REPORT OF THE COMPTROLLER & AUDITOR GENERAL OF INDIA UNION GOVT. 1976 PASU 4

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REPORT OF THE

COMPTROLLER AND AUDITOR GENERAL

OF INDIA

UNION GOVERNMENT (COMMERCIAL)

1978

PART IV

THE FERTILIZER CORPORATION OF INDIA LIMITED
(NAMRUP UNIT)

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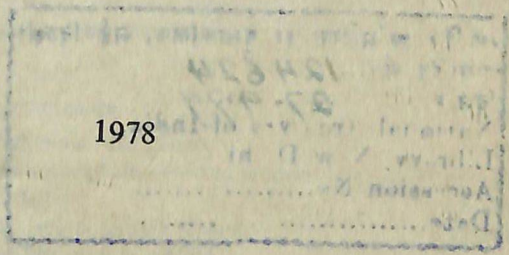

1978

PART IV

THE FERTILIZER CORPORATION OF INDIA LIMITED
(NAMRUP UNIT)

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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—Part III—Union Government (Commercial 1978—The Fertilizer Corporation of India Limited—Trombay Unit—wherein it was *inter alia* mentioned that the Report on the working of Namrup Unit was being printed separately.

2. This part contains the results of the appraisal undertaken by the Audit Board of the working of Namrup Unit (including Namrup Expansion) of The Fertilizer Corporation of India Limited. The Report has been brought up to date by incorporating data up to 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 up to 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 *Ex-officio* Director of Commercial Audit (Coal), Calcutta.

(4) Shri M. P. Singh Jain, Member, Audit Board and *Ex-officio* Director of Commercial Audit, Calcutta up to 31st October 1978.

(5) Shri A. C. Bose, Member, Audit Board and *Ex-officio* Director of Commercial Audit (Fertilizers and Chemicals), New Delhi.

(6) Shri Paul Pothen, Managing Director, Indian Farmers Fertilizers Co-operative Limited, New Delhi—Part Time Member.

(7) Shri T. R. Visvanathan, Superintendent, Technical Services, Madras Fertilizers Limited, Madras—Part Time Member.

(8) 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 part time 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 result of discussions held with the representatives of the Ministry of Chemicals and Fertilizers and the Corporation at its meetings held from 4th to 7th October 1978 : and

(b) the additional information furnished by the Ministry in November 1978 and considered in the meeting of the Audit Board held on 8th and 9th January 1979.

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.

NOTE :—Dr. P.K. Narayanaswamy could not attend the meeting of the Audit Board held on 8th and 9th January 1979 as he was away from India on tour to South East Asian Countries.

1. Introduction

The first concrete proposal for a fertilizer project in Assam was submitted by the State Government to the Fertilizer Production Committee in 1955. The proposal related to production of urea and nitrolimestone, using coal from the Khasi Hills as feedstock. The Fertilizer Production Committee, after examining the proposal, concluded that it would not be economical. Subsequently, when natural gas was discovered in the Naharkatiya oil fields, Government appointed a foreign firm (M/s. Snod Grass Associate of U.S.A.) to report on the feasibility of utilising natural gas. The firm recommended that this gas could be used, *inter alia*, for production of nitrogenous fertilizers and generation of electricity. A committee appointed by the then Ministry of Mines and Fuels also went into this question and, based on its recommendations, Government appointed a technical committee under the chairmanship of Dr. G. P. Kane, Industrial Adviser, to study further the possibility of a fertilizer factory in Assam.

The Kane Committee and the Central Water and Power Commission conducted a techno-economic study of all the sites and, after considering the economics of both production and distribution of fertilizers, recommended Namrup as the best site for a fertilizer factory and a station for generating thermal electricity. The product pattern recommended was 50,000 tonnes per annum each of urea and ammonium sulphate.

In May 1960, Government conveyed its preliminary approval for the project, which was entrusted to Hindustan Chemicals and Fertilizers Limited (subsequently re-named on marger as the Fertilizer Corporation of India Limited).

It was proposed subsequently to raise the annual production capacity to 55,000 tonnes of urea and 1,00,000 tonnes of ammonium sulphate. This was based on a representation by the Tea Board indicating a higher requirement of ammonium sulphate for tea industry in the North-East Zone than earlier assumed. Government accepted the proposal in June 1962.

The Corporation has been reorganised with effect from 1st April 1978 under the directives issued by the President under Article 110 of the Articles of Association of The Fertilizer Corporation of India Limited. Under the re-organisation, the Namrup Unit stands transferred to the newly incorporated Company of Hindustan Fertilizers Corporation Limited.

2. Capital expenditure decisions

2.1 *Project estimates*

The Detailed Project Report prepared by the Corporation in May 1960 for annual production of 50,000 tonnes each of urea and ammonium sulphate, envisaged a capital cost of Rs. 15.13 crores. With the increase in the production capacity, the project estimate was revised in December 1962 to Rs. 18.03 crores. The estimate of December 1962 was further revised to Rs. 19.84 crores in December 1965 and approved by Government in June 1966. This estimate was further revised to Rs. 24.26 crores in January 1969. The actual expenditure incurred till the completion of the project was Rs. 24.20 crores.

The revised estimates of Rs. 24.26 crores were sent to the Ministry for approval in May 1969. The estimates sent to the Ministry indicated actual expenditure incurred upto 31st March 1968. These estimates were the subject matter of correspondence between the Ministry and the Corporation upto May 1973. In June 1973, the Ministry conveyed *ex post facto* approval of the revised estimates of Rs. 24.26 crores including Rs. 2.67 crores as working capital.

2.2 *Agreement with M/s. Chemico*

In October 1962, the Corporation entered into a contract with M/s. Chemico of Great Britain for supply of the following plants and services in respect of Namrup Project :

(a) Supply of Ammonia, Urea and Sulphuric Acid Plants at a lumpsum price of £ 3.242 million and Rs. 84.70 lakhs.

(b) Inland transportation of imported equipment at a cost of £ 13,400 plus Rs. 34 lakhs.

(c) Services of one Senior Structural Engineer for 12 months at a remuneration of £ 9,200 plus Rs. 59,130.

(d) Erection supervision at a cost of £ 1,55,280 plus Rs. 10.40 lakhs (based on 122 man months for erection engineers and 234 man months for erection).

(e) Supervisory personnel for 36 man months at a remuneration of £ 75,500 plus Rs. 3.50 lakhs to supervise the erection of plant by the Corporation's personnel to M/s. Chemico's specifications.

The agreement was to expire in August 1966, after 48 months of its effective date. As there was delay in execution of the project, firstly, due to the Chinese aggression, and secondly, because of change in the site of the plant, the agreement with M/s. Chemico was extended for 18 months, *i.e.* upto February 1968. Under the supplemental agreement, the Corporation agreed to increase the lumpsum charges for Chemico's erection and operation personnel by Rs. 10.56 lakhs.

At an advanced stage, it was assessed that the schedule of the supplemental agreement might not be adhered to. Accordingly, further extension of the Agreement was negotiated in January 1968. M/s. Chemico agreed to extend the construction, completion and start up schedule from February 1968 to June 1968, subject to the following :—

(i) M/s. Chemico would be able to complete the supervision of erection within 356 man months mentioned in the agreement with a possibility that an extra 4 man months may be required. This would also cover additional man months of vendor's engineers which it might be necessary for M/s. Chemico to provide after February 1968.

(ii) It was agreed that excess, over the 36 man months provided for operation supervision, upto a maximum of 40 man months would be charged by M/s. Chemico at daily rates laid down in the supplemental agreement. Beyond 40 man months, the rates were to be £ 60 and Rs. 200 per day per operator.

The scope of the agreement with M/s. Chemico did not cover the Ammonium Sulphate Plant. Installation and testing of this plant was the responsibility of the Planning and Development Division of the Corporation.

2.3 *Agreement for power supply*

In May 1965, the Unit entered into an agreement with the Assam State Electricity Board for its phased requirement of energy (as given below) on the tariff effective from January 1965, for 10 years from 1965-66 to 1974-75, subject to the approval of the appropriate authority of each organisation.

	Maximum Demand (KW)
1965-66	500
1966-67	700
1967-68	700
1968-69 to 1974-75	14,000 each year

Based on the anticipated maximum demand, the overall cost of energy on the existing tariff was 5.73 paise per KWH. In January 1967, the Chairman, Assam State Electricity Board intimated the Unit that the Board had informally decided to increase the tariff from March-April 1967 but that the industries which had started consuming power by 1965, would be given a "tariff freeze" till March 1971, provided they paid the minimum demand charges from the end of 1965. The Electricity Board, therefore, advised the Unit that if it wanted the benefit of the "tariff freeze" offered by the Board, it (Unit) should pay by the end of January 1967 the minimum demand charges on 14,000 KW (maximum contracted demand) at Rs. 11.76 lakhs each year from the 1st January 1966 itself,

failing which the proposed increased tariff would be applicable from April 1967. The rate of energy on the proposed tariff, was 7 paise per KWH for the anticipated demand of the factory. After a comparative study of the offers, the Unit decided to take the benefit of "tariff freeze" and paid Rs. 7.89 lakhs in February 1967, being the difference between the minimum demand charges and the amount payable calculated on the actual consumption of energy from April 1966 to January 1967. The unit also executed an agreement with the Board in February 1967 accepting the minimum demand charges of Rs. 11.76 lakhs per annum on the maximum demand of 14,000 KW, for 5 years from 1966-67 to 1970-71. From February 1967 to January 1968, the Unit paid an extra amount of Rs. 7.41 lakhs (approximately) as the difference between the minimum demand charges and the amount payable on the basis of actual consumption of energy. Thereafter, actual consumption was more than the minimum demand charges.

The Assam State Electricity Board introduced the new tariff from August 1971 and not from March-April 1967, as intimated earlier. The Unit did not claim refund of Rs. 15.30 lakhs paid in excess to the Electricity Board on the basis of the minimum demand charges, till July 1976.

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

> "The Assam State Electricity Board rejected our claim for refund of Rs. 15.30 lakhs on the ground that the question of refunding any amount on account of minimum charges to The Fertilizer Corporation of India Limited should not arise as the Board was obliged to keep ready the quantum of power for FCI every year as per agreement.....Since the agreement with the stipulation for payment of minimum charges from the date of commencement of supply *i.e.* 1-4-1966 was executed on the assurance given by A.S.E.B. Chairman of tariff freeze for five years against the proposed tariff

increase from April 1967, the contention of the A.S.E.B. does not seem to be tenable. H.F.C. are pursuing the claim for refund, and, if necessary, will seek legal opinion".

3. **Schedule of completion**

The Plant was originally scheduled to go into commercial production by April 1965. This date was subsequently revised to January 1966 and again to the end of February 1968. Finally, the Plant went into commercial production in January 1969.

The erection of Ammonia and Sulphuric Acid Plants was completed in January 1968 and that of Ammonium Sulphate and Urea Plants in July and August 1968 respectively as against the scheduled date of February 1965. The main reasons for delay in erection, as attributed by the Management, were :—

(i) Delay in acquisition of land.

(ii) Location of the plant originally decided was found to be unsuitable by the foreign suppliers based on the detailed soil investigation carried out in March 1964. An adjacent site was selected in December 1964 and approved of by the foreign suppliers in February 1965.

(iii) Delay in receipt of construction materials and imported equipment and parts because of transport difficulty.

(iv) Non-availability of skilled labour, high sub-soil water, heavy monsoon and Chinese aggression.

(v) Delay in replacement of faulty supply of some materials and faulty design of equipment supplied by the plant suppliers.

The Ministry have stated (October 1978) that the delays were largely beyond the control of the Corporation.

The delay in commencement of commercial production was ascribed to the following factors in the Completion Report :

Ammonia Plant.—While 'A' stream went into production in August 1968, 'B' stream was commissioned in November 1968. Guarantee tests commenced on the 2nd and completed on the 7th December 1968. During commissioning, there were equipment failures including power failures and voltage dips. Their modification and rectification took time.

The Ministry have stated (October 1978) that the erection of Ammonia Plant was completed in January 1968 but actual commissioning of this Plant took longer time than anticipated because of technological problems.

Urea Plant.—Based on the experience in Trombay, various modifications were done to minimise the troubles of choking, etc. After ammonia was produced, trial runs of the Plant were started in September and the guarantee tests were completed by October 1968.

Sulphuric Acid Plant.—Although this plant was erected in January 1968, it could not be started because the Sulphate Plant was not ready. Guarantee test for stream 'B' was completed in June 1968 and the stream was finally put on line in September 1968 when the Sulphate Plant was ready to receive acid. 'A' stream was commissioned in November 1969 by the Corporation's own staff, as Chemico were required to prove guarantee tests for one stream only.

Ammonium Sulphate Plant—Commissioning was started in August 1968 after overcoming troubles of leakage, corrosion and improper feed and the first salt was produced in the same month. The guarantee test was, however, undertaken in August 1969.

The delay in execution of the project increased the capital cost by Rs. 3.82 crores.

4. Performance appraisal

4.1 *Plant complex and process description*

The Unit has four process plants mentioned below :—

(i) Ammonia Plant (capacity 200 tonnes per day in two streams).

(ii) Urea Plant (capacity 167 tonnes per day in two streams).

(iii) Sulphuric Acid Plant (capacity 250 tonnes per day in two streams).

(iv) Ammonium Sulphate Plant (capacity 304 tonnes per day).

The production processes of these products in Namrup are:—

Ammonia:—Natural gas is desulphurised by passage through beds of activated carbon. Then it is compressed with steam pre-heated and passed to the primary reformer where it is reformed into hydrogen, carbon monoxide and carbon dioxide. The partially reformed gas is thereafter passed on to the secondary reformer where air is added so that the nitrogen in the final gas is in the correct proportion for production of ammonia. The reformed gas and steam are passed to the carbon monoxide converter where carbon monoxide reacts with the steam, in the presence of a catalyst to produce carbon dioxide which is removed from the gas in two stages, leaving hydrogen and nitrogen. The gases after purification are synthesised to ammonia at 365 Kg/cm^2 pressure.

Urea:—Urea is produced by Chemico's complete carbamate solution by recycle process. Carbon dioxide and ammonia (from the Ammonia Plant) are pumped into the urea autoclave where they react at elevated temperature and pressure to produce ammonium carbamate as an intermediate compound. At high pressure and temperature, a portion of this compound dehydrates

to form urea. The unconverted ammonia and carbon dioxide are separated from urea and recycled back to the autoclave. The urea solution is evaporated in two stages and the concentrated urea melt is sprayed from the top of the Prilling Tower to form prills. The prills are cooled, stored and bagged.

Sulphuric Acid:—Crystalline sulphur is melted in the sulphur melting pits and the molten sulphur, after filtration, is pumped into the sulphur furnace where it is burnt with dried air at a temperature of 1100°C to produce the gas containing approximately 12 per cent of sulphur dioxide. This gas is then passed through a waste heat recovery boiler and is diluted with additional dried air so as to contain 7-8 per cent sulphur dioxide before entering the converter. It is then converted to sulphur trioxide in a converter at a temperature of 440°C. The effluent gas leaves the converter and is cooled in an economiser to about 200°C. It is then passed upwards through the Absorption Tower. The counter current contact is maintained by circulating sulphuric acid (98 per cent strong) flowing downwards. The effluent gas leaves the Absorption Tower at a temperature of about 80°C and is vented into the atmosphere. The product acid is tapped and, before transporting to the storage tanks, is cooled in the product acid cooler.

Ammonium Sulphate:— Ammonium sulphate is produced by direct reaction of sulphuric acid with ammonia in the neutralisers. The resultant solution gets concentrated in the neutralisers by the heat of reaction and crystals form. The neutralisers operate in vaccum. Ammonium sulphate from the resultant slurry is separated out by high speed centrifuges. The mother liquor is sent back to the process and the wet salt is dried in a rotary drier, cooled in rotary coolers and then sent for storage and bagging.

4.2 *Rated capacity*

On the basis of 330 working days in a year and capacities indicated above, the annual rated capacity of

each process plant was computed by the Corporation as follows:—

(i) Ammonia Plant	66,000 tonnes of ammonia
(ii) Sulphuric Acid Plant	82,500 tonnes of sulphuric acid.
(iii) Urea Plant	55,000 tonnes of urea.
(iv) Ammonium Sulphate Plant	1,00,000 tonnes of ammonium sulphate.

Based on the guaranteed norms of consumption of ammonia and sulphuric acid for production of urea and ammonium sulphate, 61,600 tonnes of ammonia and 80,000 tonnes of sulphuric acid would be required to produce the quantities of urea and ammonium sulphate mentioned above. The designed capacities of Ammonia and Sulphuric Acid Plants were thus higher by 4,400 tonnes of ammonia and 2,500 tonnes of sulphuric acid.

According to the feasibility studies made by the Planning and Development Division of the Corporation (May 1970), all the four plants were designed with an additional inbuilt margin of atleast 10 per cent. In fact, each Plant during guarantee tests performed, on an average, 5—10 per cent better than the rated capacity. The bottlenecks in achieving the rated capacity of these plants, as mentioned in the feasibility report, were carbon monoxide conversion and refrigeration condenser in the Ammonia Plant; Ammonia condensers and final evaporators in the Urea Plant; sulphur contamination, corrosion and catalyst clogging in the Sulphuric Acid Plant; Ph control, crystal growth, speed control gear on slurry pumps and wet salt conveyor spillage in the Ammonium Sulphate Plant. In this connection, a reference is also invited to paragraph 5.3.

It was mentioned that, in view of these limitations, the plants had not been able to achieve the capacities. If these limitations were removed, additional throughput of 10 per cent could be got without a major change in the plants. It will, however, be seen from the succeeding paragraph that only Ammonia and Urea Plants attained the rated capacity in 1977-78 and 1974-75 to 1977-78 respectively.

The Ministry have stated (October 1978) that the above referred bottlenecks were progressively got over, leading to improvement in production.

5. Actual production performance

5.1 *Ammonia and Sulphuric Acid Plants*

Actual production performance of the plants *vis-a-vis* the rated capacity and the production planned for the years 1970-71 to 1977-78 were :

Ammonia Plant—Rated capacity—0.66 *lakh tonnes per annum*

(in lakhs of tonnes)

Year	Production (original plan)	Production (revised plan)	Actual production (Gross)
1970-71	0.49	0.44	0.45
1971-72	0.57	0.56	0.46
1972-73	0.57	0.54	0.50
1973-74	0.58	0.56	0.52
1974-75	0.61	0.57	0.55
1975-76	0.60	0.55	0.61
1976-77	0.55	0.55	0.62
1977-78	0.60	0.64	0.66

Sulphuric Acid Plant—Rated capacity—0.83 *lakh tonnes per annum*

(in lakhs of tonnes)

Year	Production (original plan)	Production (revised plan)	Actual production
1970-71	0.64	0.64	0.51
1971-72	0.73	0.67	0.44
1972-73	0.73	0.63	0.49
1973-74	0.68	0.62	0.53
1974-75	0.77	0.60	0.57
1975-76	0.73	0.66	0.73
1976-77	0.64	0.65	0.74
1977-78	0.71	0.75	0.75

It will be seen that while the Ammonia Plant achieved rated production in 1977-78, Sulphuric Acid Plant was yet to attain the rated capacity.

5.2 *Urea and ammonium sulphate—finished products*

The rated capacity, original and revised plans and actual production for the years 1970-71 to 1977-78 were :

Urea-Rated annual capacity—0.55 *lakh tonnes*

(in lakhs of tonnes)

Year	Production (original plan)	Production (revised plan)	Actual production
1970-71	0.39	0.30	0 31
1971-72	0.46	0.40	0 40
1972-73	0.48	0.49	0.48
1973-74	0.52	0.51	0.50
1974-75	0.54	0.55	0.55
1975-76	0.54	0.49	0.55
1976-77	0.50	0.50	0.58
1977-78	0.55	0.58	0.56
Ammonium Sulphate—Rated annual capacity—1.00 *lakh tonnes*			
1970-71	0.80	0.80	0.60
1971-72	0.90	0.79	0.56
1972-73	0.86	0.76	0.60
1973-74	0.82	0.74	0.64
1974-75	0.91	0.74	0.70
1975-76	0.91	0.84	0.95
1976-77	0.80	0.80	0.92
1977-78	0.87	0.92	0.91

It will be seen that performance of both the Plants has improved considerably in recent years.

5.3 *Reasons for shortfall*

The following reasons have been mentioned by the Unit for the shortfall in production performance :—

Ammonia Plant :

(i) Unsatisfactory performance of carbon monoxide conversion catalyst. The catalyst was changed but its performance was also poor (refer paragraph 5.5).

(ii) Bottlenecks in Refrigeration and Synthesis Sections and leakages in cold exchangers, etc.

(iii) Failure of primary reformer catalyst in stream 'B' in 1973-74 and breakdown of flue gas boiler in July 1974.

(iv) Annual statutory boiler inspection.

Sulphuric Acid Plant :

(i) Severe corrosion in the acid lines.

(ii) Choking of catalyst beds and complete shut-down for bimonthly catalyst screening/re-charging.

(iii) Inadequacy of molten sulphur pit.

(iv) Contamination of sulphur in 1974-75 and shortage of sulphur in 1973-74 and 1974-75.

Urea Plant :

(i) Frequent choking of coolers etc. and corrosion of lines resulting in failures of equipment.

(ii) Limitations of ammonia and carbon dioxide.

Ammonium Sulphate Plant :

(i) Limitation of ammonia and sulphuric acid.

(ii) Breakdown of the plant due to failure of acid carrying lines on account of corrosion, failure on vapo-riser condenser tubes and failure of slurry transfer pumps.

(iii) Breakdown of all the neutralisers in the plant in 1974-75.

In addition to the plant-wise reasons mentioned above, lack of steam, power cuts/failures and voltage dips, lock out or shut down (in 1972-73 and 1977-78) and 'Assam Bandh' (in 1973-74) also contributed to less production as compared to production planned each year.

The Ministry have stated (November 1978) that :—

(a) the loss of production on account of power failures/ voltage dips was of the order of 7,796 tonnes of nitrogen for the years 1970-71 to 1977-78; and

(b) apart from direct loss of production, frequent power failures/voltage dips were found to have adversely affected the critical machinery and their operating efficiency.

An analysis of the reasons for production losses indicated that, notwithstanding the limitations of unforeseen breakdowns, process problems, power failures/voltage dips, catalyst problems, etc., the improvement in production performance in 1976-77 and 1977-78, particularly in the Ammonia and Urea Plants, was achieved on account of the following :—

	Ammonia Plant		Urea Plant	
	1976-77	1977-78	1976-77	1977-78
	Tonnes	Tonnes	Tonnes	Tonnes
(i) Saving in Plant maintenance	752	5989	4264	5105
(ii) Over-rated production	—	1072	6236	3478
(iii) S.M.G. Supply to Expansion Plant	1816	2004	—	—

Steps taken from time to time to improve performance are mentioned later in paragraph 5.4. In addition, the following steps have been taken :

Ammonia Plant.—An ION Exchange Plant and Ammonia Stripping Plant have been installed not only to solve the problem of pollution but also to improve overall efficiency to the extent that ammonium sulphate liquor is recovered from the effluent (refer paragraph 12.2.4).

Sulphuric Acid Plant.—Adoption of the double absorption system in the Sulphuric Acid Plant is being considered both to increase the production of acid and to solve the problem of pollution.

5.4 *Optimisation and de-bottlenecking scheme*

A technical team of the International Bank for Reconstruction and Development, after studying the working of the Namrup Unit, reported in November 1969 that the capacity of Ammonia Plant could be increased from 200 tonnes per day to 250—280 tonnes per day by utilising installed standby synthesis and process air compressors and adding a separate line for reformation, carbon monoxide conversion and purification, at an additional estimated cost of Rs. 10 millions and that similar possibilities existed in the Urea Plant. The Team also recommended thorough studies for optimisation of and removal of bottlenecks in the Sulphate and Sulphuric Acid Plants at an estimated cost of Rs. 30 lakhs.

These recommendations were examined (May 1970) by the Planning and Development Division and the Unit but were not found practicable on technical considerations and the magnitude of investment involved.

However, in order to investigate the extra potential for production with marginal investment by utilising inbuilt capacity in the machines and standby spares, a feasibility report was prepared which envisaged :

(a) removal of bottlenecks in the existing plants at a cost of Rs. 46.87 lakhs in the first phase so that these could run at their rated capacity and also be tested for extra inbuilt potential ; and

(b) making additions in the Ammonium Sulphate and Sulphuric Acid Plants in the second phase at a cost of Rs. 201.49 lakhs.

Government approved (February 1971) the optimisation programme (Phase-I) for Namrup Unit at a total cost of Rs. 25 lakhs (including Rs. 6 lakhs as foreign exchange component). The programme was reviewed in June 1972 ; while certain items were deleted, certain other items were introduced. The revised scheme was estimated to cost Rs. 18.11 lakhs (including Rs. 3.29 lakhs as foreign exchange). The estimated cost was subsequently revised to Rs. 27.33 lakhs on account of price increase following the oil price hike in November 1973. Actual expenditure up to 31st March 1978 amounted to Rs. 27.67 lakhs (including Rs. 6.27 lakhs charged to revenue).

The following features of the scheme deserve mention :—

(a) The scheme had not been completed by the scheduled date of March 1973. The Corporation stated (August 1977) that the scheme had been completed except for one item which would be installed in August/ September 1977. The Ministry have stated (October 1978) that this item was installed in January 1978.

(b) Certain items deleted in June 1972 from the original scheme together with the reasons were :—

(i) *Low temperature catalyst.*—A new charge of high temperature catalyst was replaced in Ammonia Plant in August 1971 and the performance was stated to have slightly improved from December 1971.

(ii) *Dirty sulphur pump, precoat pit, etc.*—On account of improvement in the operation.

(iii) *Covering of sulphur storage yard.*—Because of difficulties encountered being less.

The scheme relating to low temperature catalyst was revived in March 1974 when it was decided by the Director (Technical) that necessary modification for changing the second bed of high temperature catalyst with low temperature catalyst should be

taken up immediately and completed by May 1974 in 'A' stream. It was further decided that modification of 'B' stream may be taken up in the month of September/October 1974 for charging low temperature catalyst. The job of introducing low temperature catalyst in 'A' stream was taken up and completed in July-August 1975. The modification for introducing low temperature catalyst for stream 'B' was completed in July/August 1976 at a cost of Rs. 6.27 lakhs.

(c) An additional holding pit for sulphur (not envisaged in the scheme) was constructed and commissioned in October 1974 to overcome the problem of contamination of sulphur and to avoid shut down of the Sulphuric Acid Plant on account of getting the existing pit cleaned.

(d) The Unit had been suffering loss of production continuously for lack of steam. The shortage of steam was caused by consumption of steam being higher than contemplated in the guaranteed norms, particularly in the Ammonia and Sulphuric Acid Plants. The deficiency could not be made good even by the two steam boilers installed by the Unit on account of insufficient steam production for the following reasons :—

(i) Proper combustion did not take place resulting in frequent soot deposition, requiring frequent cleaning of tubes.

(ii) Vibration problem due to improper gas to air ratio, as the micro control system had become ineffective.

(iii) Delays in starting the boilers due to trouble on sophisticated control system.

A temporary steam inter-connection between Expansion and Unit steam headers was provided

in August 1975 to make up the deficiency of steam. The work for permanent inter-connection was taken up in December 1974 and completed in May 1978 at a cost of Rs. 0.39 lakh.

(e) No decision had, so far, been taken to implement Phase II of the scheme mentioned in the feasibility study of May 1970. The Ministry have stated (October 1978) that the Second Phase of optimisation decided in 1971 involved the setting up of an additional capacity in the Sulphuric Acid and Ammonium Sulphate Plants. However, since the DCDA technology resulting in better recovery and conversion of sulphur and consequent pollution abatement has been established, the Unit is now actively considering the conversion of the existing Sulphuric Acid Plant into a DCDA (Double Conversion Double Absorption) Plant.

5.5 *Unsatisfactory performance of catalyst*

In April 1969, the Unit received 35.6 tonnes of high temperature catalyst for carbon monoxide conversion from the Planning and Development Division, which was physically inspected and found to be in good condition. On charging 8.6 tonnes of this catalyst (value Rs. 0.80 lakh) in one stream of the Ammonia Plant in the 3rd week of November 1969, it was noticed that the stream could be run safely only up to about 65 per cent of the capacity, thereby resulting in 35 tonnes less of ammonia being produced per day. The stream functioned at reduced load for 182 days, before it was completely shut down for recharging the catalyst.

The Unit stated (June 1972) that the catalyst was allowed to remain in the line because :—

(a) A good catalyst was not available at the site.

(b) Replacement of the catalyst required pre-planning.

(c) Normally, no major maintenance was done in the winter unless it was forced.

The Planning and Development Division stated that an analysis of samples from the disputed lots in October 1971 and January 1972 had indicated that the activity ranged between 80 and 83.5 per cent which was satisfactory. In September 1973, the Division contended further that the catalyst might have failed in service due to operational upsets and not necessarily due to inherent defects.

The Chairman and Managing Director of the Corporation decided in January 1974 that the balance of 27 tonnes of the catalyst (value Rs. 2.46 lakhs) should be returned to the Planning and Development Division for re-processing, if possible. Accordingly, the catalyst was returned to Sindri in May 1974.

The Corporation stated (February/August 1977) that 23.295 tonnes of catalyst were issued to and consumed by Sindri Unit after mixing with fresh catalyst and the remaining 3.705 tonnes had been issued to the Ramagundam Division.

The Ministry have stated (October 1978) that, because of problems in the consuming plants, there was less demand for ammonia and for this reason also earlier replacement of the catalyst was not necessary.

6. Stream efficiency

After providing for 35 days (840 hours) for planned maintenance, the various plants are expected to be on stream for 330 days (7920 hours) in a year. It will be seen from the data for 1970-71 to 1977-78 given in Appendix-I that actual working hours were below the rated available hours in all the years except Ammonia and Urea Plants in 1977-78.

While the working hours in Ammonia and Urea Plants improved progressively (except for Ammonia Plant in 1974-75

and slight set back in Urea Plant in 1975-76), improvement in respect of Sulphuric Acid and Ammonium Sulphate Plants was noticeable only from 1975-76 onwards. In fact, Ammonia and Urea Plants were on stream for more than 330 days in 1977-78.

Idle hours up to 1974-75, according to analysis made by the Unit, were attributable mainly to mechanical failures, more time required for maintenance and other reasons. In 1975-76, these were ascribed to mechanical breakdowns and other reasons ; time spent on planned maintenance was less than 35 days (840 hours) provided in working out the stream efficiency of 330 days. In 1976-77 and 1977-78, idle hours in Sulphuric Acid and Ammonium Sulphate Plants have been ascribed to mechanical and power failures, unforeseen breakdowns and changing of flue gas boiler.

While the stream efficiency of Urea Plant in 1974-75 to 1976-77 was less than 330 days, it attained rated capacity production in these years.

7. Nitrogen efficiency

Nitrogen efficiency represents the ratio of input of nitrogen in the form of ammonia used in the production of urea and ammonium sulphate and output of nitrogen present in the urea and ammonium sulphate. The nitrogen efficiency as guaranteed by

the designers and as actually obtained since inception of the Plant were as follows :—

Plant	Percentage of nitrogen efficiency									
	Guaranteed	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Urea	92	49.92	65.45	76.38	81	82	83.88	86.26	88.04	85.72
Ammonium Sulphate	92	93.22	84.65	91.11	89	89	95.81	95.20	93.98	95.70
Combined	92	70.33	73.27	81.50	83.8	85	88.01	90.13	90.47	89.75

It will be seen that there was improvement in the efficiency in respect of Urea Plant even though it was still below the guaranteed efficiency. Ammonium Sulphate Plant was, however, able to improve on the guaranteed norm in 1969-70 and from 1974-75 to 1977-78.

In regard to the Nitrogen efficiency achieved by these two plants, the Planning and Development Division in its feasibility study made in May 1970 observed as follows :—

(a) The existing Urea Plant working on two small streams, with a number of ammonia leakage points, had a low ammonia efficiency of 80% instead of the guaranteed 92%.

(b) As against achieving ammonia efficiency of 85% on good performance on longer continuous run in urea production, it would be possible to achieve about 97% efficiency in ammonium sulphate production with proper controls.

The Unit attributed (October 1973/November 1974) non-attainment of guaranteed norm of nitrogen efficiency to :—

(i) Excessive leakage of ammonia.

(ii) Plant shut-downs due to frequent failure of equipment ; leakages from acid carrying lines and less acid produced because of insufficient sulphur received.

(iii) Draining and washing of various equipment frequently due to shut-downs and start ups of the plants during various breakdowns.

(iv) Blowing of relief valves.

(v) Leakages from glands or seals of various pumps.

(vi) Power failures.

(vii) Running of plants on low load because of shortage of ammonia and carbon dioxide.

The Ministry have stated (October 1978) that as a result of corrective measures taken, the overall nitrogen efficiency has improved.

8. Consumption of raw materials and utilities

8.1 *Fixation of norms*

The norms of consumptions recommended (January 1971) by the Tendolkar Committee were adopted (July 1972) by the Corporation.

In so far as Namrup Unit is concerned, the Tendolkar Committee in its report had observed as follows :—

> "The Namrup Plant has not been able to achieve the current accepted norms for various raw materials and utilities. This is perhaps due to production and maintenance difficulties. It is necessary that before any revision in norms is suggested, Namrup Unit should attempt to achieve the current accepted norms. The Committee does not feel any necessity in increasing the norms at this stage since the current norms are yet to be achieved."

When the Tendolkar Committee considered the question of fixation of norms for Namrup Unit, the Unit had been in operation for two years. It was because of this fact that the Committee had not fixed any norms for Namrup. In spite of this, no review of the norms then prevalent was undertaken by the Corporation with a view to fix the norms on scientific basis.

The Ministry have stated (October 1978) that another Committee (Kachwaha Committee) was set up by the Corporation in 1975 to review the consumption norms of the various units including Namrup. Although, the norms of this Committee are yet to be formally accepted by the Corporation, these are being adopted and are being achieved by and large.

8.2 *Actual consumption*

Apppendix II incorporates the data relating to :

(a) norms of consumption prescribed by the designers as well as recommended by the various Committees set up by the Corporation;

(b) norms of consumption adopted by the Corporation as well as planned by the Unit annually; and

(c) actual consumption of different raw materials and utilities during the years 1971-72 to 1977-78.

The following facts emerge from the data given in the Appendix :—

(a) Actual consumption of all raw materials was higher in most years than the design norms.

(b) According to the design, Ammonia and Sulphuric Acid Plants are to export 778 Kgs. of steam per tonne of ammonia and 960 Kgs. of steam per tonne of sulphuric acid produced to the other plants. The actual quantity of steam exported was in each year less than the design norms. Quantities of steam exported from the Ammonia Plant was even less than the norm of 450 Kgs. per tonne of ammonia adopted by the Unit. This resulted in overall lack of steam with consequent adverse effect on production of urea and ammonium sulphate.

(c) There were wide variations between the norms adopted by the Unit on the one hand and those guaranteed by the designers and recommended by the Committees or planned by the Unit.

A number of steps (e.g., installation and replacement of equipment, re-flooring of sulphur yard, etc.) are stated to have been taken by the Unit to improve the usage efficiencies of raw materials in the Sulphuric Acid, Urea and Ammonium Sulphate Plants. The Corporation further stated (February 1977) as follows :—

(i) Higher consumption of raw materials was mainly due to break-down of equipment.

(ii) Efforts are made to minimise the stoppage of plant and reduce the break-down in equipment. It is expected that specific consumption figures would reach near the design norms in the coming years.

The Ministry have stated (October 1978) that the design norms are given by the designer/supplier in ideal conditions and steady operation of the Plant and do not take into account the losses of raw materials incurred during start up, shut down, process up-sets, break-down, maintenance, etc.

9. Material management and inventory control

9.1 *Inventory holdings*

The stocks held by the Unit at the end of each of the last 8 years were as follows :—

(Rs. in lakhs)

As on 31st March	Stores and spares (including in transit)	Raw materials (including in transit)	Packing Materials	Finished goods
1971	166 95	49.37	3.11	168.60
1972	162.76	56.03	1.19	14.31
1973	174.73	61.58	4.25	7.72
1974	194.74	47.43	3.22	15.93
1975	207.66	152.80	4.16	69.44
1976	223.01	121.17	5.49	72.55
1977	808.75	48.24	11.95	155.24
1978	866.69	84.92	7.09	190.13

NOTE : The figures of inventory as on 31st March 1977 and 1978 include the data relating to Expansion Plant which went into commercial production from 1-10-1976.

The inventory as on 31st March 1978 included the following :—

(a) Regular consumable spares valued at Rs. 288.42 lakhs (indigenous Rs. 101.52 lakhs and imported Rs. 186.90 lakhs) which represented 12.0 months requirements in respect of indigenous items and 35.0 months requirements of imported items as against the norms of 6 months and 15 months holdings laid down by the Corporation for these items.

(b) Insurance spares valued at Rs. 293.37 lakhs (indigenous Rs. 110.29 lakhs and imported Rs. 183.08 lakhs). (Norms for holding of insurance spares have been laid down at 3 per cent of the cost of plant and machinery and no itemwise identification has been made. Even with reference to the norms of 3 per cent of the cost of plant and machinery, holding of insurance spares was in excess of Rs. 60.27 lakhs).

(c) Surplus items valued at Rs. 23.43 lakhs and construction stores worth Rs. 40.33 lakhs.

(d) 7605 items valued at Rs. 57.40 lakhs (including Rs. 43.93 lakhs in respect of Namrup Unit) which had not moved for more than 2 years.

9.2 *Physical verification*

(a) Stores

In March 1971, the Internal Consultative Committee of the Corporation had decided that physical verification of stores, sub-stores, plants, etc., hitherto being done by the Accounts Department, would be conducted by the Material Management Department of the respective Unit/Division. The Material Management Department of the Unit, started physical verification only from 1973-74.

The extent of physical verification conducted during the last 8 years ended 31st March 1978 was :—

Year	Total Number of items held	Total number of items verified	Percentage of items verified	
1970-71	23,860	3,665	15.36	
1971-72	23,700	160	00.68	
1972-73	20,798	3,080	14,80	
1973-74	22,060	9,854	44,67	
1974-75	20,741	13,966	67.33	
1975-76	21,095	20,753	98.38	
1976-77	10,544	10,544	100.00	(Erection surplus and spares)
	20,861	5,456	26.15	Other items
1977-78	33,068	6,172	18.66	

NOTE : Figures for 1976-77 and 1977-78 are inclusive of Expansion Plant.

Physical verification was conducted on a selective basis up to 1973-74. It was stated to have been done on the perpetual inventory basis from February 1974 onwards.

(*b*) *Finished goods and raw materials*

The results of physical verification of raw materials and finished goods in the last 8 years ended 31st March, 1978 were :—

Item	1970-71		1971-72		1972-73		1973-74		1974-75		1975-76		1976-77		1977-78	
	Excess	Shortage	Excess	Shortage	Excess	Shortage	Excess	Shortage	Excess	Shortage	Excess	Shortage	Excess	Shortage	Excess	Shortage
1. Urea (tonnes)	..	508.00	..	..	394	..	..	3.11	..	208.77	1009	..	505.10	..	..	322.78
2. Ammonium sulphate (tonnes) . .	..	2729.00	1172	..	109	..	48.29	..	1052.59	..	500.40	..	380.55	..	..	616.19
3. Sulphur (tonnes)	..	1363.78	..	..	..	236.51	..	360.24	..	479.27	..	945.40	..	632.62	300.77	..
4. Value of excess and shortage (Rs. in lakhs) . .	..	19.87	4.34	..	3.40	1.14	0.20	1.81	6.00	5.99	14.27	10.57	8.49	6.01	7.01	7.83

NOTE : The value of excess for 1976-77 and 1977-78 includes the value of 7.70 and 378.49 tonnes of urea found excess in these years in respect of Expension Plant.

The excesses and shortages revealed in physical verification of finished goods were adjusted against production. Shortage of sulphur was treated as consumption.

In this connection, the following observations are made :

(i) The question of reviewing the system and procedure for identifying and reducing stock shortages noticed in all the Units was referred by the Corporation to a firm of Chartered Accountants. The firm, in its report, submitted in July 1971, observed that under the existing system it was extremely difficult to identify the cause of the loss as there were many stages where losses could take place and there were weaknesses in measurement devices and procedures at each point *e.g.*,

(a) measurement of raw material receipts and consumption;

(b) measurement of production and despatches;

(c) physical verification of bulk raw materials and finished products; and

(d) handling losses, etc.

The firm, thereafter, recommended that a record of actual stock differences broken down into locations and/or reasons should be maintained at each plant. After recording the actual performance for a year or so, norms should be laid down for each element of loss or difference.

A Committee of three General Managers was constituted to study the report submitted by the firm.

The Committee submitted its Report in April 1975. This Report was considered by the Internal Consultative Committee in May 1976. Subsequently, the Board of Directors considered the recommendations of the Committee and decided in February 1977 to remit the proposal to another Committee. The

Committee of Directors, with the approval of the Board, fixed the norms for loss of finished products and raw materials in August 1978. The proposal for fixation of norms on the basis of the recommendation has been submitted to the Board of Directors of Hindustan Fertilizer Corporation for consideration in their Sixth Meeting to be held on 29th September, 1978.

(ii) At the instance of Director (Production), a special committee was constituted in January 1974 to investigate the shortage of 376 tonnes of sulphur detected in December 1973. The report submitted in April 1974 by the special committee was transmitted to the Chief Auditor (Internal Audit) for further examination.

A team consisting of the Plant Manager, Trombay and officers of the Internal Audit Department stated in its report submitted in October 1974 that the shortage was mostly accounted for by the loss in sludge, start ups and shut downs.

With a view to overcome the deficiencies in the existing procedure, the team made the following recommendations :—

(1) The consumption of sulphur per tonne of sulphuric acid may be calculated as per design norm and loss on account of sludge formation and shut down and start ups may be determined on actual computation. In addition, loss on account of handling etc. may be reckoned at 1 per cent.

(2) Sample of the sulphur may be taken at the Port to assess its quality.

(3) Before putting the sulphur bags in the wagons at loading point, wagons should be properly cleaned so that the contamination is avoided.

(4) At least 5 per cent of the bags received be weighed on a weigh-bridge instead of the present practice of weighing the individual bags on a beam scale on test basis.

(5) Proper sloping arrangement may be provided at sulphur yard so that water logging is prevented and oxidation of sulphur in the presence of water reduced.

The Corporation stated (August 1976) that the recommendations have been accepted and are being complied with.

9.3. *Points of interest*

In test audit of purchases, the following instances were noticed.

(i) *Purchase of degasser separator for the Urea Plant*

In December 1972, the Unit invited open tenders for fabrication and supply of two degasser separators in low carbon stainless steel. In response, six quotations were received. The tender committee recommended in May 1973 the offer of the third lowest firm (M/s. M. Lakhani & Company, New Delhi) at Rs. 0.65 lakh F.O.R. destination per separator. The first and second lowest offers were found technically unacceptable.

After verification of the antecedents, capacity, etc. by the Corporation's Chief Purchase and Liaison Officer, an order was placed on the firm in June 1973.

In November 1973, the firm engaged by the Unit for inspection reported that there would be difficulties in fabrication because of the manufacturer's inexperience. The Unit Deputy Chief Engineer (Mechanical), after inspection of the firm's premises, also reported in April 1974 that the firm was neither well equipped nor experienced for the job, work on which had not commenced.

The order was cancelled in May 1974 and fresh quotations were invited in June 1974. Of the three offers received, the lowest was rejected on technical grounds and the second lowest offer of M/s. Garlick Engineering, Bombay was accepted. The offer was for Rs. 1.33 lakhs (*ex*-works Ambernath) per separator to be fabricated from stainless steel as against original specification of low carbon stainless steel. An order was placed in January 1975 on this firm for delivery within six months.

M/s. Garlick Engineering, Bombay were the fourth lowest tendered in the tenders received in December 1972, their offer being for Rs. 0.71 lakh (*ex*-works Ambernath) per separator. In view of their reputation, in the field, the Plant Engineer had proposed negotiation with this firm, too, to bring down their price. This proposal had not been accepted. M/s. A. Stock & Company, were the second lowest tenderer in response to the tender notice of December 1972. Their offer of Rs. 0.51 lakh per separator *ex*-works Calcutta was rejected because the steel they proposed to use was not low carbon; the order was finally placed for stainless steel and not for low carbon stainless steel.

The extra expenditure incurred by the Unit on this deal amounted to Rs. 1.25 lakhs less freight from Ambernath to Namrup with reference to the offer of M/s. Garlick Engineering and Rs. 1.65 lakhs less freight from Calcutta to Namrup with reference to the offer of M/s. A. Stock & Co.

The tender committee considered that the extra expenditure was due to the wrong information furnished by the Chief Purchase and Liaison Officer, New Delhi.

The Ministry have stated (October 1978) as under :—

> "..... It would, however, have to be appreciated that during the intervening period, the prices of materials, generally plant and equipment, had escalated considerably due to the oil crisis. It cannot be considered reasonable to compare quotations received in January 1973 with that of quotations received in July/August 1974 because of the rapidly fluctuating market conditions as a result of the oil crisis".

The fact, however, remains that extra expenditure resulted from the wrong information furnished.

(ii) Purchase of cold drawn seamless tubes

On 19th January 1974, the Unit issued limited tender enquiries to 13 parties for supply of 750 cold drawn seamless

tubes of 11 swg. thickness required for process refrigeration condensor, indicating 15th February 1974 as the opening date.

Only 2 offers were received by 15th February 1974 and the Plant Engineer (Mechanical) recommended on 4th/5th March 1974 the acceptance of the offer of Rs. 266.40 per tube received from the 2nd lowest tenderer (*i.e.* M/s. M. J. Patel and Company) which was according to specifications and valid upto March 1974.

Another 2 offers (including one which was rejected by the Unit) were received before the Tender Committee met on 19th March 1974 and it was decided that response from other parties (including the Indian Tube Company—a leading manufacturer of tubes) may be awaited and all the 3 tenderers should be requested to extend the validity of their offers.

On 23rd March 1974, the Unit received an offer of Rs. 245 per tube of 10 swg. wall thickness from M/s. Sharad Kumar and Bros. While no offer was received from Indian Tube Company, the 3 parties who had quoted earlier but did not extend the date of validity, were requested to quote the revised prices.

As the quotations received from the parties other than M/s. M. J. Patel and Company were for tubes of 10 swg. wall thickness as against the indentor's requirement of 11 swg. wall thickness, the Tender Committee decided on 4th June 1974 to re-float the enquiry. Accordingly, enquiry was floated for the second time to 10 parties including M/s. Sharad Kumar and Bros. and six new parties. It may be mentioned that neither was the offer of 23rd March 1974 received from M/s. Sharad Kumar and Bros. considered, nor was the party asked to extend the date of validity.

Out of 10 firms, only four submitted the offers and quotation of M/s. Sharad Kumar & Bros. for Rs. 375 per tube of 10 swg. thickness was the lowest.

The Tender Committee met for the third time on 2nd August 1974 and decided to accept the offer of M/s. Sharad Kumar & Bros. on the following considerations :—

(a) 10 swg. thickness tubes are heavier than 11 swg. thickness tubes and normally the rates for the former should be more than the latter. However, the market trend was absolutely reverse, presumably due to more demand and less supply of 11 swg. tubes.

(b) Owing to rising trend in the prices, fresh offers were likely to be still higher.

(c) According to the indentor, he could use 10 swg. tubes also with a very slight modification in the condensor.

(d) The tubes were required urgently.

The accepted offer of the successful firm was higher by Rs. 130 per tube than its earlier offer, thereby entailing an extra expenditure of Rs. 0.98 lakh. Again, the acceptance of the offer of M/s. M. J. Patel & Company, within the validity period, would have not only secured the material of the required specification but also avoided an extra expenditure of Rs. 0.81 lakh.

The Ministry have stated (November 1978) that "as the tubes in question were imported and generally scarce in the market, more so, during the above period as a result of oil price hike, the purchase at higher price was unavoidable".

10. Profitability analysis

10.1 *Working results*

The Plant went into commercial production in January 1969. It incurred losses through-out except in 1974-75 when there was a profit of Rs. 1.07 crores. After taking the past period adjustments and profit earned in 1974-75, the cumulative loss as on 31st March 1978 amounted to Rs. 8.13

crores. Operating income and expenditure of the Unit from 1970-71 to 1977-78 were :—

(Rupees in crores)

		1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
I.	Sales	2.48	0.01	0.01	0.02	0.02	0.02	0.04	0.05
II.	Transfer of stock to other Units	2.37	7.93	7.40	8.05	11.30	15.05	16.16	15.21
III.	Other income	0.08	0.43	0.26	0.15	0.25	0.18	0.21	0.15
IV.	Closing stock	1.70	0.18	0.09	0.19	0.74	0.76	0.41	0.35
	TOTAL	6.63	8.55	7.76	8.41	12.31	16.01	16.82	15.76
I.	Opening Stock	1.00	1.70	0.18	0.09	0.19	0.74	0.75	0.41
II.	Cost of operations	4.54	5.01	5.44	5.97	8.34	12.99	13.89	11.99
III.	Interest	0.70	0.45	0.66	0.43	0.36	0.37	0.39	0.85
IV.	Depreciation	1.59	1.60	1.85	1.89	1.88	1.89	1.89	1.91
V.	Deferred revenue expenditure, write off and provision for bad & doubtful debts.	0.13	0.17	0.02	0.05	0.02	0.02	0.01	0.28
VI.	Share of Central Office expenses & services rendered by other Units/Divisions	0.12	0.12	0.14	0.32	0.45	0.62	0.68	0.93
	TOTAL	8.08	9.05	8.29	8.75	11.24	16.63	17.61	16.37
VII.	Profit (+)/Loss (—)	(—)1.45	(—)0.50	(—)0.53	(—)0.34	(+)1.07	(—)0.62	(—)0.79	(—)0.61

The following facts deserve mention :—

(a) The losses upto 31st March 1974 were stated to be due to poor production but it would appear that substantially higher consumption of raw materials and utilities, loss of the catalyst and the high inventory maintained, mentioned in paragraphs 5.5, 8 and 9.1, also contributed to the loss.

(b) The profit of Rs. 1.07 crores earned in 1974-75 was the effect of the increase in selling prices from June 1974 which fetched an additional revenue of Rs. 2.25 crores partly off-set by increases in wages and higher prices, as also of increase in production.

(c) Apart from the natural gas used as feed-stock, other principal raw materials and utilities are sulphur and power. The prices of these three materials are the main determining factors in assessing the profitability of the Unit. The price of natural gas was increased from December 1974. Similarly, the tariff for power was increased by the Assam State Electricity Board. The price of sulphur supplied by the Minerals and Metals Trading Corporation had also increased substantially in 1975-76. As a result of this as well as higher consumption of raw materials and utilities, the Unit suffered a loss of Rs. 0.62 crore, Rs. 0.79 crore and Rs. 0.61 crore in 1975-76, 1976-77 and 1977-78 respectively despite increase in net sales realisation (particularly in 1977-78 on account of subsidy received after fixation of ex-factory retention price from November 1977) and production in the Urea and Ammonium Sulphate Plants at 100 per cent and over 90 per cent of the rated capacity respectively.

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

(1) The gap between the designed norms which are based on steady run under certain ideal conditions and

actual consumption has progressively narrowed down over the past years. This had comparatively much lesser impact on profitability than the increase in prices of the inputs.

(2) Recognising this, Government on the recommendations of the Marathe Committee fixed ex-factory retention prices for the manufacturers from 1st November 1977 which has corrected the position and helped the Unit to get some contribution on ammonium sulphate and urea.

10.2 *Break-even analysis*

The 'break-even points' of Ammonium Sulphate and Urea Plants for the eight years ended 31st March 1978 worked out as on next page :—

(Rs. per tonne)

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
A. *Ammonium Sulphate Plant*								
Net sales realisation (Rs.)	424.93	396.18	400.24	436.43	563.73	580.35	600.50	668.99
Variable cost of production (Rs.)	236.26	206.31	232.96	235.88	342.69	476.44	463.06	436.88
Contribution per tonne of production to fixed cost (Rs.)	188.67	189.87	167.28	200.55	221.04	103.91	137.44	232.11
Total fixed cost (Rs. in lakhs)	187.677	181.756	198.408	210.337	236.011	280.895	270.474	288.912
Production level at which the Plant will break even (Tonnes)	99,474	95,731	118,608	104,880	106,773	270,325	196,794	124,472
Rated capacity (Tonnes)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Break-even point (per centage of rated capacity)	99.47	95.73	118.61	104.88	106.77	270.32	196.8	124.5
B. *Urea Plant*								
Net sales realisation (Rs,)	706.92	712.35	753.16	792.52	1058.23	1172.19	1216.83	1208.99
Variable cost of production (Rs.)	204.41	210.13	208.56	195.59	230.34	385.61	468.83	477.99
Contribution per tonne of production to fixed cost (Rs.)	502.51	502.22	544.60	596.93	827.89	786.58	748.00	731.00
Total fixed cost (Rs. in lakhs)	221.739	214.080	231.381	252.548	283.051	331.091	361.072	398.160
Production level at which the Plant will break even (Tonnes)	44,126	42,627	42,486	42,308	34,189	42,092	48,272	54,468
Rated capacity (Tonnes)	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000
Break-even point (per centage of rated Capacity)	80	77.5	77.25	76.9	62.16	76.53	87.8	99.0

It will be seen that ammonium sulphate will not be profitable at current prices, costs and levels of efficiency even if production is increased to the rated capacity.

11. Costing

The Unit follows the system of process costing as in the case of other Operating Units, which are compiled on historical basis and compared with the estimates of costs framed annually. Appendix III incorporates the data relating to estimates of costs and the actual costs for the years 1970-71 to 1977-78. It will be seen therefrom that there was a sharp increase in the variable cost of urea in 1976-77 and 1977-78 over 1975-76 as well as in fixed cost in 1977-78 over 1976-77.

12. Namrup Expansion

12.1 *Introduction*

As further quantities of natural gas were available in the Naharkatiya Moran region of Assam and fertilizers available in the country continued to be short of demand, Government approved in January 1967 a scheme for expansion of the Namrup Unit.

The Expansion Project is designed to produce annually 3.30 lakh tonnes of urea (1.52 lakh tonnes of nitrogen) using natural gas as feed-stock.

12.2 *Capital expenditure decisions*

12.2.1 *Technical know-how, design, engineering, etc.*

Indigenous technology, design and engineering and indigenous catalysts developed by the Planning and Development Division were to be utilised to the maximum extent possible. While steam reformation and ammonia synthesis are based on designs supplied by M/s. Montecatini Edison, Italy (renamed as Technimont), technology for the other sections, particularly gas purification and desulphurisation, was developed by the Planning and Development Division. The Ammonia Plant was to employ

the Montecatini process, considered to be modern and good at that time. The process was remarkable for its heat recovery system, by which the saving in power was expected in the expansion project ; the consumption of 257 kwh of power per tonne of ammonia produced was envisaged as against 960 kwh in the existing Unit.

12.2.2 *Agreements with Technimont*

(1) The Corporation had entered into four agreements with M/s. Montecatini Edison, Italy (renamed as Technimont) for the execution of the Namrup Expansion Project. These were (i) Equipment supply agreement, (ii) Spare supply agreement and (iii) two process know-how and licence agreements for Ammonia and Urea Plants.

The Corporation was *inter alia* responsible for furnishing details of technical specifications of the equipment and executing all civil works, erection, commissioning and operation of the plant.

The foreign supplier was to be paid 11581 million Italian Lires (Rs. 13.90 crores) of which a sum of 10655 million Italian Lires (Rs. 12.79 crores) was covered under the deferred credit to be paid in nine annual equal instalments ; the first instalment being due 44 months from March 1968 with interest at 5.75 per cent per annum. The above payment included 50 million Italian Lires towards the services of experts to be made available by the foreign supplier and any amount exceeding the above figure was to be paid by the Corporation in cash.

(2) The equipment supply agreement included the following guarantees :

For materials and workmanship.—Guarantee valid for 24 months from the date of the last shipment or 12 months from the date the erection of the plant was completed, whichever was earlier.

For equipment performance.—Guarantee valid for 27 months from the date of last shipment or 6 months from the date the

plant was commissioned, whichever was earlier, except for the Process Air and Synthesis Gas Compressors for which the guarantee was valid for 36 months from the date of delivery.

As there was substantial delay in erection and commissioning of the plant, the material and workmanship guarantees expired in January 1973, equipment performance guarantee in April 1973 and the guarantee for compressors in January 1974. The Corporation entered into a supplementary agreement with the foreign supplier in November 1974 for extending the guarantees upto 31st December 1975. While agreeing to the extension of the guarantees, the foreign supplier imposed a condition that if their engineers at site were unable to certify the satisfactory condition of any equipment, their experts would be brought to India to check the condition of the equipment, alignment, etc. before it was commissioned. It was feared that, in the long period which had elapsed since the equipment was brought to India, some damage might have occurred in storage or erection. Further, the Corporation was to pay higher per diem rates for the services of the experts deputed for this purpose. The supplementary agreement was approved by Government in February 1975. The Ministry have stated (October 1978) that no damage or deterioration was found in the equipment due to storage. It was further clarified that performance of most of the equipment/machines was checked up prior to December 1975 while that for some machines like synthesis gas compressor, CO_2 compressors, carbamate and ammonia feed pumps in actual fluid service could be seen only when the respective fluids like synthesis mixture gas, CO_2 gas, carbamate solution and liquid ammonia were actually available in the course of commissioning of the Plant.

(3) Numerous defects and deficiencies were found in the equipment in the pre-commissioning and commissioning period and modifications were carried out from time to time as desired by the foreign suppliers' engineers or vendors' representatives. According to the Corporation, it was not possible to prove the satisfactory performance of certain items even after modifications or replacements. Details of defective equipment and materials are given in Appendix IV. A formal claim was also lodged by

the Corporation with the foreign suppliers in January 1976. In this regard, the Corporation informed the Ministry in May 1977 as follows :—

(a) Deficiencies noticed in the equipment and the modifications made therein were found necessary due to:—

(i) mal-functioning of the equipments ;

(ii) modifications recommended by foreign suppliers or vendors' of the equipments ;

(iii) modifications considered desirable in the light of experience of the Durgapur and Cochin Fertilizer Plants.

(b) Accordingly, claims were lodged on Technimont for the following :—

(i) Rectification of defects as well as improvements effected in the equipment—Rs. 38.15 lakhs for Namrup Expansion Project and Rs. 50.87 lakhs for Barauni Project.

(ii) Liquidated damages for the late delivery of spares—Rs. 4.22 lakhs.

(iii) Liquidated damages for non-performance of guarantee—Rs. 3.62 lakhs each for Barauni and Namrup Expansion Projects.

(c) The Technimont had also raised their claims in respect of supply of some of the items for effecting modifications in the equipment to bring out improvement in the functioning of the equipment necessitated on the basis of the Corporation's experience at Durgapur and Cochin. Technimont had also supplied a number of items like bellows, membrances and other fittings for the repair of R.G. boilers. They had also supplied two boiler feed water pumps, one each for Barauni and Namrup Expansion Projects on the understanding that the pumps would be taken back if the pumps

supplied originally by them performed satisfactorily. The pumps originally supplied and modified had been working fairly satisfactorily even though they could not be considered as reliable as some other makes of pumps.

Technimont's total claim worked out to Rs. 58.97 lakhs.

(d) The claims of the Corporation for Namrup Expansion Project as well as Barauni Project were discussed with Technimont in the meetings held from 4th to 7th November 1976 and it was finally agreed that Technimont would pay to the Corporation a sum of Rs. 15.40 lakhs in settlement of all the claims of the Corporation for Namrup Expansion Project and Barauni Project. In addition, Technimont agreed to consider components supplied for modifications/ improvements and the two boiler feed water pumps, as free supplies.

The above settlement was approved by the Government in May 1978.

The background of the modifications and action taken in respect of the modifications, as intimated by the Ministry in their reply of October 1978 is given in Appendix V.

(4) The schedule of repayment provided for in the contract coincided with the schedule of commissioning of the Plant. Owing to delay in commissioning from July 1971 to October 1976, repayment commenced before production. By October 1976, the Corporation had paid 5 instalments out of the 9 instalments required to repay the entire credit. The delay also led to payment of 2393 million Italian Lires in addition to 50 million Italian Lires provided in the contract for services of experts and included in the lump sum of 11,581 million Italian Lires paid for equipment, etc.

12.2.3 *Project estimates.*—The feasibility study, approved by the Government in January 1967, estimated that the Expansion Scheme would cost Rs. 29.47 crores on the assumption that the Plant would be commissioned by July 1971. The detailed project cost estimates were revised to Rs. 47.03 crores on the expectation that commercial production would commence from April 1972. These estimates were forwarded to Government in March 1970 for approval.

In December 1971, the Ministry of Petroleum and Chemicals decided that, as there were slippages in the schedule on which the earlier estimates were based, the realistic project cost estimates should be submitted by the Corporation after taking into account the revised schedule of deliveries. Accordingly, the estimates of capital cost were revised to Rs. 50.69 crores by the Corporation in February 1972, assuming commencement of commercial production in January 1974. These were approved by the Board in March and forwarded to the Government in April 1972. Estimates were subsequently revised on seven occasions because of slippage in the construction schedule, as detailed below :—

	As revised in						
	September 1973	January 1974	June 1974	September 1974	December 1974	June 1975	July 1976
Overall estimate of capital cost (Rupees in crores)	55.40	55.86	59.24	58.62	60.89	67.51	72.91
Date of commencement of commercial production	July 1974	July 1974	April 1975	April 1975	October 1975	April 1976	October 1976

Estimates of July 1976 for Rs. 72.91 crores (including Rs. 24.21 crores in foreign exchange) were approved by the Board on 2nd August 1976 and forwarded to Government in

July 1976 for approval. The estimate was further revised to Rs. 74.91 crores and approved by the Board in August 1977. The estimate of Rs. 74.91 crores has been approved by the Public Investment Board but approval of Government is awaited (October 1978). Rs. 67.23 crores (including Rs. 22.84 crores in foreign exchange) were spent upto 31st March 1978.

The latest revised estimates of Rs. 74.91 crores were higher by Rs. 45.44 crores than the feasibility study estimate (Rs. 29.47 crores) of October 1966 and were attributed to the following factors :—

	(Rs. in crores)
(i) Change in scope	2.82
(ii) Modifications	2.58
(iii) Fresh provisions due to change in scope	11.39
(iv) Price escalation	4.32
(v) Exchange rate variation	0.07
(vi) Customs duty, excise duty, sales tax, etc.	2.19
(vii) Financing charges	10.88
(viii) Departmental charges and D.E.P. charges	5.16
(ix) Others	6.03
TOTAL	45.44

As regards the escalation in the estimate of cost, the Ministry have stated (October 1978) as follows :—

(a) "Considering the revised cost estimates of all the fertilizer projects implemented by F.C.I. including Namrup Expansion, P.I.B. noted that the original cost estimates drawn for the purpose of project approval were not by any means firm and were nearly indicative figures. P.I.B. also noted that these original estimates were based on preliminary information available at the time of project formulation and that, in almost all the cases, there was a time lag between the preparation of the estimates and the investment approvals and further time lag between the investment approvals and the commencement of

actual implementation. It is for this reason that the Government has now decided that within one year from the investment approval the project authorities should come up with firm estimates for any future cost comparison."

(b) "P.I.B. further noted that in the initial stages of its history, P & D was rather unrealistic about the time schedule for the completion of projects and estimation of cost."

12.2.4 *Effluent treatment*

(1) *Introduction.*—For any chemical complex, it is usually necessary to consider the question of effluents. Neither for the Unit nor for the Expansion Project was an effluent treatment scheme envisaged. When the existing plant was being started in 1968-69, it was found that effluents discharged, consisting of ammonia and urea, were beyond the tolerance limit. As an immediate measure, the Unit constructed three big delay tanks in the river bed without the prior sanction of the State Government. Initially, the State authorities insisted on dismantling the unauthorised construction. Subsequently (March 1970), they claimed compensation of Rs. 0.54 lakh on account of loss of revenue arising from ponds dug inside a stone quarry. The compensation was paid by the Unit on 22nd April 1970.

Ministry have stated (October 1978) as follows :—

(a) "Most of the plants of Namrup-I were designed and supplied by M/s. Chemico and they had indicated the quality of effluents coming out of various plants. It was informed by them that effluents from Ammonia and Urea Plants will be intermittent in nature and will be generally of small flow rates." M/s. Chemico had also mentioned that 'it should be noted that the compositions and quantities of effluents are a direct function of the mode of operation of the plant and that under start up conditions effluent quantities and compositions may well, for short periods, be greater than the normal operational effluents'.

(b) "Namrup-I plants were commissioned in August 1968 and the effluent discharge contained high amounts of ammonia. The problem of pollution increased in proportion as the commissioning of the plants proceeded and in order to combat the pollution problem delay ponds were constructed on the river bed urgently without obtaining prior sanction from the Forest Department of the Government of Assam".

(c) "In order to have a permanent solution to the problem of ammoniacal nitrogen effluents, a scheme to put up an ION-Exchange effluent treatment plant for treating the effluent from Urea Plant-I was taken up".

(d) "As regards Namrup Expansion Project, the specifications of effluents were supplied by the designers, Planning and Development Division of F.C.I., at the start of the Project itself". "Keeping the above designs and specifications in view, a scheme to treat the regular ammoniacal nitrogen containing effluents was drawn in 1970".

(2) *Formulation of scheme.*—As a permanent solution to the problem, the Planning and Development Division suggested in November 1970 an integrated scheme to take care of the effluents of the existing and the Expansion Plants. The scheme in brief was as follows :—

(i) Around 80 cubic metres of effluents are discharged per hour from the existing Urea Plant containing on an average 1000 ppm of ammonia. It was proposed to treat the effluents in an ION-Exchange unit where ammonia would be absorbed by a cation exchange resin. This ammonia was to be recovered as 15 per cent ammonium sulphate and processed further in the Ammonia Stripping Plant.

(ii) For effluents from the Expansion Urea Plant, (around 25 tonnes per hour of condensate with 2.4 per cent of ammonia), a Stripping Plant was proposed to be

installed. The ammonia was to be recovered as 40 per cent ammonium sulphate liquor and processed in the Sulphate Plant.

It was expected that, after commissioning of the Expansion Plant, the total discharge from the factory would be of the order of 5 to 7 million gallons daily and effluents being only 0.5 million gallons, there would be a ten-fold dilution of the ammonia content which would not be more than 20 ppm at any time. After undergoing a ten-fold further dilution in river water on the basis of minimum discharge of the river, ammonia content in the river was expected to be below the permissible limit of 2 ppm.

(3) *Execution of the scheme.*—The contract for the plant for processing ammonia from effluents of the Expansion Plant was awarded to M/s. De Smet of Bombay in June 1971 and for the existing plant to M/s. ION Exchange (India) Limited, Bombay in May 1973. The estimated cost of these two schemes was Rs. 38.30 lakhs.

Meanwhile, during the commissioning of the Durgapur Plant, some other effluent problems in other areas also came to light as given below :—

(i) Because of the exigencies of operations, regeneration and de-carbonisation towers in the Ammonia Plant containing vetrocoke solution were sometimes drained. Draining a large quantity of solution containing poisonous arsenic oxide was not advisable ; yet storage of tower washing was difficult.

(ii) Because of numerous shut-downs and start-ups, substantial quantities of carbamate solution containing ammonia were being drained out.

After further study, the initial scheme was supplemented as follows :—

(a) A storage tank for collecting arsenic solution drained whether occasionally by design or accidentally from the vetrocoke section of the Ammonia Plant.

(b) A storage tank for collecting the occasional discharge containing urea and ammonia from both Urea Plants.

(c) A separate surge tank for storage of the urea solution to prevent its drainage to the surface drain during short shut-downs of the Prilling Tower.

(d) A tank for collection of arsenic solution with a higher concentration for re-utilisation in the system.

(e) A tank for collection of arsenic solution washing from the towers which may be necessitated on account of shut-down and maintenance jobs.

(f) Filter for filtering the arsenic solution to concentrate and re-use it.

(g) Inter-connecting pipes and the pumps for the feed-back into the system.

(h) A stainless steel header in the Expansion Urea Plant to connect drains to the 50 cubic metres tank and pumps required to pump the solution from this tank to the tank mentioned at (a) above and the ammonia stripper.

These items were estimated to cost Rs. 26.30 lakhs, thereby raising the total cost to Rs. 64.60 lakhs. The latest revised estimate of June 1975 was, however, for only Rs. 51.50 lakhs and actual expenditure incurred upto 31st March 1978 was Rs. 51.80 lakhs.

The ION Exchange Plant meant for the main Plant was commissioned in October 1976 and was stated (August 1977) to be in service since then. Against the full capacity of 7.4 tonnes per day, the actual recovery of ammonium sulphate was stated to be 5-6 tonnes per day owing to lesser quantity of effluent and lesser ammonia content therein

The Ammonia Stripping Plant was completed in the first quarter of 1976. A number of storage tanks, etc. were also completed by June 1976.

12.3 *Schedule of commissioning*

12.3.1 Originally the Plant was to be commissioned in July 1971. The Plant went into commercial production in October 1976. The scheduled and actual dates of completion of the main items of work are given below :—

Sl. No.	Item of work	Date of commencement		Date of completion		Remarks
		Scheduled	Actual	Scheduled	Actual	
1	2	3	4	5	6	7
A. *Civil Works (Factory Construction)*						
1.	Site development	September 1968	September 1968	November 1970	—	As no more land was proposed to be acquisitioned further, this activity was treated as complete.
2.	Main factory building foundations					
	(a) Ammonia Plant	December 1968	December 1969	June 1970	April 1973	Major work completed
	(b) Urea Plant	September 1968	September 1968	June 1970	March 1973	-do-

B. *Plant & Equipment* (Imported) Machinery delivered	June 1969	July 1969	November 1969	April 1973	Delivery completed except in respect of discrepant items and replacement.
C. *Plant & Equipment* (indigenous) Machinery delivered	August 1969	August 1970	August 1970	April 1974	
D. *Total mechanical, electrical and instrument erection* (Site responsibility)	November 1969	December 1970	April 1971	July 1974	
E. *Total Project completion*			June 1971	October 1976 (date of commencement of commercial production)	

It will be seen from above that there has been a delay of over 5 years in the completion of the project with reference to the scheduled date of 1st July 1971 indicated in the feasibility report. Although erection of plant and equipment and other connected works were completed by July 1974, the Plant commenced commercial production in October 1976. The main factors which led to abnormal delay in completion and commissioning of the project, as intimated by the Management from time to time, were as follows :—

Delay in completion :

(a) Delay of 8 to 12 months in completion of civil engineering works owing to non-availability of steel and cement.

(b) Delay in issue of import licence and in ratification by the Italian Government of the shipping contract, as a result of which initial shipment of imported materials required for fabrication of equipment indigenously was delayed between 4 and 18 months.

(c) Difficulties in transportation of equipment and materials on account of over-sized consignments, heavy rains and floods in July—October 1971 and conflict with Pakistan.

(d) Language agitation in 1972 as a result of which the contractors' operations were dislocated.

(e) Delay of one year to 4½ years in supply of equipment by Indian fabricators.

(f) Problems caused by short supplies and discrepancies in respect of imported items.

(g) Delay in insulation of pipelines and vessels as aluminium sheets were not available, because of power cuts in the country in 1973-74.

Delay in commissioning

(a) Delay in making arrangement for supply of gas by Oil India Limited from Naharkatiya and Moran fields through the Assam Gas Company Limited. [This did not, however, affect the commissioning as the Corporation was not in a position to receive the supplies on account of other factors. (Also refer paragraph 12.4)].

(b) Uncertainty in getting continuous supply of 30 MW of power from the Assam State Electricity Board.

(c) Vibrations, found during testing, in the impeller and shaft of the Flue Gas boiler supplied by the Bharat Heavy Electricals Limited.

(d) Failure twice of the refractory lining of the flue gas duct.

(e) Unusual sound observed in the air-pre-heater of all the 3 boilers of the Steam Generation Plant supplied by the Bharat Heavy Electricals Limited, when run on full load and leaks detected in one of the economiser coils and from the sampling probs on the boiler drum.

(f) Leaks in the sealing bellows of the Reformed Gas Boiler riser and down-comer tubes. At the instance of the foreign suppliers (designed and manufactured by M/s. Oschatz of West Germany and supplied by M/s. Technimont of Italy), repairs and modifications were completed in October 1975.

(g) Problems regarding effluent disposal, storage of ammonia, quality of cooling water, paucity of instrument air quantity and the supply of proper quality of polished water for Ammonia Plant.

For solving the above problems, the Corporation drew up schemes estimated to cost Rs. 245.35 lakhs (actual expenditure on modifications was Rs. 2.58 crores vide paragraph 12.2.3).

The Unit stated (November 1975) that it was difficult to apportion the responsibility for delay on any particular agency at the existing stage.

12.3.2 *Erection contracts*.—The Unit had entered into contracts with four firms for the erection of equipment, etc. for the Expansion Project. The contracts stipulated payment of compensation to the contractors for prolongation of the schedule of completion beyond the prescribed period for reasons not attributable to the contractors and for levy of damages on the contractors for their default in completing the work by the scheduled dates.

There were delays ranging from 12 to 19 months in the completion of work which were attributable to the project authorities. As a result, compensation aggregating Rs. 4.05 lakhs had to be paid to these firms as follows :—

Sl. No.	Name of the work	Name of the contractor	Cost of the work (Rs. in lakhs)	Date of commencement of work	Scheduled date of completion of work	Actual date of completion	Extent of delay	Compensation paid for delay (Rs. in lakhs)	Remarks
1.	Equipment erection	M/s. Engineering Construction Corporation Limited	22.00	12th December 1970	12th September 1972	30th April 1974	19 months	1.20	
2.	Piping erection Part II	M/s. Western India Erectors Private Limited	17.00	5th April 1971	4th July 1973 (after taking into account 6 months holiday period)	30th September 1974	14 months	1.17	Compensation paid upto 15th October 1973. The matter stands referred to Arbitrator for the subsequent period.
3.	Piping erection Part III	M/s. Stewarts and Lloyds India Limited	8.00	28th December 1970	30th June 1972 (Extended to 28th December 1972)	31st December 1973	12 months	0.60	
4.	Instrumentation erection	M/s. Bestobell India Limited	6.00	17th August 1972	1st July 1973	30th September 1974	15 months	1.08	Compensation paid upto August 1974

The following points were also noticed :

(i) *Ex-post-facto* sanction of the competent authority for payment of the compensation was obtained.

(ii) *Contract with M/s. Bestobell India Limited.*—Compensation was payable to the contractor for the period beyond 10½months at ½ per cent of the contract value per week subject to a maximum of 10 per cent of the total contract value. By 31st March 1974, there was a delay of 9 months in the completion of the work attributed to the Management. For the delay, the contractor claimed compensation at the rate of ½ per cent per week without restricting it to the overall ceiling of 10 per cent of the contract value and asked for termination of contract from the 1st April 1974.

After discussion, the Unit agreed (April 1974) to pay Rs. 1.08 lakhs as compensation for the period July 1973 to March 1974, whereas the maximum compensation payable in terms of the contract was Rs. 0.60 lakh only.

It has been stated by the Unit that it could not terminate the contract with effect from 1st April 1974, as it did not have the facilities and the staff for completing the remaining job.

The Ministry have stated (November 1978) as follows :—

(a) The contractor had contended that though a ceiling of 10 per cent had been indicated in the contract, the compensation was to be time based. This contention was accepted.

(b) The delay in the completion of the work was as a result of delay in piping erection work done by another contractor. A claim for compensation has been lodged with the arbitrator against the latter.

12.4 *Agreement for transportation of gas*

The Corporation has entered into an agreement with the Assam Gas Company Limited for transportation of gas from Naharkatiya and Moran Oil fields of Oil India Limited to the battery limits of Namrup factory. The agreement is effective from April 1971 and will remain in force as follows :—

(a) From April 1971 to December 1984 for gas from Naharkatiya.

(b) From the date of commissioning of the Moran—Numrup pipeline of the Assam Gas Company till December 1994 for gas from Moran.

The salient features of the agreement are given below :—

Naharkatiya

(a) The Assam Gas Company is to transport a maximum of 25 million scft.* of gas per day. The gas was to be delivered at the battery limits of the Namrup Unit at a minimum pressure of 14.2 kg./cm^2/Gauge.

(b) Transmission charges for the gas fixed at 45 paise per 1000 scft. were effective from 1st April 1971.

(c) When the Corporation started drawing more than 8 million scft. of gas per day, (that is after the Expansion Project is commissioned) transmission chrages would be reduced to 30 paise per 1000 scft. subject to a minimum payment based on 50 per cent of the maximum demand of 25 million scft. per day for 330 days in a year.

(d) The above minimum payment would continue from the period when the Corporation starts drawing

*standard cubic feet.

more than 8 million standard cubic feet of gas per day until two years after commercial production starts. Thereafter, the Corporation is to guarantee a minimum annual payment of 75 per cent of the maximum demand of 25 million scft. per day for 330 days in a year.

Moran

(a) Assam Gas Company was to arrange to complete by July 1973 the laying of a pipeline (diameter 330 mm *i.e.* 12 inch) to transport gas. The Assam Gas Company was to compensate the Corporation for its failure to do so.

(b) The pipeline was to be designed for transmission of a minimum of 10 million scft. of gas per day at a starting pressure of 150 pounds per square inch at Moran field off-take point and a minimum pressure of 71 pounds per square inch at the battery limit of the Corporation.

(c) For transport of gas from Moran, the transmission charge was not dependent on the quantity transported. Instead the Corporation was to pay to the Assam Gas Company Rs. 22.50 lakhs per annum from the date of actual commissioning of pipeline by the Assam Gas Company till December 1994 towards the cost of transmission. (The pipeline was commissioned in October 1973).

From 1971-72 to March 1975, the gas taken from Naharkatiya was throughout less than 8 million scft. a day, mainly because the completion and commissioning of the Expansion Project was delayed on account of reasons mentioned in paragraph 12.3.1. It was also not possible for the Unit to ensure that the minimum drawal during any period of 330 days was not less than 12.5 million scft. a day. Thus, transmission charges had to be paid for gas from Naharkatiya at the higher rate of 45 paise per 1000 scft. No gas was drawn from the Moran

fields till October 1974, though Rs. 22.99 lakhs had to be paid (at Rs. 22.50 lakhs per annum) from October 1973 onwards, as transmission charges.

The Corporation stated (February 1977) that commissioning got delayed due to reasons beyond the control of project authorities.

12.5 *Economic viability*

According to the Feasibility Report of October 1966, the Expansion Project, on attainment of rated production, was estimated to yield a net profit annually of Rs. 10.63 crores, before tax but after providing for interest on loans. This profitability was based on a net sales realisation of Rs. 580 per tonne of urea and estimated cost of production (including interest on loans) of Rs. 258 per tonne.

Based on the revised estimates of cost, the ruling prices for input and output and consumption efficiencies guaranteed by the designers, the Corporation has computed (November 1978) the profitability of the Expansion Project at 90 and 100 per cent capacity utilisation, as given below :—

Sl. No.	Particulars	At 90 per cent capacity	At 100 per cent capacity
1.	Cost of production (including interest on loans) (in rupees per tonne)	920.95	858.96
2.	Sales price (net) (in rupees per tonne)	1135.30	1135.30
3.	Sales income (in crores of rupees)	33.72	37.47
4.	Cost of sales (in crores of rupees)	28.02	29.01
5.	Profit before tax (in crores of rupees)	5.70	8.45
6.	Break-even point	65.09 per cent of rated capacity	

As already mentioned, the Expansion Plant went into commercial production from 1st October 1976. Actual production was 42 per cent of the rated capacity for the period from October 1976 to March 1977 and 36 per cent for 1977-78.

Based on the working results compiled by the Corporation, the Expansion Plant incurred a loss of Rs. 2.06 crores for the period from October 1976 to March 1977 and Rs. 5.29 crores for 1977-78.

NEW DELHI;
The 23-4-1979

(T. RENGACHARI)
Chairman, Audit Board and
Ex-officio Additional Deputy
Comptroller and Auditor General (C)

Countersigned

NEW DELHI;
The 23-4-1979

(GIAN PRAKASH)
Comptroller and Auditor General of India

APPENDIX—II

(Referred to in paragraph 8.2)

Statement showing the data relating to norms and actual consumption of raw materials and utilities.

Sl. No.	Output	Material/ utility consumed	Unit	Design norms	Adopted norms	Mahadevan Committee norms	Kachwaha Committee norms	1971-72		1972-73		1973-74		1974-75		1975-76		1976-77		1977-78	
								Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
1.	Ammonia . . .	Natural gas	(*i*) 10^6K Cal	9	10.6	9	..	10.6	11	9	10.41	9	8.75	9	8.857	9	8.66	9.0	9.59	9.24	9.50
			(*ii*) NM^3	..	1000	..	960	1000	1028	1000	952	1000	943	1000	956	1000	927	1000	979	1027	960
		Steam	Kgs.	(—)778	(—)450	..	(—)160	(—)400	(—)345	(—)450	(—)166	(—)450	(—)370	(—)450	(—)138	(—)450	..	(—)450	(—)110	(—)450	(—)363
		Power	KWH	910	1050	1000	950	1050	1188	1000	1089	1000	1072	1000	1059	1000	986	1000	949	1004	909
2.	Ammonium Sulphate .	Ammonia	MT	0.263	0.29	0.265	0.270	0.29	0.29	0.275	0.293	0.275	0.286	0.275	0.270	0.275	0.267	0.275	0.271	0.276	0.267
		Acid	MT	0.80	0.82	..	0.80	0.84	0.815	0.82	0.83	0.80	0.82	0.80	0.805	0.800	0.771	0.80	0.799	0.802	0.796
		Steam	Kgs.	414	560	..	400	450	552	560	456	450	387	450	334	450	339	450	365	450	323
		Power	KWH	36	40	..	35	40	206	40	42	40	40	40	34	40	29.49	40	30	40	31
3.	Urea	Ammonia	MT	0.62	0.80	0.63	0.63	0.78	0.75	0.67	0.69	0.67	0.68	0.65	0.663	0.650	0.646	0.65	0.634	0.651	0.651
		Steam	Kgs.	2120	2900	..	2500	2900	3207	2900	2520	2900	2807	2900	2403	2900	2389	2900	2238	2900	2218
		Power	KWH	222	360	250	250	360	310	250	272	250	262	250	245	250	213	250	247	250	271
4.	Sulphuric Acid . .	Sulphur	MT	0.34	0.36	0.34	0.34	0.36	0.36	0.36	0.36	0.36	0.366	0.36	0.363	0.360	0.360	0.360	0.360	0.360	0.360
		Power	KWH	60	100	..	100	100	174	100	91	100	98	100	92.75	100	84.86	100	82	100	77
		Steam	Kgs.	(—)960	(—)770	..	(—)860	(—)770	(—)999	(—)770	(—)786	(—)770	(—)900	(—)770	(—)889	(—)770	(—)879	(—)770	(—)808	(—)770	(—)815

NOTE : Minus figures in the table indicate export of steam to other plants.

Source : Data obtained from Quarterly Performance Reports except in respect of Mahadevan Committee Norms and Kachwaha Committee Norms.

APPENDIX—III

(Referred to in paragraph 11)

Statement showing the break-up of budgeted cost and actual cost

(Cost in rupees per tonne)

Product	1970-71		1971-72		1972-73		1973-74		1974-75		1975-76		1976-77		1977-78	
	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual
Ammonium Sulphate																
Variable	226.74	236.26	215.35	206.31	223.09	232.96	236.27	235.88	352.47	342.69	528.96	476.44	481.96	463.06	453.23	436.88
Fixed	217.84	308.89	232.57	319.68	252.64	325.02	255.62	327.85	322.39	332.71	320.86	297.20	407.99	295.24	387.46	316.28
TOTAL	444.58	545.15	447.92	525.99	475.73	557.98	491.89	563.73	674.86	675.40	849.82	773.64	889.95	758.30	840.69	753.16
Urea																
Variable	204.40	204.41	216.79	210.13	206.64	208.56	197.24	195.59	238.61	230.34	414.88	385.61	512.36	468.83	509.78	477.99
Fixed	719.52	702.98	584.90	522.73	503.89	475.63	474.41	502.36	563.44	508.80	726.30	597.16	837.45	619.97	789.36	709.51
TOTAL	923.92	907.39	801.69	732.86	710.53	684.19	671.65	697.95	802.05	739.14	1141.18	982.77	1349.81	1088.80	1299.14	1187.50

(Cost in rupees per tonne)

tual	1975-76		1976-77		1977-78	
	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual
2.69	528.96	476.44	481.96	463.06	453.23	436.88
2.71	320.86	297.20	407.99	295.24	387.46	316.28
5.40	849.82	773.64	889.95	758.30	840.69	753.16
0.34	414.88	385.61	512.36	468.83	509.78	477.99
8.80	726.30	597.16	837.45	619.97	789.36	709.51
9.14	1141.18	982.77	1349.81	1088.80	1299.14	1187.50

(13) Modifications on tosi turbines.

(14) Modifications on liquid ammonia transfer pumps.

(15) Modifications on various imported piping system.

(16) Modifications on progress refrigeration compressor.

(B) *Electrical*

(1) Modifications carried out on marelli motor for process refrigeration compressor.

(2) Provision of one number normally open contract DN MCC for oil cleaner 1.23 CRI/CEI and 1.23 CR/CEIR.

(3) Modifications for remote operation for condensate extraction pump from instrument panel.

(4) Modifications for bearing oil trip and air trip to process refrigeration compressor motor.

(5) Modifications of the gate valve for synthesis gas compressor for providing extra contact in the instrument panel.

(6) Modification on DM water pump 1.42 pair.

(7) Modifications for lube motor 'on off' indication for 920 KW motor CAI and CAIR.

(C) *Instrument*

(1) Modifications in the electrical circuit of peabody burners, changing of valve action and modifications of power cylinder.

(2) Modifications of electrical circuit of boiler feed water pump and adding new trip.

(3) Modifications of electrical circuit and pneumatic circuit of 169 PCI/PI.

(4) Process air compressor, modification of electrical circuit of antisurge control valve positioner and controller.

(5) Modification of elecrical circuit, level switches transmitter gauges for process refrigeration compressor.

(6) Modifications of electrical circuit for trip and unload, modification of seal oil control valve anti surge control valve and pneumatic circuit for synthesis gas compressor.

(7) Modification of electrical circuit of storage refrigeration compressor.

(8) Modifications of electrical circuit for start up and recycle nitrogen compressor 1.23 CAI—CA2.

(9) Modifications of four way solenoid valves.

(10) Modifications of FRC 503 (V).

(11) Modifications of flexure type level switches.

II. *Urea Plant*

(A) *Mechanical*

(1) Modifications of peroni pumps for ammonia and carbamate.

(2) Modifications of CO_2 compressors.

(3) Additional heavy supports provided for checking the vibrations for CO_2 compressors, separators, coolers and piping system.

(4) Replacement of coolers for ammonia and carbamate pumps.

(5) Rechrome plating of plungers for ammonia and carbamate pumps.

(B) *Instrument*

(1) Modification of electrical circuit for CO_2 compressor.

(2) **Modification of turbines speed indicators for peroni pumps.**

Besides the above, process air compressor surface condenser tubes have started failing and require replacement of tubes with suitable material of construction.

There are apprehensions about the satisfactory performance of carbamate pumps in Urea Plant which are still under guarantee period.

Various machines supplied by M/s. Termomeccanica are still having lot of vibrations even after providing extra heavy supports.

APPENDIX V

[Referred to in paragraph 12.2.2(3)(d)]

Statement indicating action taken in respect of modifications as intimated by the Ministry

The cases listed in appendix IV of the Audit Report are the cases involving modifications/improvements in the piping/equipment for which claims were raised on M/s. Technimont. Most of these modifications were found necessary for improved running and better on-stream availability of the equipment and machines. The commissioning problems at Durgapur/Cochin had clearly indicated that some improvements would be necessary, so that the operation of the plant is safe and reliable. On the other hand, some of the modifications were necessitated because of breakdown during commissioning period.

The modifications to which M/s. Technimont agreed, they supplied the imported components and parts. This was done in good faith by them while reserving their right to charge for them later. If we would have been forced to procure these items, the formalities of import licence, release of foreign exchange and ordering etc. would have set back the project by at least two years. Some of the items which they sent for repairs/modifications/ replacement are given below :—

(i) Modification materials for R.G. Boiler, piston rod packings for 1.23 CA 1, 1 number K.S.B. make B.F.W. pump, secondary reformer air spargers (24 nos.) piping materials for replacing C.S. line to allow steel line, a new FRG-505 control valve, guide vanes of process air compressor, labyrinth rings of synthesis gas compressor, modification

materials for liquid ammonia transfer pumps and mechanical seals for process refrigeration compressor.

(ii) Deputation of the technicain of M/s. Selas, Marelli and Hyward Tylor for the rectification of primary reformer duct refractory, refrigeration compressor motor and Boiler Water Circulation Pump.

(iii) Imported components of modification materials for electrical and instrumentation circuits, various control valves, etc.

(iv) Tools for the modification of Peroni Pumps, modified packings and pistons, replacement coolers (3 nos.) for Peroni Pump Oil Circuit.

(v) During discussions and settlement of claims in November 1976, they agreed to supply 50 Nos. brass tubes to replace the failed tubes (35 nos.) of the process air compressor surface condenser.

From the above it would be seen that the Corporation did not leave any stone unturned to bring the machines/equipment upto the mark by modifying/improving their shortcomings/discrepancies and it was done by getting materials from the suppliers. However, the choice of vendors for the machines was somewhat limited in our case since the financing for the foreign exchange portion was in the form of suppliers' credit. Hence the choice and knowledge of most proven type of equipment did not play much role in getting the equipment for Namrup Expansion Project. However, it was ensured that all important items meet the stringent inspection requirements of well established standards and where necessary, Indian Standards/Rules and Regulations etc.

MGIPRRND—S/11C&AG 78—TSS II—6-4-79—1920

PAG. 66. IV. 78.
1920—1979 (DSK. III)

Price : *Inland* : *Rs.* 8.50
Foreign : £ 0.99 *or* $ 3.06

PRINTED BY THE MANAGER, GOVT. OF INDIA PRESS, RING ROAD, NEW DELHI-1100
AND PUBLISHED BY THE CONTROLLER OF PUBLICATIONS, DELHI-110054
1979

MGIPF—413NAL/79—50,000—4-12-79.