7.50
(f) For payment to Indian engineers and others	1.12
	216.15

Amounts noted against items (b), (c), (e) and (f) represented the ceiling amounts and payments were to be made on the basis of actual supplies. Of the cost of equipment, auxiliaries and spares, 85 per cent was payable in 11 annual

instalments together with interest at 2.5 per cent, the first instalment being payable 12 months after the last shipment.

The following features of the contract deserve mention :—

(a) As against the provision of Rs. 6 lakhs for spares and of Rs. 7.50 lakhs for technical assistance made in the contract, Rs. 18 lakhs were spent on spares and Rs. 12.98 lakhs on technical assistance. The additional cost of Rs. 17.48 lakhs was met by reducing the ceiling amount under 'auxiliaries'. While increased outlay on spares was due to higher cost and inclusion of additional items, that on technical assistance was on account of increase in the period, from 158 to 217 man-months, of the Techno-export personnel's stay in India.

The Ministry have stated (April 1979) that :—

- (a) the original provision of 158 man-months stipulated in the contract was found inadequate after actual site work started ; and
- (b) stay of some experts had to be extended on account of delay in receipt of certain indigenous equipment and consequential delay in erection.

(b) The foreign supplier was liable for repair or replacement of plant and equipment found defective within 12 months of the date of commissioning of the plant and equipment, or within 24 months from the date of the last shipment, whichever was earlier.

In March 1973, the Corporation requested the foreign supplier to extend the workmanship guarantee for all imported items upto the end of 1975. The request of the Corporation was not accepted by the foreign supplier. However, replacement of defective components was made by them.

(c) There were delays on the part of foreign supplier in furnishing quotations for spares and for items damaged or lost in transit. The last instalment of quotations for the spares for

instruments was received by the Corporation as late as May 1975. This affected the schedule of completion of the plant. The Ministry have explained (January 1980) that, as there were delays in receipt of indigenous items and on account of other factors, delay in receipt of items damaged or lost in transit did not affect the schedule of completion/commissioning.

(d) In terms of the contract, Techno-export were to demonstrate performance guarantee on both the streams based on pyrites having a minimum of 43 per cent sulphur content. The designed capacity (440 tonnes per day per stream) was to be deemed to have been fulfilled if, during a continuous period of 10 days' operation, the plant produced on 3 consecutive days (72 hours) sulphuric acid of the designed quality and quantity.

As actual sulphur content in the pyrites was between 26 and 36 per cent and modifications had been made in the roster for using elemental sulphur with the lean pyrites, the foreign suppliers requested the Corporation to absolve them of the contractual obligation of proving the performance. After negotiations, they, however, agreed to take part in the commissioning of the first stream. If the guaranteed performance was achieved on this stream, they would be absolved of their responsibilities for the guarantee test for the second stream on which certain modifications were being made.

The guarantee run of the first stream commenced on 25th November 1976 and continued with breaks upto 7th December 1976. During this period of 12 or 13 days the stream was run intermittently for a total period of 74 hours. According to the Corporation, it was not possible to run the stream for a continuous period of 72 hours because of the failures in the pyrites handling and crushing sections, boiler feed water pump and some other sections of the Plant falling outside the scope of the foreign suppliers.

Based on the intermittent operation of one stream, over-all performance was assessed by the Corporation and accepted by

the foreign suppliers. This assessment showed that the Plant had proved guarantees in respect of rated capacity, concentration of sulphuric acid, steam production and temperature and conversion efficiency of sulphur; in respect of steam pressure designed conditions were not maintained.

Accordingly, the Plant was deemed to have fulfilled the guarantee test and a protocol for its take over was executed in December 1976.

In this connection, the Ministry have stated (April 1979) that finalisation of contract for this Plant, in 1968, based on pyrites of 43 per cent sulphur content, was done on the basis of information supplied by the Pyrites, Phosphates and Chemicals Limited.

(ii) *Contract for Phosphoric Acid Plant.*—In January 1969, the Corporation entered into a contract with Messrs Sepulchre, Belgium for the supply of equipment and experts for the Phosphoric Acid Plant. The Plant to be supplied was based on the licence for the 'Central Prayon Process' secured by the Engineering and Design Organisation of the Fertilizers and Chemicals Travancore Limited from M/s. Engineering and Industrial Corporation of Belgium and as such design and specifications of the plant were to be supplied by the Fertilizers and Chemicals Travancore Limited. The total value of the contract was 100.82 million Belgian Francs, as indicated below :—

(In millions of Belgian Francs)

(a) Supply of equipment	57.14
(b) Additional supplies	11.37
(c) Supply of spares	4.46
(d) For licence fee	4.32
(e) Basic design fee	8.68
(f) Payment to foreign technicians	0.50
(g) Payment to F.A.C.T./F.C.I. personnel in Belgium	1.05
(h) Ocean freight on actuals	5.00
(i) Financing charges	8.30
<b>TOTAL</b>	<b>100.82</b>

There was an increase of 3.72 lakh Belgian Francs in the provision for payment to foreign technician as commissioning of the Plant was delayed. This additional provision was met out of savings under 'Ocean freight'. After taking into account all these increases and savings, 8.20 million Belgian Francs, out of the amount provided in the contract, remained unutilised against the following items :—

Items	Amount unutilised (In Belgian Francs)
(i) Equipment, additional supplies and spares . . . . .	11,70,103
(ii) Freight . . . . .	23,78,506
(iii) Services . . . . .	46,52,569
	82,01,178

The Corporation informed the Ministry in October 1975 that the provision against items (i) and (ii) above would not be utilised, as nothing more was to be imported.

As commissioning of Phosphoric Acid Plant was delayed, the Project could not avail of the workmanship guarantees in respect of equipment, spares, etc. which expired on 26th December 1974. The Ministry have stated (April 1979) that, inspite of repeated requests, the foreign suppliers did not agree to extend the guarantees.

### 9.2.3 Project estimates

The Project was originally estimated to cost Rs. 22.96 crores. This estimate included Rs. 1.86 crores for granulation facilities subsequently eliminated when it was decided to produce only triple-super-phosphate in powder form. These estimates were revised on a number of times ; the estimates as revised from

time to time and expected date of commercial production were as follows :—

	Feasibility report of March 1967	May 1971	November 1971	January 1973	November 1973	June 1974	November 1975	November 1977
	1	2	3	4	5	6	7	8
(1) Overall estimates of Capital Cost (Rs. in crores)	21.10	33.94	34.99	37.16	34.55	39.76	45.03	49.01
(2) Foreign Exchange Component (Rs. in crores)	5.82	6.21	6.29	6.31	7.66	9.90	9.56	..
(3) Expected date of commissioning/commercial production							1.7.76	1.4.78

The Ministry have stated (April 1979/March 1980) as follows :—

- (i) Estimate of Rs. 49.01 crores was approved by Government in February 1979.

(ii) Based on the revised date of commercial production as 1st October 1979, the estimate has been further revised to Rs. 60.77 crores and approved by the Public Investment Board.

(iii) Government had also approved of (August 1978) the investment of Rs. 2.92 crores for change over of one stream of the Sulphuric Acid Plant to use sulphur and modifications to the second stream to use pyrites as well as modifications to the Phosphoric Acid Plant. Against this, a provision of Rs. 1 crore for providing sulphur burning facilities stood included in the estimates of November 1977.

(iv) Actual expenditure upto 31st December 1978 was Rs. 50.93 crores.

The following points deserve mention :—

(a) In addition to the Granulation Plant, the Steam Generation Plant envisaged in the Feasibility Report was also eliminated from the scope of the project. After exclusion of these items estimated to cost Rs. 1.97 crores, there was increase of Rs. 28.02 crores over the estimates included in the Feasibility Report. This was explained as being due to the following factors :—

(In crores of rupees)

(i) Changes in the scope of supply, civil and erection work of the Sulphuric acid Plant, the Phosphoric Acid Plant, the Triple Super-phosphate Plant, etc.	6.61
(ii) Price escalation as most of the equipment was ordered between November 1972 and beginning of 1973 as against the middle of 1969 anticipated in the Feasibility Reports	4.60
(iii) Shifting of supplies from indigenous to imported and vice versa and change in the exchange rate of Belgian Franc	0.94
(iv) Non-revision of inadequate provision in the Feasibility Report	7.92
(v) Modification jobs in the Sulphuric and Phosphoric Acid Plants and yard piping	1.75
(vi) Increase in duties, freight, taxes and handling, financing charges, design, engineering and procurement charges and departmental charges due to delay in execution of the Project	6.20

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28.02

It will be seen that major increase was, by and large, due to a change in the scope of the work and inadequate provision in the initial estimates.

The Ministry have stated (April 1979) that the following factors had mainly contributed to the change in scope :—

(In lakhs of rupees)

(i) Detailed engineering based on final engineering specifications submitted by M/s. Technoexport . . . . .	81.00
(ii) Elaborate pyrite crushing system to handle low grade pyrites . . . . .	22.00
(iii) Shifting of plant site necessitating additional civil works and increase in conveyor lengths . . . . .	140.00
(iv) Switch over from Dihydrate to Hemi-hydrate process . . . . .	55.00
(v) Change in the product pattern of triple super phosphate from granulation mixture to powder form . . . . .	74.25
(vi) Incorporation of effluent treatment . . . . .	40.00
(vii) Need for installation of two separate crushing system for Phosphoric Acid and Triple Super Phosphate Plants . . . . .	13.00
	425.25

Increase in the project cost due to non-provision/inadequate provision has been stated to be due to incorporation of sulphur handling arrangements, provision of acid proof brick lining, incorporation of lime and chalk handling systems, modification of gypsum grinding mills for grinding rock phosphate, increased scope of work for yard piping, etc.

- (b) Contract for a Sulphuric Acid Plant with a capacity of 880 tonnes per day based on Amjhore pyrites with 43 per cent of Sulphur was signed by the Corporation in March 1968 with Techno-export of Bulgaria.

The actual sulphur content of the ore was, however, found to be below 36 per cent, as a result of which difficulties were experienced in July 1969 in the operation of the Sulphuric Acid

Plant put up in 1968 by Pyrites, Phosphates and Chemicals Limited. In view of the uncertainty regarding ore of the required quality and quantity being available from Amjhore, Government advised the Fertilizer Corporation in February 1970 not to go ahead with the installation of the Sulphuric Acid Plant. This embargo was lifted by Government in July 1970 when it was decided that the Sulphuric Acid Plant would be equipped with facilities for burning both sulphur and pyrites. Owing to difficulties in establishing production of sulphuric acid, it has been decided (August 1978) to revamp one stream of the Sulphuric Acid Plant to use pyrites only and modify the second stream to use sulphur at a cost of Rs. 2.80 crores. The aspect relating to the circumstances under which contract based on a higher Sulphur content of Amjhore pyrites was entered into, was dealt with by Committee on Public Undertakings in its 39th Report (1972-73). Action taken on the recommendations made in paragraphs 8.44 and 8.45 of the said report is contained in 48th Report (1973-74) of Committee on Public Undertakings.

The Rationalisation Project was thus approved, in principle, on the basis of incorrect data about the quality of the pyrites and also of un-realistic estimates of capital cost. Even the process to be adopted for production of phosphoric acid had not been finalised when the project was approved.

In this connection, the Ministry have stated (April 1979) as follows :—

- (i) The estimate given in the feasibility Report of 1967 was based on the data available at that time. Engineering details were worked out later at the time of the execution of the project and the first detailed estimate for Rs. 33.94 crores was drawn up in May 1971.
- (ii) Feasibility Report had broadly assumed that the process for manufacture of phosphoric acid would be di-hydrate. All the di-hydrate processes available

at that time could not produce by-product gypsum which would yield chalk of the specifications intimated in May 1968 by A.C.C. to whom chalk was to be sold for manufacture of cement. On being intimated by the Engineering and Design Organisation of the Fertilizers and Chemicals Travancore Limited that their process licensor had developed a new hemi-hydrate process which would ultimately meet the stipulations laid by A.C.C., the matter was negotiated with the process licensor and, after conducting laboratory tests about the suitability of by-product gypsum and chalk, the said process was accepted.

As regards items (ii) above, it may be mentioned that according to the feasibility report, the chalk from by-product gypsum had been found workable to an acceptable cement clinker by suitably adjusting the working temperature of cement kiln. It was further mentioned in the feasibility report as follows :—

‘ . . . . the tests carried out by A.C.C. for production of cement from by-product gypsum corroborate the above statement. The laboratory and bench scale tests carried out by the P & D Division also confirm that it is possible to get chalk suitable for cement manufacture from by-product gypsum. However, to obtain a commitment from A.C.C. immediately on this account would be premature before the source of rock phosphate as well as the process adopted for production of phosphoric acid are finalised. The economics of this scheme will not be affected, even if no credit is allowed for the chalk.

- (c) As a result of the decision to produce triple super phosphate in powder form only, certain equipment valued at Rs. 9.95 lakhs already ordered for the Granulation Plant and Sulphur Dioxide Recovery

system in the Sulphuric Acid Plant, became surplus. Out of this, equipment, worth Rs. 6.07 lakhs are stated to have been utilised and the balance equipment valued at Rs. 3.88 lakhs are awaiting disposal (April 1979).

- (d) The estimate of January 1973 included a sum of Rs. 2.02 crores on account of short-term renovation of the existing Sindri Plant. The Provision for this item was excluded from the estimates of the Rationalisation Project which were approved by the Board in March 1976. Against the above estimate, Rs. 1.53 crores were spent upto 31st March 1975.

In this connection, the Ministry have stated (April 1979) that short term renovation was taken up mainly for safety reasons as well as to maintain production of the plants which were to be retired subsequently. Since these were considered as major repairs, the expenditure was incurred under non-project capital items.

#### 9.2.4 *Schedule for completion and commissioning*

A tentative time schedule of 30 months was anticipated in the feasibility report. The project was, originally, scheduled to be completed by October 1971. In January 1970, Government, however, placed an embargo on the project and work was stopped completely. Embargo was lifted in July 1970. Meanwhile, certain orders had been cancelled which had to be placed subsequently, causing considerable delay.

Thereafter, the project was scheduled for completion by December 1973 based on the delivery dates according to the orders placed. This schedule was also revised from time to time. The scheme went into commercial production from October 1979.

9.2.5 The major factors contributing to delay in the completion of the project, as mentioned in the progress reports, were as under :—

- (a) Delay in completion of civil works, which was commenced in January 1972 on account of following :—
  - (i) Delay in handing over of sites as a number of underground pipes, cables, etc. had to be re-routed and cleared.
  - (ii) Delay in receipt of drawings because load data were not sent in time by equipment suppliers.
  - (iii) Delay in finalising designs for the pyrites crushing plant.
- (b) There was slippage in the delivery of equipment by indigenous and foreign suppliers. While delay in receipt of imported equipment did not delay the project, indigenous suppliers had delayed the supply of materials for more than 2 years reportedly due to :—
  - (i) paucity of raw materials and constant increase in prices ;
  - (ii) overbooking by indigenous suppliers beyond their capacities ; and
  - (iii) failure of the suppliers to produce materials of correct specifications, etc.
- (c) There was serious slippage by two or three major contractors who had contracted to supply and erect certain items. Other erection contractors had also delayed the erection of equipment, pipes and instruments.
- (d) There was delay in awarding the contract for erection of electrical items due to delay in starting mechanical erection work.

9.2.6 A review of the Progress Reports of December 1975 indicated that commissioning of the Sulphuric Acid Plant and Phosphoric Acid Plant had been held up by the following :—

*Sulphuric Acid Plant*

- (a) Non-availability of cast iron tees.
- (b) Delay in completion of piping and electrical jobs.
- (c) Failure of relay in the main transformer.
- (d) Cracking of castable refractory work. The project authorities were not sure of the time by which the firm would be able to supply the material and complete the work.
- (e) Non-completion of the De-mineralised Water Plant.

*Phosphoric Acid Plant*

- (a) Modification and re-work required on rubber lined pipe due to design defect and fouling.
- (b) Defective workmanship of flourine scrubber, which required major modification before rubber-lining.
- (c) Delay in getting electrical connections due to modifications proposed by the supplier for re-laying of cables.
- (d) Re-working of seven KSB rubber lined pumps with better quality rubber.
- (e) Non-receipt of 14 numbers butterfly valves for which delivery could not be forecast.

The status of commissioning as indicated by the Ministry in April 1979 is as under :—

(1) *Sulphuric Acid Plant*

One stream of the Sulphuric Acid Plant was commissioned in July 1976. The Plant could not be operated on sustained

loads and there was frequent interruptions due to failures in pyrites crushing and handling system, cinder handling system, non-functioning of dry electro static precipitators, etc. A study of various problems was made by both FCI and other agencies, and suitable modifications, wherever possible, were carried out. Ultimately, services of M/s. Lurgi, Frankfurt who were well versed in the operation and revamping of the pyrites based Sulphuric Acid Plants were obtained and, based on their recommendations, it was decided that one stream of the plant should be revamped to run on pyrites and second stream should be converted to operate on sulphur feed.

Revamping jobs on one stream of Sulphuric Acid Plant to be run on pyrites are in progress.

It was decided to adopt Lurgi technology for operating the second stream of the plant on sulphur feed. Since execution would take about 12 months time, it was decided to incorporate solid burning facilities based on technology of M/s Technoexport (Bulgaria) as an interim measure. All modifications for feeding of solid sulphur were stated to be nearly complete and it was expected that this plant could be started on solid sulphur within 30 days of arrival of Technoexport engineers. Meanwhile, F.P.D.I.L. who has been entrusted with design engineering and procurement, are proceeding with the job in collaboration with M/s. Lurgi (India) and Lurgi (Frankfurt). Contract with M/s. Lurgi is effective from 1st May 1979 and all the jobs are to be completed in one year's time.

The Ministry have further informed (March 1980) that scheme regarding incorporation of solid sulphur burning facilities based on technology of M/s. Technoexport as an interim measure has been given up.

## (2) *Phosphoric Acid Plant*

The plant was commissioned in January 1977 but there were frequent failures of rubber lining in vacuum vessels. The

Indian contractors having re-done the job several times, it was decided to engage reputed rubber lining firm of U.K. for rubber lining of one evaporator of the Plant. Meanwhile, the Plant is being run intermittently on di-hydrate route depending on availability of sulphuric acid.

9.2.7 Delay in completion and commissioning had entailed an additional cost of Rs. 6.20 crores.

9.2.8 The performance of each contractor and supplier together with the exact delay attributable to each agency (including the Corporation), had not been analysed by the Management. The Ministry have stated (April 1979) that though detailed analysis was not made at the execution stage, all the aspects were taken into account and liquidated damages levied, before making final payment to each contractor and supplier.

### 9.3 *Techno-economic viability of the Project*

As mentioned earlier, the aim of the Project was to improve the operating economics of the existing Ammonium Sulphate and Double Salt Plants by eliminating highly un-economic and qualitatively deficient Rajasthan gypsum on the one hand, and to produce phosphatic fertilizers, on the other. The capacity and processes of the Rationalisation Project were determined on the following considerations :—

- (a) As far as possible, the ammonia produced should be utilised for maintaining the existing nitrogenous capacity.
- (b) The production of triple super-phosphate would also yield by-product gypsum required for the existing Ammonium Sulphate and Double Salt Plants and chalk required for utilising the existing capacity set up by Associated Cement Companies Limited for cement production at Sindri.

The Project conceived in the Feasibility Report anticipated an annual production of 1.56 lakh tonnes of ammonia in the existing Ammonia Plants to be used for the production of ammonium sulphate, urea, double salt, ammonium nitrate and phosphatic production.

9.3.1 According to the Feasibility Report, a gross profit (after depreciation but before interest and tax) of Rs. 12.10 crores was anticipated for the existing Unit and Rationalisation scheme involving a total capital investment of Rs. 50.93 crores (including Rs. 22.96 crores required for the Rationalisation Project), thereby giving a return of 23.76 per cent on the total capital. The profitability was based on the following costs of production and sale prices :—

Product	(Rupees per tonne)	
	Costs of Production	Sale prices
Ammonium Sulphate	275	316
Double Salt	387	426
Urea	419	582
Triple-super-phosphate Sulphate	356	425
Ammoniated triple super phosphate	492	775
Ammonium Nitrate (Explosive grade)	500	1000

NOTES :—1. Price of sulphuric acid from Pyrites, Phosphates & Chemicals Limited Plant was assumed at Rs. 170 per tonne.

2. Subsequent to the approval of Feasibility Report, it was decided to produce only triple-super-phosphate in powder form.

9.3.2 In November 1969 heads of three departments of Sindri Unit in an internal note submitted jointly opined that implementation of Rationalisation Project would increase the existing problems and limit the Unit's ability to achieve production as planned at that time. Their apprehensions were :—

- (a) Level of ammonia production envisaged in Feasibility Report was not commensurate with present condition of Coke Oven and Ammonia Plants.

- (b) Production levels of Double Salt and Urea were assumed at higher levels than those achieved in the past.
- (c) Uncertainty of successful production of Phosphoric Acid on hemi-hydrate route *vis-a-vis* production of Ammonium Sulphate from by-product gypsum.
- (d) Co-ordination problems in using certain equipment for more than one service.
- (e) Overall time efficiency was bound to suffer due to appreciable increase in material handling system.
- (f) Problems arising from congestion in Railway Yard and maintenance of conveyors and elevators where there was no stand-by equipment.
- (g) Accretion to inventory due to new types of equipment being installed.

9.3.3 In January 1972, the General Manager of Sindri Unit also expressed apprehension regarding (a) uncertainty of using by-product gypsum in such a large scale for manufacture of ammonium sulphate, (b) problems in purification of about 100 te/day of weak sulphuric acid, disposal of 5 te/day of sludge and disposal of huge quantities of cinder, (c) acceptability of chalk produced from by-product gypsum for cement manufacture by A.C.C., and (d) operational difficulties due to long conveyors.

The matter was considered by Board of Directors in January 1972 and referred to the P & D Division now (FPDIL) for examination of problems.

9.3.4 As regards the action taken by the P & D Division on observations of officers and General Manager, mentioned in preceding paragraphs, the Ministry stated in April 1979 as follows :—

- (i) With the discontinuation of Ammonia, Urea and Double Salt Plants difficulties envisaged under para 9.3.2(a), (b), (c), (f) and (g) do not exist now.

- (ii) As regards difficulties stated under paras 9.3.2(c) and 9.3.3(a), a number of plants are operating in India utilising by-product gypsum for manufacture of ammonium sulphate and hence no difficulty in this regard is foreseen at Sindri also.
- (iii) Replacement of natural gypsum with by-product gypsum will eliminate difficulties stated under para 9.3.2(d).
- (iv) With the discontinuation of old plants and installation of Modernisation Plants, pattern of material handling has changed and with adequate provision of railway facilities/difficulties stated under para 9.3.2 (f) have been removed.
- (v) As regards 9.3.3 (b), it is stated that with the installation of Effluent Treatment Plant, use of flocculating agent and disposal of cinder in low lying areas, the problems have been attended.
- (vi) With regard to para 9.3.3 (c), it is stated that technologically there is little doubt in processing by-product gypsum in Ammonium Sulphate Plant and about quality of chalk thus produced for cement manufacture.

9.3.5 While submitting the revised estimates to the Board in March 1976, it was mentioned that, on the current selling price of Rs. 1,472 per tonne for triple super-phosphate, and assuming production at rated capacities, the existing Unit and the Sindri Rationalisation together would lose annually 33.7 per cent on the total capital employed. The Rationalisation Project taken alone was likely to lose 22.45 per cent (of the capital outlay) instead of the profit of 16 per cent anticipated earlier. The profitability projections after the implementation of both Rationalisation and Modernisation Scheme are indicated in para 10.4.

## 10. Sindri Modernisation

### 10.1 Background

As mentioned earlier, insufficient ammonia available was attributed mainly to the poor quality of coke, coal and coke oven gas and the ageing of the original Ammonia Plant which together with the deteriorating quality of gypsum made stable production difficult. Because of the outmoded technology and increasing maintenance costs of the Plant, the cost of production of ammonia and consequently that of fertilizers was also increasing.

While the Sindri Rationalisation Project was intended to substitute natural gypsum by by-product gypsum in the production of ammonium sulphate and thereby improve the economics of production of ammonium sulphate, the Sindri Modernisation Project was meant to ensure that ammonia was available on a stable basis at a cost fairly comparable with that of newer installations, so as to stabilise production and economics of nitrogenous fertilizers. A Feasibility Report for the production of fertilizers using oil (heavy stock) from the proposed Bongai-gaon Refinery was submitted to Government in May 1971.

### 10.2 Genesis of the scheme

The feasibility report contained the following alternative proposals :—

#### (i) *Alternative I*

Installation of a new Ammonia Plant with a capacity of 900 tonnes a day to meet the requirement of the existing Sulphate Plant and miscellaneous uses and the conversion of the rest of the ammonia into urea

in a new 960 tonnes a day plant. The existing Ammonia Plants and Urea and Double Salt Plants were to be shut down.

(ii) *Alternative II*

The existing facilities to be operated at achievable levels. An additional Ammonia Plant with a daily capacity of 900 tonnes to be put up for the ammonia to be converted into urea in a new 1500 tonnes Urea Plant.

(iii) *Alternative III*

The existing gas Reforming Plant would be modified and operated by using gas from the existing Naphtha Reformer equivalent to 60 tonnes of ammonia daily and a new reformer to produce daily gas equivalent to 120 tonnes of ammonia to be installed. This 180 tonnes ammonia along with 900 tonnes ammonia from the new plant would be used for ammonium sulphate production, miscellaneous uses and conversion to urea in a new 1200 tonnes Urea Plant.

The feasibility report was considered by the Corporation, the Ministry of Petroleum and Chemicals, the Planning Commission and the Public Investment Board. Government finally approved in November 1973 a scheme formulated by the Projects Appraisal Division of the Planning Commission in which installation of a new Naphtha Reformer for utilising the existing expansion Ammonia Plant was not considered necessary, as firstly there was shortage of naphtha in the country and secondly conversion of the entire ammonia would require a Urea Plant of a 'non-standard' size. The scheme, therefore, contemplated the continued use of the existing Naphtha Reformer to produce 60 tonnes daily of ammonia together with a new Ammonia Plant (capacity 900 tonnes daily) based on fuel oil and a Urea Plant (capacity 1000 tonnes daily). After meeting the ammonia requirements of the Urea Plant, the balance was to be diverted

to produce ammonium sulphate and other miscellaneous uses. This scheme was similar to the Nangal Expansion Project and was expected to save time and cost by the repetition of design and engineering. The scheme was estimated to cost Rs. 88.91 crores (foreign exchange component being Rs. 21.73 crores).

After implementation of the existing scheme, the Coke Oven Battery, old Ammonia Plant, Double Salt Plant and old Urea Plant would be closed down. The Ammonium Sulphate, Nitric Acid, Material Handling, Power and Ammonium Nitrate Plants and other utility services were to continue.

### 10.3 Capital Expenditure decisions—Project Estimates

10.3.1 As mentioned above, the scheme as approved, was estimated to cost Rs. 88.91 crores. Government approached the World Bank for financing the Project. In December 1974 the Bank agreed in principle to finance the projects as essentially a duplicate of the Nangal Expansion Project, based on fuel oil gasification and desired that the Corporation should negotiate with the process collaborators (Uhde and Lurgi of West Germany and Technimont of Italy) for re-utilisation of the basic design package.

Cost was re-estimated in May 1974, on the basis of the orders placed for the Nangal Expansion Project at the then prevailing rate of exchange, at Rs. 119.35 crores (foreign exchange component—Rs. 44.74 crores). This was again revised to Rs. 134.41 crores in October 1974 during negotiations for the loan in Washington.

The revised estimates of Rs. 134.41 crores (including a foreign exchange component of Rs. 47.76 crores) were approved by the World Bank. The Bank agreed to give a loan upto a maximum of \$ 91 millions (Rs. 68.25 crores approximately).

10.3.2 The estimates framed in June 1973 and those drawn up in October 1974 under broad headings were as follows :—

(Rupees in crores)

Sl. No.	Item	Project Estimates (June 1973) and approved by Government in November 1973	Project Estimates (October 1974)
1.	Equipment supply	49.8	54.6
2.	Civil works	5.2	5.2
3.	Project Management charges	1.5	1.8
4.	Working capital and shares	5.9	8.5
5.	Financing charges	2.7	10.7
6.	Escalation		12.4
7.	Other fund requirement	23.9	41.3
		89.0	134.5

According to the Corporation, the increase in the estimate in October 1974 by Rs. 45.5 crores was mainly caused by :—

- (a) Changes in scope of the scheme, sources of supply and parity rates.
- (b) Price escalation.
- (c) Provision for escalation in price, higher than the normal, as indicated by the World Bank to cover the oil crisis period and beyond.

Estimate of capital cost of Rs. 134.41 crores was revised to Rs. 152.04 crores (foreign exchange component—Rs. 53.71 crores) in July 1976 and approved by Government in October 1978. The estimate was further revised to Rs. 167.21 crores (foreign exchange component—Rs. 56.45 crores) in December 1978. The Ministry have intimated (March 1980) that the estimate was again revised to Rs. 183.19 crores and has been approved by the Public Investment Board in October 1979.

Expenditure incurred up to March 1979 was Rs. 160.21 crores (provisional), including Rs. 49.84 crores in foreign exchange.

10.3.3 The estimates of cost for Modernisation scheme did not include expenditure considered necessary to renovate the Sulphate Plant, the Power Plant, the Nitric Acid Plant and the Material Handling Plant, so that these could be operated for another 15 years as was decided when the Modernisation and Rationalisation Plants were approved. The cost of renovation of these Plants (known as Sindri renovation) was estimated at Rs. 8.43 crores in April 1974 and approved by the Board in July 1974. This estimate was subsequently revised to Rs. 16.23 crores to provide for certain additional items and price escalation and was approved by the Board in June 1976. Government approved the scheme in March 1979. Rupees 10.25 crores were spent up to 31st March 1979.

10.3.4 The Modernisation Scheme was expected to go into commercial production by April 1979. Present status of commissioning, as intimated by the Ministry in April/May 1979 and March 1980 is given below :—

(a) *Ammonia Plant*

The gasification, carbon recovery, H<sub>2</sub>S removal Co-conversion, CO<sub>2</sub> removal and Liquid Nitrogen Wash Section have been commissioned and are running satisfactorily. Synthesis gas mixture of the desired specification is being produced. On 17th March 1979 the synthesis gas compressor has been tried with synthesis gas and further trial runs are under way.

As a temporary arrangement, part of the synthesis gas is being utilised in the old Ammonia Plant for ammonia production

(b) *Urea Plant*

The trial runs were carried out successfully and prilled urea was produced on 25th February 1979.

(c) The Project went into commercial production on 1st October 1979.

10.3.5 In the wake of commissioning of Modernisation Scheme, the position of operation/shut down of old plants was as follows :—

- (1) Double Salt and Urea Plants were shut down in July 1976. A complete list of surplus equipment is being circulated for utilisation in other Fertilizer Plants or for disposal.
- (2) Ammonia (Chemico) Plant was shut down since February 1978. However, synthesis section along with refrigeration and storage sections continue in operation.
- (3) Semi-water Gas Plant was closed down in stages from 1976 onwards.
- (4) The Gas Reforming Plant and Expansion Ammonia Plant have been closed with effect from July 1979.
- (5) Ammonium Sulphate Plant was shut down in January 1978. The Plant, after renovation, is, however, being worked as and when adequate quantities of ammonia and carbon dioxide are available after meeting the requirement of Modernisation scheme and Ammonium Nitrate Plant.
- (6) The Coke Oven Plant has been kept in operation with heavy renovation/maintenance in anticipation of taking over of the plant by M/s. B.C.C.L.

The maintenance expenditure on retired/to be retired plants during 1975-76 to 1977-78 was as follows :—

	(Rupees in crores)
1975-76	1.63
1976-77	1.41
1977-78	1.11

As a result of closing down of old plants at Sindri, a large number of personnel have become surplus. According to the assessment made and reported to the Board in January 1980, there would be 1254 persons surplus to the requirement.

### 10.4 Profitability projections

A study of the overall profitability of the Sindri Unit, after completion of the Modernisation scheme, made by the Corporation on the basis of June 1973 estimates and October 1974 estimates indicated the following position for the years 1976-77 to 1979-80 :—

(In crores of rupees)

1	June 1973 Estimates				October 1974 Estimates			
	1977	1978	1979	1980	1977	1978	1979	1980
	2	3	4	5	6	7	8	9
Sales (net)	48.5	55.0	59.1	62.2	57.3	75.2	114.4	119.1
Cost (including depreciation)	47.6	55.1	55.1	55.5	65.9	79.8	110.2	112.2
Operating profit	0.9	(-)0.1	4.0	6.7	(-)8.6	(-)4.6	4.2	6.9
Interest on loans and Deferred revenue	1.7	3.2	4.7	4.7	2.5	3.1	11.3	11.1
Net Profit(+)/loss (-)	(-)0.8	(-)3.3	(-)0.7	(+)2.0	(-)11.1	(-)7.7	(-)7.1	(-)4.2

The study was based on the commissioning of the Modernisation scheme in 1976-77 and assumed a capacity utilisation of 90 per cent. It indicated the overall position of the Unit as a whole *i.e.* after taking into account the Sindri Rationalisation and Modernisation schemes and the old Ammonium Sulphate Plant, etc. continued under the Rationalisation/Modernisation schemes.

In the above forecast, the following costs of production and selling prices were assumed :—

Item	(Rupees per tonne)			
	Cost of production		Sale price (net)	
	June 1973 estimates	October 1974 estimates	June 1973 estimates	October 1974 estimates
1	2	3	4	5
Urea . . . . .		1055	727	1177
Ammonium Sulphate . . . . .		634	415	582
Triple Super-Phosphate . . . . .		1865	829	2185
Ammonium Nitrate . . . . .		1855	2000	2000

It would be seen that :—

- (i) Even after implementation of Modernisation and Rationalisation schemes, the Sindri Unit was to suffer losses upto 1980-81, after providing for interest on loans.
- (ii) The production of ammonium sulphate, even after natural gypsum is replaced by by-product gypsum and ammonia is available from the Modernisation scheme at a fairly competitive rate, was to be un-economical.
- (iii) Urea and triple-super-phosphate were thus the determining factors in the profitability of the Sindri Unit as a whole, ammonium nitrate capacity being only 9,000 tonnes. The sale price assumed in October 1974 estimates for the triple-super-phosphate was Rs. 2,185 per tonne. As against this price, the net

realisation per tonne having regard to the prevailing prices of phosphate fertilizers was expected (January 1976) to be Rs. 1,472 per tonne. At this price, even triple-super-phosphate would not be economical.

According to the Ministry, the estimates of June 1973 and October 1974 were based on the commencement of commercial production by Sindri Modernisation and Rationalisation schemes on certain assumed dates as well as certain selling prices and the input costs. The position had considerably changed and the Sindri Modernisation, Rationalisation and Renovation were now estimated to cost Rs. 183.19 crores, Rs. 60.77 crores and Rs. 18 crores respectively.

After taking into account these developments and the date of commencement of commercial production as 1st October 1979 in respect of Sindri Rationalisation and Modernisation, the Ministry have intimated (March 1980) the following profitability projections :—

	(Rupees in crores)	
	BE 1979-80	BE 1980-81
<b>Plant</b>		
Sindri Modernisation (Urea) . . . . .	(—)10.45	(+) 1.00
Sindri Rationalisation (TSP) . . . . .	(—) 6.94	(—) 5.97
<b>Old plants</b>		
Ammonium Nitrate, Ammonium Sulphate, Sodium Hexamataphosphate, Nitric Acid & Coke Oven plants . . . . .	(—) 5.68	(—) 5.29
Interest on loan relating to accumulated losses upto 31-3-1978 . . . . .	(—) 8.60	(—)8.60
Interest on loan relating to accumulated losses after 31-3-1978 . . . . .	..	(—)4.05
Idle facilities/retired plants . . . . .	(—) 6.71	(—) 2.75
Advance towards wage revision . . . . .	(—) 0.42	..
	(—)38.80	(—)25.66

The Ministry have further elaborated as follows :—

“The loss of Rs. 25.66 crores estimated for 1980-81 is based on expected retention prices with input prices obtaining in February 1979. If the net realisation is also worked out at expected retention prices with latest input prices and latest project estimates there would be an improvement in realisation to the extent of Rs. 27.38 crores resulting in a profit of Rs. 1.72 crores against the estimated loss of Rs. 25.66 crores”.

## 11. Mining Organisation—Jodhpur

### 11.1 Introduction

A mining organisation was established in 1951 at Jodhpur for exploration and exploitation of gypsum deposits in Rajasthan. During 1951—56, the organisation explored about 235 gypsum fields containing reserves of over 100 million tonnes. Departmental mining of gypsum was started at Kavas Mines (Barmer District) in 1952, followed by the opening of Uttarlai mines (Barmer District) in 1956. In all, the organisation developed 22 mines, out of which mining had been discontinued permanently or temporarily on different dates between August 1969 and October 1976 in 8 mines.

Details of the mines opened, capital expenditure incurred on development and estimated reserves of gypsum are indicated in Appendix III.

In addition to gypsum, the organisation also undertook exploration and development of apatite mines at Visakhapatnam (Andhra State) and rock phosphate deposits in Maldeota (Uttar Pradesh State) but abandoned or discontinued these mines subsequently.

The mining lease for the apatite mines in Visakhapatnam was executed in May 1966 for 20 years. Reserves were estimated at 18,000 tonnes of apatite containing 40 per cent  $P_2O_5$  which could be used by Trombay Unit in place of imported rock phosphate. It was established by February 1969 that the quality was not suitable for Trombay Unit. It was accordingly decided (July 1969) to sell the entire stock and transfer the lease.

Earlier during geological exploration it was found that major area under mining lease was barren and, therefore, to reduce the incidence of dead rent/royalty in respect of the leased area, an application for surrendering the area of 1139.09 hectares was moved to the State Government in May 1968. In December 1969, State Government was requested for permission to transfer lease of the remaining area of 758.07 hectares to a private party. It was sought to be done on the consideration that the proposed transfer, on the basis of terms and conditions agreed to by the party, would contribute substantially (about Rs. 4 lakhs) towards the recovery of development expenditure. When State Government approached the Central Government in June 1971 for permission to transfer the lease in favour of the private party, the latter suggested that the Corporation should surrender the entire area. Thereupon, State Government asked the Corporation in February 1972 to surrender the entire area; in the absence of any reply, a show cause notice was issued by the State Government in March 1974 for determining the lease. The lease was finally cancelled on 13th May 1974 notwithstanding the Corporation's request made in April 1974 to wait for some time more. The revision petition filed in August 1974 by the Corporation against the order of the State Government was dismissed by the Ministry of Steel and Mines in November 1976.

Proceeds from sale of 14,500 tonnes of apatite totalled Rs. 13.62 lakhs, against Rs. 18.91 lakhs spent on development and operation of the mine. The case was reported to the Board in August 1979 which noted the position emerging from the development and operation of the mine.

The preliminary work on the rock phosphate deposits at Maldeota was commenced in May 1968. In September 1969, it was decided to transfer the mine to the Pyrites, Phosphates and Chemicals Limited. The mining lease transfer agreement was signed in April 1972. As against a total expenditure of Rs. 4.08 lakhs incurred by the Corporation, Rs. 3.83 lakhs were adjusted.

From April 1975, the control of the mining organisation was transferred from Sindri Unit to the Marketing Division.

## 11.2 Performance appraisal

### 11.2.1 Overall requirement of gypsum

The Ammonium Sulphate Plant at Sindri was designed to process 93—95 per cent pure gypsum from Doudkhel mines in erstwhile West Punjab. Gypsum available from Rajasthan was, however, less pure; the average purity of gypsum during the last 8 years being as follows :—

Year	Range of purity
1970-71	Between 82.30 per cent and 92.34 per cent except from Chotisaraï mine where it was 79.34 per cent.
1971-72	Between 84.97 per cent and 92.34 per cent.
1972-73	Between 83.24 per cent and 90.85 per cent.
1973-74	Between 80.93 per cent and 91.65 per cent.
1974-75	Between 82.68 per cent and 89.33 per cent except from Karnisar and Hardaswali I mines where it was 72.33 per cent and 79.84 per cent respectively.
1975-76	87.41 per cent on an average for all the mines.
1976-77	85 per cent or more.
1977-78	Between 79.88 per cent and 86.63 per cent.

According to the accepted norms, 1.9 tonnes of gypsum of 81.6 per cent purity is required to produce a tonne of ammonium sulphate. On the basis, 6.74 lakh tonnes of gypsum are required for the rated output of 3.55 lakh tonnes of ammonium sulphate. As the Ammonium Sulphate Plant could also be operated on sulphuric acid (produced in the Sulphuric Acid Plant which went into production in 1969-70) instead of gypsum and as the actual production of ammonium sulphate was less than the rated output,

the annual requirements of gypsum for the last 8 years were as follows :—

Year	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Annual requirement (in lakhs of tonnes)	6.14	6.46	2.43	2.58	2.79	2.66	0.68	0.78

### 11.2.2 Actual production and despatches

The table below indicates the production and despatches of the gypsum during 1969-70 to 1977-78 :—

(In lakhs of tonnes)

Year	Production			Despatches		
	Sindri Grade	Other Grade	Total	Sindri Grade	Other Grade	Total
1969-70	4.35	0.87	5.22	4.36	0.81	5.17
1970-71	3.56	0.29	3.85	3.98	0.64	4.62
1971-72	3.80	0.91	4.71	3.71	0.60	4.31
1972-73	2.98	0.68	3.66	3.07	0.67	3.74
1973-74	2.84	0.41	3.25	2.68	0.81	3.49
1974-75	4.26	1.37	5.63	3.69	1.31	5.00
1975-76	2.56	0.48	3.04	2.92	0.54	3.46
1976-77	0.54	0.95	1.49	0.68	1.28	1.96
1977-78	0.66	1.41	2.07	0.78	1.50	2.28

- (a) No rigid targets for the quantity of gypsum to be delivered were fixed by the Management due to break downs in the Sindri factory, non-availability of railway wagons, natural calamities and non-acceptance of material by the Railways on account of jammed railway yards.
- (b) In the course of mining, gypsum of lower grade is also produced with one of higher grades required for the production of ammonium sulphate. Low grade gypsum is suitable for cement factories, agricultural purposes, etc., but the Corporation has no right to

sell it (except from Kavas and Uttarlai mines, from where it is supplied to cement factories) to any outside party on account of the restrictive clause to this effect in the mining lease agreement and the working permissions granted by the State Government.

The State Government was approached by the Corporation and the Government of India from time to time to withdraw the restrictive clause but the former has not so far (December 1978) agreed to the proposal, except that the Corporation has been permitted from April 1973 to sell 'C' grade gypsum quarried from all its mines to consumers other than cement factories. The relaxation was initially for a period of six months and subsequently extended from time to time. The Ministry have stated (December 1978) as follows :—

“The main industries which used gypsum in the country till 1973-74, besides Sindri fertilizers factory, were cement manufacturers and to some extent the building industry. The demand of other industries was negligible. As the State Government had not permitted Fertilizer Corporation of India to sell the low purity material, stocks of low purity material were left in the mines.....”.

(c) An analysis of the despatches and unit cost of production for various groups of mines is given in Appendix IV. It will be seen that despatches from some of the mines were quite insignificant throughout. The gypsum required for ammonium sulphate could be met by operating the mines in the Mohangarh, Malkasar and Dhandra group. The Corporation intimated (December 1974) that it was operating other mines too on the following considerations :—

(1) Supply of wagons by the Northern Railway was uncertain or erratic.

- (2) The Corporation was projecting a large scale sale of agricultural grade gypsum and in case some mines were not operated, the State Government might take them over.

It may be mentioned, in this connection, that no exercise had been made by the Corporation to determine the economics of operation of the mines which produce mostly low grade gypsum and incur losses. In fact, up to 1974-75, the entire cost on mining operations less the recoveries on the sale of low grade gypsum, was passed on to Sindri. After the mining organisation was attached to the Marketing Division from April 1975, it was noticed that in Kurla, Nagaur, Nal, Jetsar and Suratgarh mines which produced mostly low grade gypsum for sale to outside parties, a loss of Rs. 2.16 lakhs had been incurred in 1975-76. According to the information furnished by the Ministry in January 1980, while, the organisation incurred a loss of Rs. 5.26 lakhs in 1976-77, it earned a profit of Rs. 2.43 lakhs in 1977-78 and that of Rs. 1.00 lakh in 1978-79.

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

- (i) In view of the steep shortfall in the requirement of natural gypsum consequent upon implementation of Rationalisation Project, the Corporation had the following alternatives left :—
- (1) to close the organisation;
  - (2) to handover the organisation lock, stock and barrel to the State Government of Rajasthan; and
  - (3) to diversify the activities in such a way that the quantity of gypsum which was earlier being despatched to Sindri could be despatched to other users.

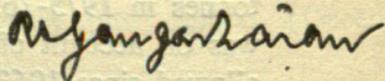
As the first alternative was not found feasible as it would render 425 personnel jobless and the second alternative did not work as the State Government declined to accept the proposal, the management of Fertilizer Corporation of India explored the possibility of alternative use of gypsum.

- (ii) In 1973-74 on the recommendation of Soil Salinity Research Institute, Karnal that gypsum powder can be used in the reclamation of alkaline soils, the State Government of Punjab and Haryana through their agencies started use of gypsum. The Corporation took advantage of this opportunity and entered the market. The despatches to agricultural sector have since picked up and it is expected that Jodhpur Mining Organisation would be self-sustaining in due course.
- (d) The despatch of other grades of gypsum declined from 1.31 lakh tonnes in 1974-75 to 0.54 lakh tonnes in 1975-76. It was noticed that the decline was on account of withdrawal of credit of a month allowed since 1963-64 to the cement factories, from April 1975. Consequently, overall production was lower, affecting the cost of production. The credit facility was restored in February 1976 and despatches again picked up in 1976-77 and 1977-78.
- (e) Despatches from Suratgarh, Jetsar and Mohangarh group of mines were much below the estimated quantities of 1.20, 1.05 and 3 lakh tonnes per year respectively envisaged in the proposals for their development approved by the Board. The raising from other mines was also not upto the desired levels. As a result, the Unit not only resorted to extensive mining instead of intensive mining, but also had to procure during 1969-70 to 1971-72 a total quantity of 2.40 lakh tonnes valued at

Rs. 218.16 lakhs from Bikaner Gypsum Limited involving an extra expenditure of Rs. 26.74 lakhs. Another order for 20,000 tonnes was placed on the above firm in January 1974 at Rs. 27.60 per tonne exclusive of sales tax and other taxes involved an extra expenditure of Rs. 2.78 lakhs.

The Corporation attributed (January 1977) the following reasons for lower production and despatches :—

- (i) During summer season, mines practically remained closed for some months due to blockage of roads by sand dunes.
- (ii) The seasonal shortage of labour during harvest period in Suratgarh, Jetsar and Hanumangarh group of mines.
- (iii) Poor and erratic supply of wagons by Railways which affected very badly the operations of the Mohangarh mines.



(P. P. GANGADHARAN)

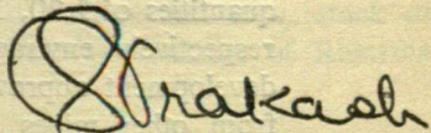
New Delhi

*Chairman, Audit Board and Ex-officio  
Additional Deputy Comptroller*

The 29<sup>th</sup> August 1980.

*Auditor General (Commercial)*

Countersigned



(GIAN PRAKASH)

New Delhi

*Comptroller and Auditor General of India*

The 29<sup>th</sup> August 1980.

## APPENDIX I

(Referred to in paragraph 6)

*Statement showing the production achieved, profits earned and losses incurred by Sindri Unit since inception to 1977-78*

Year	Ammonium Sulphate (in lakh of tonnes)	Double salt (in lakh of tonnes)	Urea (in lakh of tonnes)	Profit/Loss (in lakhs of rupees)
1952-53	2.23	..	..	75.85
1953-54	2.54	..	..	127.68
1954-55	3.05	..	..	191.47
1955-56	3.31	..	..	179.67
1956-57	3.39	..	..	184.35
1957-58	3.37	..	..	139.09
1958-59	3.35	..	..	154.30
1959-60	2.90	0.23	0.05	(—)15.34
1960-61	3.05	0.36	0.11	22.89
1961-62	2.84	0.55	0.14	16.83
1962-63	3.24	0.62	0.19	59.88
1963-64	3.07	0.47	0.18	41.57
1964-65	3.11	0.48	0.18	113.47
1965-66	3.27	0.55	0.19	157.02
1966-67	3.14	0.60	0.19	105.95
1967-68	2.41	0.61	0.16	8.40
1968-69	2.66	0.49	0.16	(—)38.89
1969-70	2.91	0.43	0.16	(—)25.76
1970-71	2.75	0.42	0.15	(—)157.95
1971-72	2.31	0.31	0.14	(—)346.97
1972-73	1.72	0.57	0.10	(—)579.58
1973-74	1.94	0.48	0.12	(—)718.19
1974-75	1.98	0.27	0.09	(—)892.82
1975-76	1.77	0.21	0.07	(—)1478.46
1976-77	1.03	0.02	Negligible	(—)1784.84
1977-78	0.43	..	..	(—)2244.34
<b>Total</b>	<b>67.77</b>	<b>7.67</b>	<b>2.38</b>	<b>(—)6704.72</b>

APPENDIX II

(Referred to in paragraph 7.5.)

Statement showing the results of physical verification where excesses and shortages were significant

Sl. No.	Item	1972-73			1973-74			1974-75			1975-76			1976-77			1977-78		
		Excess/short (in tonne)	Percentage to total receipt/production	Value (Rs. in lakhs)	Excess/short (in tonne)	Percentage to total receipt/production	Value (Rs. in lakhs)	Excess/short (in tonne)	Percentage to total receipt/production	Value (Rs. in lakhs)	Excess/short (in tonnes)	Percentage to total receipt/production	Value (Rs. in lakhs)	Excess/short (in tonnes)	Percentage to total receipt/production	Value (Rs. in lakhs)	Excess/short (in tonnes)	Percentage to total receipt/production	Value (Rs. in lakhs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.	Coking Coal	(+)8720	3.904	6.26	(+)3623	1.8	3.97	(-)2892	1.28	3.31	..	..	..	(+)2176	0.93	3.62	(+)760	0.31	1.14
2.	Gypsum	(+)21286	6.630	22.29	..	..	..	(+)4931	1.33	6.40	(+)24951	7.66	36.22	(+)2224	1.35	3.63	(-)1169	1.17	2.30
3.	Pyrites	(-)4319	11.160	4.60	..	..	..	(-)1920	4.55	5.44	..	..	..	(-)309	0.56	1.08	(+)1910	4.80	6.42
4.	Sulphur	(-)82	1.093	0.35	..	..	..	(+)1276	56.55	8.15	..	..	..	(-)23	0.59	0.17	(+)127	1.2	0.94
5.	Sulphur-sludge	..	..	..	..	..	..	(+)121	7.67	0.24	..	..	..	(-)21	1.13	0.04	(+)8	0.55	0.02
6.	Produced/purchased Coke	(-)8840	6.385	14.89	(-)2209	2.1	4.40	..	..	..	(-)4574	1.37 for produced coke 2.78 for purchased coke	17.35	(+)2034	1.92	8.24	(+)2006	2.08	6.56
7.	Ammonium sulphate	(-)2254	1.264	8.44	..	..	..	..	..	..	(-)541	0.31	2.95	(+)81	0.07	0.44	(+)1	..	0.01
8.	Double Salt	..	..	..	..	..	..	(+)473	1.77	3.91	(-)1966	9.25	15.67	(-)161	5.90	1.05	(-)30	4.80	0.19
9.	Urea	..	..	..	..	..	..	..	..	..	(-)1029	15.78	11.34	(-)34	4.39	0.31	(-)1	0.28	0.01

APPENDIX III

(Referred to in Paragraph 11.1)

Statement showing the names of mines opened, capital expenditure incurred, reserve of ore, etc., and present status of the mines

Sr. No.	Name of mine	Date of opening	Period of lease/ working permission	Capital expenditure incurred upto 31-3-1978 (Rs. in lakhs)	Ore reserve as on 31-12-78 (In lakh of tonne)	Range of purity percen- tage of Sindri Grade Gypsum	Total produc- tion up to 31-3-1978		Remarks	
							Sindri Grade (In lakh of tonees)	Other Grade		
1	2	3	4	5	6	7	8	9	10	
1.	Uttarlai group									In respect of Kavas mine, status quo is being main- tained after the expiry of lease period pending decision by the Government of India on the revision appli- cation submi- tted by the Corporation.
	Kavas . . . . .	1-5-1952	1-5-52 to 30-4-72	14.51 for the whole group	2.00	above 85	26.24	2.24		
	New Kavas . . . . .	15-12-1965	upto 31-12-79		0.12		0.48	nil		
	Uttarlai . . . . .	2-9-1956	upto 30-6-81		2.00		18.68	3.76		
	Sheokar . . . . .	1-6-1962	-do-				2.05	0.01	Surrendered w.e.f. 6-6-77	

1	2	3	4	5	6	7	8	9	10
	Kurla	21-12-1961	-do-		..		0.31	0.15	Surrendered w.e.f. 1-1-78
2.	<i>Nagaur group</i>								
	Khairat	17-1-1965	upto 31-12-1979	0.35	1.43		6.18	0.23	} Reopened on 15-9-1976
	Bhadana	17-1-1965	-do-		0.50	above 85	0.92	0.02	
	Chotisarai	17-1-1966	-do-		0.10	-do-	0.40	0.33	
	Golsar Kitalsar	1-7-1968	upto 30-6-1988		1.00	-do-	0.23	0.01	
3.	<i>Nal Group</i>	1-11-1966	Indefinite period	1.64	6.90	-do-	2.09	0.37	
4.	<i>Suratgarh group</i>								
	Baropal	1-1-1966	7-12-65 to 6-12-85	9.19	..	-do-	2.03	..	} Surrendered w.e.f. 1-8-1976
	Kishanpura	1-7-1968	4-1-72 to 3-1-92	including expendi- ture on Jetsar group	..	-do-	0.01	0.16	
	Bakia Ki dhar	1-2-1967	indefinite period	..	-do-	0.22	0.08		
5.	Mohan garh	1-4-1968	indefinite period	18.67	64.11	-do-	11.25	..	
6.	<i>Jatsar group</i>								
	Hardaswali I & II	1-1-1966	upto 6-12-1985	Merged with Suratgarh group	..	above 85	1.65	..	Surrendered w.e.f. 30-5-1977
	Karnisar-I	-do-	upto 13-9-1986		1.50	-do-	0.75	..	
	Raghunathpura (M)	-do-	-do-		0.65	-do-	1.27	0.34	
	Raghunathpura-I	-do-	-do-		0.64				
7.	Dhandra	1-5-1968	indefinite period	2.23	7.45	-do-	2.72	..	
8.	Malkasar	16-8-1971	up to 24-10-91	6.09	11.50	-do-	3.31	0.95	

## APPENDIX IV

(Referred to in paragraph 11.2.2)

Statement showing the despatches and unit cost of the groups of mines for 1969-70 to 1977-78)

(Despatches in lakh of tonnes,  
unit cost in rupees per tonne)

Sl. No.	Name of the Group	1969-70		1970-71		1971-72		1972-73		1973-74		1974-75		1975-76		1976-77		1977-78	
		Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost	Despatch	Unit cost
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.	Uttarlai . . . . .	1.94	10.50	1.71	15.00	1.16	16.05	0.79	18.96	0.72	17.18	1.14	19.99	0.61	27.75	0.45	26.03	0.39	32.76
2.	Nagaur . . . . .	0.78	16.08	0.67	17.36	0.49	19.70	0.27	21.89	0.21	18.05	0.30	22.32	0.14	27.13	0.16	19.24	0.19	22.61
3.	Suratgarh . . . . .	0.58	18.11	0.17	20.75	0.03	26.55	..	..	0.04	120.41	0.10	77.38	0.03	54.37	0.07	44.43	0.01	33.97
4.	Jetsar . . . . .	0.43	20.87	0.54	19.44	1.04	20.52	0.49	23.42	0.22	36.88	0.21	57.13	0.01	199.13	0.13	72.15	0.14	88.59
5.	Nal group . . . . .	0.14	16.01	0.03	19.98	0.32	16.40	0.12	21.02	0.05	29.13	0.21	25.29	0.09	27.40	0.07	25.72	0.11	31.15
6.	Mohan Garh . . . . .	1.30	18.35	1.50	23.02	0.95	25.90	1.51	26.61	1.53	27.28	1.22	33.28	1.31	31.94	0.48	62.33	0.53	75.20
7.	Malka Sar . . . . .	Started operation from 1971-72				0.32	26.43	0.25	31.99	0.51	26.20	1.13	31.36	0.80	36.62	0.37	38.82	0.76	46.77
8.	Dhandra . . . . .	This was part of Jetsar group upto 1972-73						0.31	19.67	0.21	23.13	0.69	28.14	0.47	32.15	0.23	43.38	0.14	67.15
	TOTAL . . . . .	5.17	15.19	4.62	18.69	4.31	20.58	3.74	23.82	3.49	25.04	5.00	28.48	3.46	32.68	1.96	42.52	2.27	52.01

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