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

UNION GOVERNMENT (COMMERCIAL)

1979

PART III

210

**THE FERTILIZER CORPORATION OF INDIA
LIMITED**

(NANGAL UNIT)

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| iv | 4 | 2 | application | appreciation |
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PREFATORY REMARKS

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

2. This part contains the results of appraisal undertaken by the Audit Board of the working of Nangal Unit (including Nangal Expansion) of the Fertilizers 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. (Subsequently, Director of Audit, Eastern Railways, 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 up to 8th March 1979.

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

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

- (a) the results of discussions held with the representatives of the Ministry of Chemicals and Fertilizers and the Corporation at its meetings held on 20th March 1979 and 29th August 1979, and
- (b) the additional information furnished by the Ministry in August 1979 and supplementary information furnished by the Corporation in September to November 1979.

4. The Comptroller and Auditor General of India wishes to place on record the application 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.

Nangal Unit

1. *Historical background.*—Of the various projects recommended by the Fertilizer Projection Committee, Government decided in April 1955 to set up a fertilizer-cum-heavy water factory at Nangal on account of following considerations :—

- (i) Availability of abundant and cheap power generated from the Bhakra Power Complex.
- (ii) Fertilizer factory based on electrolytic hydrogen offered an attractive opportunity for simultaneous production of heavy water at a reasonable cost for supply to the Department of Atomic Energy.

While the fertilizer group of plants (with the exception of third hyper compressor in the Ammonia Plant) was commissioned on 22nd February 1961, the Heavy Water Plant was commissioned on 8th August 1962.

Operations of the Nangal Unit up to the year ending 31st March 1964 were reviewed in Section III of Audit Report (Commercial) 1965. This Report deals with operations of the Unit later, in particular from 1971-72 to 1977-78.

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, Nangal Unit stands transferred to National Fertilizers Limited.

2. *Plant complex and processes.*—The fertilizer group of plants and the Heavy Water Plant were initially designed to produce annually 3.88 lakh tonnes of calcium ammonium nitrate (containing 20.5 per cent of nitrogen) and 14.11 tonnes of heavy water. From August 1967, the nitrogen content of calcium ammonium nitrate was raised to 25 per cent and capacity of the fertilizer group of plants is reckoned at 3.18 lakh tonnes of calcium ammonium nitrate.

The Plant complex comprises the following main plants :—

- (i) Rectifier equipment to feed direct current to the Electrolysers.
- (ii) Electrolysis Plant designed to produce hourly 26,500 cubic metres of hydrogen and 13,250 cubic metres of oxygen, consuming about 1.32 lakh KWH of power.
- (iii) Air Liquefaction Plant designed to process about 12,000 cubic metres of dry air per hour in two streams to yield pure oxygen and pure nitrogen (purity of oxygen-95 per cent).
- (iv) Ammonia Plant designed to produce 307.2 tonnes a day of liquid ammonia in 3 streams.
- (v) Nitric Acid Plant designed to produce 1045 tonnes of 53 per cent concentrated nitric acid a day in 2 streams.
- (vi) Nitrolime-stone Plant with a capacity of 1176 tonnes a day of calcium ammonium nitrate (containing 20.5 per cent nitrogen) in two streams.
- (vii) Bagging Plant designed to fill 48,000 bags of 50 Kgs. each daily.
- (viii) Heavy Water Plant designed to produce 14.11 tonnes annually of heavy water.

The manufacturing process of calcium ammonium nitrate and heavy water in this complex is briefly as follows :—

Calcium ammonium nitrate.—Water is electrolyzed in the Electrolysis Plant to give hydrogen and oxygen. Air is liquified in the Air Liquefaction Plant to give nitrogen and oxygen. Nitrogen and hydrogen are then compressed in the Ammonia Plant and passed over ammonia catalyst to get ammonia. Approximately half the ammonia produced is oxidised with oxygen enriched air in the Nitric Acid Plant and absorbed in water to give nitric acid of 53 per cent

concentration. The rest of the ammonia is reacted with the nitric acid in the Fertilizer Plant to give ammonium nitrate liquor, which is concentrated and mixed with limestone to form granules. These granules are dried, cooled and coated with soapstone to give the final fertilizer.

Heavy Water.—Enriched hydrogen obtained from the third stage of the Electrolysis Plant is processed to produce heavy water by distillation of liquid hydrogen. Depleted hydrogen from the Heavy Water Plant is returned to the Ammonia Plant and utilised for ammonia production.

3. Agreements

3.1 Power supply

Electricity is the main feed stock for this Unit. An agreement for supply of power effective from January 1961, for a period of 25 years, subsists between the Bhakra Management Board and the Corporation. The agreement has, however, not been formalised. The draft agreement *inter alia* provides for :—

- (i) the quantum of power supply and power cut ;
- (ii) charges for supply ; and
- (iii) the payment of compensation/penalty on account of failure to supply power as per draft agreement.

(a) *Power supply and quantum of cut.*—The Corporation can claim undisturbed power supply of 164 M.W. (from November 1962) during the currency of the agreement. However, power cuts not exceeding 40 M.W., could be imposed by the Bhakra Management Board, if power generated in the Bhakra Complex was less than 392 M.W.

(b) *Charges for supply.*—When the factory was started, the rate fixed for power was 1.51 paise per unit (excluding electricity duty). According to the agreement, the rate was to be reviewed every quin-quennium, provided the cost of operation and maintenance varied by 25 per cent or more.

(c) *Payment of compensation/penalty.*—If the supply to the Unit was interrupted for reason other than what has been provided for in the agreement, the Unit would be entitled to claim a penalty at the rate of Rs. 5.50 per K.W. per month on 50 per cent of the contract demand for the period exceeding 200 minutes of interruptions in a month.

Implementation of the agreement

The Bhakra Management Board supplied power to the Unit in accordance with the draft agreement till May 1970, but, thereafter, power supply decreased to less than 124 M.W. In July 1970, the quota of power for Nangal Unit was pegged at 98 M.W. by a notification issued by the State Government of Punjab under the Indian Electricity Act, 1910.

The rate for power was revised to 2 paise per unit from January 1966, 2.54 paise per unit from January 1971 and 4.88 paise per unit from January 1976.

The Corporation contended that the power cut imposed was not justified as the generation at Bhakra was more than the minimum generation up to which no power cut could be imposed on the Nangal Unit. This issue together with the question of payment of compensation to the Corporation and the payment of enhanced rates was considered at the level of the then Ministers of Petroleum and Chemicals and Irrigation and Power between September 1970 and January 1971 when the following decisions were taken :

- (i) Bhakra Management Board should supply 124 M.W. of power to the Corporation and, from July 1971, it should be possible for Bhakra Management Board to give 164 M.W.
- (ii) The Bhakra Management Board should pay compensation to the Corporation at the rate of 9 paise per unit for reduction in power from 98 M.W. to 60 M.W.

The average supply of power during 1970-71 to 1977-78 was as follows :—

| <u>Year</u> | <u>Power supply in M.W.</u> |
|-------------|-----------------------------|
| 1970-71 | 105.73 |
| 1971-72 | 110.87 |
| 1972-73 | 103.02 |
| 1973-74 | 119.47 |
| 1974-75 | 74.897 |
| 1975-76 | 148.24 |
| 1976-77 | 144.21 |
| 1977-78 | 87.45 |

According to the Management, the restricted power supply during 1970-71 to 1977-78 resulted in a loss of production of 7.29 lakh tonnes of calcium ammonium nitrate (value Rs. 24.80 crores) and 25.32 tonnes of heavy water (value Rs. 1.54 crores). The compensation for supply of power at 60 M.W. or above but below 98 M.W. worked out to Rs. 3.97 crores upto 1976-77.

In a meeting held in March 1977, wherein the representatives of FCI, BBMB and Ministry of Energy were present, an agreement was finally reached which provided as follows :—

- (i) The agreement shall remain in force till 31st December 1985 or till the existing plant is retired whichever is earlier.
- (ii) The Board would supply 98 M.W. power at 100 per cent load factor to the existing plant w.e.f. 1st January 1978 and the power supply would not be reduced below 72 M.W.
- (iii) The following would be the tariff for supply of power :—
 - (a) Till 31st December 1977 when the new plant (i.e. Expansion Plant referred to in paragraph-9) would be deemed to have gone into commercial production.

..... 4.88 paise/KWH

- (b) With effect from 1st January 1978 when 98 M.W. at 100 per cent load factor would be made available.
 5.859 paise/KWH
- (c) When supply of power is less than 98 M.W. at 100 per cent load factor but not below 72 M.W.
 3.6 paise/KWH
- (d) When supply is above 98 M.W. at 100 per cent load factor.
 10.0 paise/KWH
 for the excess
 power above
 98 M.W.

The rates of power agreed to are exclusive of electricity duty levied by the State Government. No formal agreement has, however, been executed.

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

- (i) Under the agreement reached in March 1977, a payment of Rs. 10.50 crores has been made by FCI to BBMB in full and final settlement of their claims towards enhanced rates after adjusting the compensation of Rs. 3.89 crores.
- (ii) Agreement with BBMB for supply of power to old plant is in the process of execution.

3.2 Contract for the setting up of fertilizer group of plants

In Section III of Audit Report (Commercial) 1965, it was mentioned that certain disputes pending with the contractor—M/s. Saint Gobain had been referred to the International Chamber of Commerce for arbitration.

The Arbitrators gave their award on 29th September 1969 on the claims and counter claims of both the parties. After adjustment of an admitted liability of Rs. 31.69 lakhs (outside

the Arbitrator's award), the net amount recoverable from the contractor was Rs. 91.88 lakhs which was received together with interest (Rs. 8.65 lakhs) in September 1971.

The Corporation also spent Rs. 18.43 lakhs on arbitration fees, legal charges, etc.

4. Production performance

4.1 Electrolysis plant

The Plant initially consisted of 60 electrolyzers in 20 cell lines and was designed to produce hourly 26,500 cubic metres of hydrogen and 13,250 cubic metres of oxygen. From its inception, the Plant was affected by corrosion and leakage of electrolyte, resulting in fewer cell lines being available and higher specific consumption of power and caustic potash. As a result, down-time for maintenance increased and the production of hydrogen and, consequently, of ammonia was affected. The Corporation decided in December 1965 to procure 5 used electrolyzers, with connected rectifiers and transformers, from the Fertilizers and Chemicals, Travancore Limited. Of the 5 electrolyzers, 3 were installed in August 1966, in one cell line, raising the number of cell lines to 21; two were to be utilised as stand by for overhauling the installed electrolyzers. Rs. 38.45 lakhs were spent on procurement, installation, etc. of these electrolyzers.

The average number of cell lines available, production capacity and actual production of hydrogen from 1971-72 to 1977-78 were as follows :—

| Year | Average cell lines in operation | Rated capacity of hydrogen production based on 330 days working and 132 M.W. of power | Actual production of hydrogen |
|---------|---------------------------------|---|-------------------------------|
| | (No.) | in 1000 cubic metres | |
| 1971-72 | 18.30 | 2,09,880 | 1,56,836 |
| 1972-73 | 18.82 | " | 1,46,726 |
| 1973-74 | 18.47 | " | 1,68,782 |
| 1974-75 | 17.68 | " | 1,10,885 |
| 1975-76 | 19.44 | " | 2,06,040 |
| 1976-77 | 19.34 | " | 2,00,120 |
| 1977-78 | 17.67 | " | 1,22,805 |

In this connection, the following observations are relevant :—

- (a) The average number of cell lines available was less than 20. In fact, less than 18 cell lines were available on an average in 1966-67, 1967-68, 1974-75 and 1977-78. To ensure the actually attained availability of cell lines, the Unit had to undertake two major overhauls at a total cost of Rs. 110.94 lakhs from 1964-65 to 1972-73, besides an amount of Rs. 149.97 lakhs spent on normal maintenance of the Electrolysis Plant during this period. From 1973-74 onwards, expenditure on overhaul was not booked separately but formed part of maintenance expenditure, which during 1973-74 to 1977-78, worked out to Rs. 177.43 lakhs.

The Ministry have stated (November 1978) that, as no major overhauls were undertaken from 1973-74 onwards, provision was made in the normal budget estimates and expenditure was, accordingly, booked under regular repairs and maintenance.

- (b) According to the Corporation, regular operation of 18 cell lines is the minimum necessary for maintaining the rated production. But, though 18 cell lines or more were in operation from 1971-72 to 1973-74; 1975-76 and 1976-77, the Plant did not attain the rated production. This was stated to be due to reduced power supply.
- (c) According to the process scheme of the Plant, caustic potash at the rate of 0.254 tonne a day is required to produce 26,500 cubic metres of hydrogen per hour. This works out to 0.4 gramme (approximately) of caustic potash per cubic metre of hydrogen produced at the full rated production of hydrogen at 132 M.W. load.

As against this, it was mentioned by the Additional Chief Engineer in the 17th Quarterly Production Review in October 1974 that, on past experience, consumption of caustic potash was

more than 3 grammes/cubic metre and standard of 3.55 grammes at 124 M.W. load had been adopted for the years 1971-72 to 1973-74. He also mentioned that, besides load variations, other factors mentioned below were also responsible for the higher consumption of caustic potash :—

- (i) Electro-chemical corrosion of cooling chests.
- (ii) Leakage from P.V.C. separating drums.
- (iii) Leakage in gas pipelet sleeves.
- (iv) Fill and drain lines gasket failure and P.V.C. line cracks.
- (v) Loss from miscellaneous sources.
- (vi) Maintenance jobs.

In this connection, the Ministry have stated (November 1978) that consumption norms are fixed only for major items and, as caustic potash accounts for less than 1 per cent of the total cost of production, only budgetary control is exercised and no specific consumption norms have been fixed.

While remedial action was stated to have been taken, it was noticed that there was delay of six months in replacement of cooling chest tubes on account of difficulties in procuring the tubes from M/s. Indian Tube Company, Calcutta.

In this connection, the Ministry have stated (November 1978) that there was delay on the part of Indian Tube Company (the only manufacturer) in supplying the cooling chest tubes for which order had been placed on 14th May 1973, on account of unprecedented steel shortage as well as severe power cuts from the month of May 1973 onwards. In the circumstances, the process of repairing and re-conditioning of the tubes through plugging continued. The caustic potash loss during the period from October 1973 to March 1974 was about 66 tonnes more than the normal loss.

- (d) 13.250 NM³ of oxygen per hour produced in the Electrolysis Plant was being vented as this could not be used in the Nitric Acid Plant on account of

presence of caustic potash. A small purification unit was used to purify 500 NM³ per hour of oxygen and the purified gas was used in the Nitric Acid Plant for enrichment of air. However, the process has since been discontinued due to operational difficulties. The quantum vented from 1967-68 to 1977-78 was 9515.15 lakh NM³.

In July 1967, the Unit contracted with a firm to sell daily 2,000 cubic metres of oxygen (raised to 4,000 cubic metres subsequently) at 17.5 paise per cubic metre. As the firm did not fulfil its contractual obligation regarding off-take, the contract was annulled in August 1971.

Utilisation of the surplus oxygen was also considered in 1968 while finalising proposals for the Expansion Project but, to safeguard against shortage in availability of power, it was considered prudent to delink the Ammonia Plant in the Expansion Project from the dependence on surplus oxygen available from the existing facilities. To meet the requirement of oxygen for the Expansion Plant, additional air fractionation facilities have been provided for.

Between August 1972 and November 1973, the Unit was able to enter into agreements with 9 parties for supply of 19,000 cubic metres of gas per day. Out of these, only one party started lifting gas from 1974-75, though the gas lifted (7.48 lakh cubic metres) during 1974-75 to 1977-78 was much below the contracted quantity (49.10 lakh cubic metres). Another party the contract with whom had been extended for another 5 years from 6th September 1977, has failed to lift any oxygen so far (April 1979). Agreements with the remaining 7 parties were cancelled for their failure to fulfil certain terms and conditions.

4.2 Intermediate Plants

As against the rated capacity of 1.01 lakh tonnes of ammonia and 1.83 lakh tonnes of nitric acid (at 100 per cent concentration),

the production planned and actual quantities produced during the years 1971-72 to 1977-78 were as follows :—

(Figures in lakhs of tonnes)

| Year | Ammonia Plant | | | Nitric Acid Plant | | |
|---------------|---------------|---------|-------------------|-------------------|---------|-------------------|
| | Planned | | Actual production | Planned | | Actual production |
| | Original | Revised | | Original | Revised | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1971-72 . . . | 0.85 | 0.70 | 0.73 | 1.51 | 1.26 | 1.30 |
| 1972-73 . . . | 1.01 | 0.71 | 0.70 | 1.80 | 1.28 | 1.25 |
| 1973-74 . . . | 0.79 | 0.73 | 0.80 | 1.42 | 1.31 | 1.44 |
| 1974-75 . . . | 0.79 | 0.50 | 0.53 | 1.42 | 0.89 | 0.93 |
| 1975-76 . . . | 0.50 | 0.95 | 0.99 | 0.89 | 1.71 | 1.78 |
| 1976-77 . . . | 0.65 | 0.83 | 0.96 | 1.69 | 1.69 | 1.87 |
| 1977-78 . . . | 0.49 | 0.55 | 0.58 | 1.52 | 1.52 | 1.31 |

As stated in paragraph-2 approximately half of the the ammonia produced is oxidised with oxygen enriched air in the Nitric Acid Plant and absorbed in water to give nitric acid of 53% concentration. Accordingly, the capacity utilisation of Ammonia and Nitric Acid Plants was more or less the same upto the year 1975-76. However, capacity utilisation of Nitric Acid Plant was higher during the years 1976-77 and 1977-78 because of purchase of 8786.467 M.T. and 14901.135 M.T. respectively of ammonia from outside.

Variations in production from year to year and lesser quantities produced were stated to be due mainly to the fluctuating power supply.

4.3 Finished product plants

As against the rated capacity of 3.18 lakh tonnes of calcium ammonium nitrate and 14.11 tonnes of heavy water, the

production planned and actual quantities produced in the years 1971-72 to 1977-78 were as follows :—

| Year | Planned | | Actual production (Net) |
|---------------------------------|----------|---------|-------------------------|
| | Original | Revised | |
| (Figures in lakhs of tonnes) | | | |
| Calcium Ammonium Nitrate | | | |
| 1971-72 | 2.60 | 2.15 | 2.23 |
| 1972-73 | 3.08 | 2.19 | 2.14 |
| 1973-74 | 2.42 | 2.24 | 2.46 |
| 1974-75 | 2.42 | 1.52 | 1.61 |
| 1975-76 | 1.44 | 2.97 | 3.09* |
| 1976-77 | 2.88 | 2.89 | 3.20† |
| 1977-78 | 2.59 | 2.59 | 2.21† |

*Includes 4337 tonnes produced from ammonia procured from Indian Farmers Fertilizers Cooperative Limited, Kalol.

†Includes 0.27 lakh tonnes in 1976-77 and 0.45 lakh tonnes in 1977-78 produced from imported ammonia as well as ammonia procured from IFFCO and that produced in the Expansion Plant.

| (Figures in tonnes) | | | |
|---------------------|------|------|-------|
| Heavy Water | | | |
| 1971-72 | 12.5 | 11.6 | 12.1 |
| 1972-73 | 14.0 | 10.7 | 10.3 |
| 1973-74 | 12.2 | 11.6 | 11.4 |
| 1974-75 | 12.2 | 8.1 | 8.5 |
| 1975-76 | 8.1 | 13.7 | 20.0* |
| 1976-77 | 10.2 | 12.2 | 13.7 |
| 1977-78 | 8.0 | 8.3 | 9.1 |

*Includes 5.62 tonnes produced from tritiated heavy water.

In this connection, the following features deserve mention :—

- (a) Lower production compared to rated production during 1971-72 to 1974-75 and 1977-78 was mainly on account of lower availability of power. Production in 1975-76 and 1976-77 improved significantly on account of higher quantum of power. Loss of production resulting from lower availability of power

as against the contracted supply of 164 MW has been mentioned in paragraph 3.1.

In order to take advantage of higher quantum of power available during certain periods, scheduled maintenance and overhaul of certain machines were postponed or preponed in all the years.

- (b) Rated capacity of calcium ammonium nitrate and heavy water is based on 330 days stream efficiency at full load. As against this, the stream efficiency anticipated in production planning was 342 days in 1971-72, 330 days in 1972-73, 356 days in 1973-74 and 1974-75, 362 days in 1975-76, 358 days in 1976-77 and 361 days in 1977-78 at varying loads of power expected.

As the power load varied from day-to-day, actual stream efficiency is not comparable on like to like basis with the anticipated stream efficiency. However, on the basis of equated stream days on full load, the position in respect of ammonia and calcium ammonium nitrate production was as follows :—

AMMONIA PRODUCTION

CALCIUM AMMONIUM NITRATE PRODUCTION

| Year | Anticipated power load MW | Actual power load MW | Anticipated stream days on full/partial running of the Plant | Anticipated production (MT in lakhs) | Actual production (MT in lakhs) | Anticipated equated stream days on full load | Actual equated stream days | Anticipated production (MT in lakhs) | Actual production (MT in lakhs) | Anticipated equated stream days on full load | Actual equated stream days on full load. |
|---------|---------------------------|----------------------|--|--------------------------------------|---------------------------------|--|----------------------------|--------------------------------------|---------------------------------|--|--|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| 1971-72 | 135 | 110.870 | 342 | 0.85 | 0.73 | 278 | 239 | 2.60 | 2.23 | 270 | 231 |
| 1972-73 | 170 | 103.020 | 330 | 0.01 | 0.70 | 330 | 229 | 3.08 | 2.14 | 320 | 222 |
| 1973-74 | 124 | 119.470 | 356 | 0.79 | 0.80 | 258 | 261 | 2.42 | 2.46 | 251 | 255 |
| 1974-75 | 124 | 74.897 | 356 | 0.79 | 0.53 | 258 | 173 | 2.42 | 1.61 | 251 | 167 |
| 1975-76 | 72 | 148.240 | 362 | 0.50 | 0.99 | 163 | 323 | 1.44 | 3.09 | 149 | 321 |
| 1976-77 | 98 | 144.210 | 358 | 0.65 | 0.96 | 212 | 314 | 2.88 | 3.20 | 299 | 332 |
| 1977-78 | 72 | 87.450 | 361 | 0.49 | 0.58 | 160 | 190 | 2.59 | 2.21 | 269 | 229 |

- (c) To reduce the loss in production of heavy water when fertilizer plants are put into operation after annual shut-down but the Heavy Water Plant continues to be stopped for 15 to 20 days on account of maintenance, a 220 cubic metres condensate storage tank was installed in March 1968 at a cost of Rs. 0.36 lakh to collect the condensate from the second stage of electrolyzers in Electrolysis Plant. The condensate so collected is utilised in the third stage of the electrolyzers when heavy water production restarts. This has resulted in improvement in heavy water production to the extent of about 220 Kgs. per shut-down.

5. Process efficiencies

5.1. Fertilizer group of plants

It was reported in Section-III of Audit Report (Commercial) 1965 that guarantees regarding specific consumption had not been achieved in respect of the fertilizer group of plants; the Management had, therefore, fixed norms of consumption on the basis of experience. Subsequently, norms laid down by the Tendolkar Committee (January 1971), were adopted in July 1972. Appendix-I incorporates the data relating to norms and actual consumption and overall nitrogen efficiency from 1971-72 to 1977-78. For a proper appreciation of the data contained in the Appendix, the following facts are relevant :—

- (a) The quantity of hydrogen produced was calculated and not measured as no suitable instrument could be found to measure the hydrogen due to its low working pressure. Power consumed per unit of hydrogen produced was less than the norm in all the years except for 1975-76 and 1976-77 because, according to the Management, the reduced load of power available from Bhakra resulted in lower current density and decrease in specific power consumption.

The Mahadevan Committee constituted by the Corporation to review the norms recommended by the Tendolkar Committee had suggested (July 1971) revision of the existing norms for consumption of power after installation of silicon type rectifiers and activation of anodes. The Corporation stated (December 1976) as under :—

- (i) Silicon type rectifiers were not installed because no decision had been taken with regard to running of Electrolysis Plant after completion of Expansion Project.
- (ii) The activation of anodes was started in 1970 and will continue while electrolyzers were in use. It was difficult to assess the actual quantum of power savings. However, 2% saving in power was likely to be achieved after activation of all the anodes.

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

As power supply at 98 MW till December 1985 has now been assured, it has been decided to replace the mercury rectifiers with silicon rectifiers; one cell line with silicon rectifiers is planned to be commissioned in the first quarter of 1979. After watching the performance, a phased programme for installation of more silicon rectifiers will be taken up. The expected level of efficiency after changeover from mercury rectifiers to silicon type rectifiers was expected to go up from 95 per cent to 97 per cent.

- (b) Consumption of ammonia and nitric acid used for the production of calcium ammonium nitrate is recorded with reference to the level of the storage tanks. Further, the quantities of calcium ammonium nitrate produced are calculated on the basis of a

pre-determined consumption ratio (0.5798 tonne of nitric acid per tonne of calcium ammonium nitrate) of nitric acid, stated to have been established after long experience. Similarly, consumption of limestone per tonne of calcium ammonium nitrate was calculated on the basis of the pre-determined consumption ratio of 0.2825 tonne of limestone. As a result, there was no variation between the norm and actual consumption in respect of these materials. The Corporation stated (December 1976) that the production of nitric acid and calcium ammonium nitrate had to be calculated because the performance of the measuring instruments was erratic. It was further stated that another belt weighing machine for recording production of calcium ammonium nitrate was installed and commissioned in February 1971 at a cost of Rs. 0.25 lakh C.I.F. but its performance was also unsatisfactory.

The Ministry have stated (November 1978) that the cost of the defective machine supplied by the original supplier had been recovered from them and that no dependable apparatus for recording production of calcium ammonium nitrate is available as yet.

- (c) In addition to the materials mentioned above, caustic potash, caustic soda, fuel oil, soapstone, etc., are also consumed in the production of calcium ammonium nitrate. In respect of these, consumption varied widely as for example :—

| Year | Power load | Total yearly CAN Production | Total consumption of caustic potash | | Consumption of caustic potash per MT of CAN | | Total yearly consumption of fuel oil | | Consumption of fuel oil per MT of CAN | |
|---------|------------|-----------------------------|-------------------------------------|---------|---|--------|--------------------------------------|----------------|---------------------------------------|-----------|
| | | | Estimated | Actual | Estimated | Actual | Estimated | Actual | Estimated | Actual |
| | | | | | | | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| | M.W. | (in lakh tonnes) | (in tonnes) | | (in Kgs.) | | (in tonnes/Kilolitres) | | (in Kgs./litres) | |
| 1971-72 | 110.87 | 2.23 | 476 | 496.300 | 2.129 | 2.201 | 956.431 tonnes | 865.561 tonnes | 4.281 Kg. | 3.874Kg. |
| 1972-73 | 103.02 | 2.14 | 470 | 534.470 | 2.20 | 2.498 | 807.037 tonnes | 520.177 tonnes | 3.78Kg. | 2.436 Kg. |
| 1973-74 | 119.47 | 2.46 | 606 | 524.810 | 2.46 | 2.122 | 763.685 tonnes | 705.830 tonnes | 3.10 Kg. | 2.864 Kg. |
| 1974-75 | 74.897 | 1.61 | 396 | 233.728 | 2.46 | 1.437 | 499.056 tonnes | 470.710 tonnes | 3.10 Kg. | 2.924 Kg. |
| 1975-76 | 148.247 | 3.09 (3.05)* | 750 | 221.990 | 2.46 | 0.723 | 945.500 KL | 290.410 KL | 3.10 Lt. | 0.940 Lt. |
| 1976-77 | 144.21 | 3.20 (2.93)* | 381 | 177.500 | 1.30 | 0.597 | 586.000 KL | 629.965 KL | 2.00 Lt. | 1.967 Lt. |
| 1977-78 | 87.45 | 2.21 (1.76)* | 264 | 193.000 | 1.50 | 1.079 | 390.720 KL | 594.624 KL | 2.22 Lt. | 2.682 Lt. |

Notes 1. *Figures in the brackets indicate CAN production from own Ammonia.

2. Figures given in column 4, 8 and 10 are estimated consumption with reference to actual production.

Pilot plant studies were carried out during 1970-71 and 1971-72 for recovery of caustic potash from the wash water from the electrolyzers etc., which was previously drained. On the basis of pilot plant studies, a regular causticisation unit was installed in the Electrolysis Plant in 1975-76 at a cost of Rs. 0.46 lakh. On an average, about 10 tonnes of caustic potash worth Rs. 0.50 lakh was being recovered from causticisation unit per month.

As regard consumption of fuel oil, the Unit started using surplus steam available in the Ammonia Plant to dry calcium ammonium nitrate granules from 1972-73 resulting in a saving of fuel oil.

The Ministry have stated (April 1979) that no norms of consumption have been fixed for caustic potash and fuel oil as these are in the nature of "operational supplies" and only budgetary norms are fixed every year for purpose of control.

5.2 Heavy Water Plant

According to the Corporation, the process followed in the Heavy Water Plant is such that consumption of utilities (power, steam and cooling water) and materials (hydrogen, nitrogen and ammonia) is almost constant irrespective of the load at which the Plant runs. An analysis of overall estimated requirement and actual consumption of these items together with planned and actual production (given in Appendix-II) however, indicated that :—

- (i) The consumption of nitrogen and ammonia was much higher and that of steam much lower than the standard in all the years. The Ministry have explained (April 1979) that nitrogen consumption in 1976-77 and 1977-78 was higher due to transfer of nitrogen to Expansion Plant through the Heavy Water Plant.
- (ii) Even though the production of heavy water in 1975-76 at 14,353 Kilograms was the highest and

more than the rated capacity, the overall consumption of hydrogen was the lowest. The Corporation explained (March 1977) that lower consumption in 1975-76 was due to certain modifications made in the plant, as a result of which hydrogen leaking from the inner shell was being recovered and sent to the Ammonia Plant for processing. The Ministry have stated (November 1978) that the recovery of purge hydrogen through the inner shell has been discontinued due to operational disadvantages.

- (iii) Standard requirements of hydrogen, steam and ammonia were revised upward and that of nitrogen revised downward.

6. Profitability analysis

The operating income and expenditure of the Unit during the last eight years were as follows :—

(In crores of rupees)

| | 1970-71 | 1971-72 | 1972-73 | 1973-74 | 1974-75 * | 1975-76 * | 1976-77 * | 1977-78 * |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| I. Sales | 13.28 | 13.42 | 12.53 | 15.00 | 14.79 | 25.38 | 33.69 | 45.71 |
| II. Transfer of stock to other Units | 0.28 | .. | 0.18 | 0.17 | .. | .. | 0.07 | .. |
| III. Other income | 0.87 | 0.67 | 0.63 | 0.76 | 1.99 | 0.43 | 0.51 | 0.42 |
| IV. Closing stock | 0.25 | 0.13 | 0.03 | 0.04 | 0.04 | 0.63 | 0.40 | 0.48 |
| TOTAL | 14.68 | 14.22 | 13.37 | 15.97 | 16.82 | 26.44 | 34.67 | 46.61 |
| I. Opening stock | 0.45 | 0.25 | 0.13 | 0.04 | 0.04 | 0.04 | 0.63 | 0.40 |
| II. Cost of Operation | 9.18 | 9.43 | 9.07 | 10.85 | 11.03 | 15.71 | 26.21 | 41.85 |
| III. Depreciation | 2.19 | 2.20 | 0.49 | 0.45 | 0.45 | 0.47 | 0.46 | 0.47 |
| IV. Provision for bad & doubtful debts | .. | .. | .. | .. | .. | 0.01 | .. | 0.02 |
| V. Share of Central Office ex- penses & services rendered by other Units/Divisions | 0.18 | 0.22 | 0.19 | 0.27 | 0.19 | 0.31 | 0.41 | 0.74 |
| TOTAL | 12.00 | 12.10 | 9.88 | 11.61 | 11.71 | 16.54 | 27.71 | 43.48 |
| VI. Operating profit | 2.68 | 2.12 | 3.49 | 4.36 | 5.11 | 9.90 | 6.96 | 3.13 |

*This excludes Fertiliser Pool Equalisation Charges.

Note : The figures of operating profit include Rs. 0.65 crore in 1970-71, Rs. 0.46 crore in 1971-72, Rs. 0.40 crore in 1972-73, Rs. 0.55 crore in 1973-74, Rs. 1.72 crores in 1974-75, Rs. 0.11 crore in 1975-76 and Rs. 0.08 crore in 1976-77 as compensation from Bhakra Management Board for power cut.

- (a) The Unit has been making profit since its inception except in 1961-62 when it incurred a loss of Rs. 0.13 crore. The profit earned by the Unit till the 31st March 1978 totalled Rs. 57.37 crores. The main factor responsible for the sustained profitability of the Unit has been stability in the variable cost of production of calcium ammonium nitrate which in turn was mainly contributed by feedstock (i.e. electricity) being available at a stable price till 1975-76. The electricity rates were revised from Rs. 28.175 per MWH in 1975-76 to Rs. 61 per MWH in 1976-77. The decrease in profit in 1976-77, notwithstanding higher level of production, was mainly contributed by higher cost of electricity. Further, steep decline in profit during 1977-78 was owing to lower production of calcium ammonium nitrate as well as heavy water.

In addition to the sale of calcium ammonium nitrate and heavy water, total sales included sale of imported fertilizers, fertilizers produced by other units and industrial products ; details are given below :—

(In crores of rupees)

| Item | 1970-71 | 1971-72 | 1972-73 | 1973-74 | 1974-75 | 1975-76 | 1976-77 | 1977-78 |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| (1) Fertilizers | | | | | | | | |
| (a) Calcium Ammonium Nitrate | 11.36 | 11.69 | 11.40 | 13.81 | 11.85* | 23.14* | 27.55— | 20.10* |
| (b) Other Units' products | 0.97 | 0.61 | 0.14 | .. | .. | 0.94 | 2.24 | 2.97 |
| (c) Imported | 0.44 | 0.19 | .. | 0.33 | 1.94 | .. | 2.39 | 21.21 |
| (ii) Heavy Water | 0.45 | 0.80 | 0.74 | 0.71 | 0.72 | 0.77 | 0.83 | 0.78 |
| (iii) Industrial products | 0.06 | 0.13 | 0.25 | 0.15 | 0.28 | 0.53 | 0.68 | 0.65 |
| TOTAL | 13.28 | 13.42 | 12.53 | 15.00 | 14.79 | 25.38 | 33.69 | 45.71 |

*This excludes Fertilizer Pool Equalisation Charges which are payable to Government.

—Including retention price subsidy amounting to Rs. 1.55 crores.

(b) The Unit does not work out the product-wise profit or loss. Calculated on the average sales realisation and average cost of production, product-wise profitability was as follows (no profit accrues) to the Unit on the sale of imported fertilizers and the fertilizers produced by other Units):—

| (Rupees in crores) | | | | | | | |
|--|---------|---------|---------|---------|---------|---------|---------|
| Product | 1971-72 | 1972-73 | 1973-74 | 1974-75 | 1975-76 | 1976-77 | 1977-78 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| (i) Calcium Ammonium Nitrate (including industrial products) | 1.91 | 3.11 | 3.97 | 4.71 | 9.48 | 6.58 | 2.74 |
| (ii) Heavy Water | 0.21 | 0.38 | 0.39 | 0.40 | 0.42 | 0.38 | 0.39 |

Based on estimates.

(c) The increase in profit in 1972-73 and over 1971-72 was contributed by :—

(i) lower cost of production in 1972-73 on account of reduction in the incidence of depreciation; and

(ii) partly by lower cost of production as mentioned above and partly on account of increase in the average sales realisation in 1973-74.

The increase of Rs. 0.75 crore in the operating profit of 1974-75 over that of 1973-74, inspite of calcium ammonium nitrate produced being 1.61 lakh tonnes in 1974-75 as compared to 2.46 lakh tonnes in 1973-74, was mainly due to :—

- (i) increase in the sale price of calcium ammonium nitrate from June 1974 which contributed Rs. 2.29 crores ; and
- (ii) increase of Rs. 1.16 crores in the compensation paid by the Bhakra Management Board on account of less power supplied.

The profit of Rs. 9.90 crores in 1975-76 has been arrived at without taking into account a provision of Rs. 1.19 crores on account of increase in electricity rates effective from January 1976 which was made in 1976-77. Even then the profit achieved in 1975-76 was the highest in any year so far and resulted mainly from the substantial increase in production of calcium ammonium nitrate and heavy water as well as increased sales realisation and better usage efficiencies. Even though the production in 1976-77 was higher than the level attained in 1975-76, there was decline in profit mainly caused by higher incidence of electricity charges as mentioned in (a) above. Further decline in the profit in 1977-78 over that of 1976-77, was due to lower level of production achieved in that year.

7. Costing

7.1 System.—The Unit follows a system of process costing for ascertaining the cost of finished and intermediate products. As in the case of other Units, estimates of cost are prepared annually on the basis of the budgeted production and consumption ratios and actual cost is analysed with reference to the estimated cost.

7.2 Actual cost of production

(i) The actual and estimated costs and the net sales realisation per tonne of calcium ammonium nitrate in the years 1971-72 to 1977-78 were as follows :—

| | 1971-72 | | 1972-73 | | 1973-74 | | 1974-75 | | 1975-76 | | 1976-77 | | 1977-78 | |
|--|---------------------|-------------|---------------------|-------------|---------------------|-------------|---------------------|-------------|---------------------|-------------|---------------------|-------------|---------------------|-------------|
| | Esti- mat- ed | Act- ual | Esti- mat- ed | Act- ual | Esti- mat- ed | Act- ual | Esti- mat- ed | Act- ual | Esti- mat- ed | Act- ual | Esti- mat- ed | Act- ual | Esti- mat- ed | Act- ual |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| Cost of Production | | | | | | | | | | | | | | |
| (i) Variable cost (Rs.) . | 151 | 145 | 149 | 143 | 149 | 144 | 148 | 136 | 149 | 145 | 148 | 290 | 272 | 291 |
| (ii) Fixed cost (Rs.) . | 180 | 192 | 185 | 137 | 131 | 142 | 144 | 228 | 168 | 146 | 195 | 157 | 323 | 285 |
| (iii) Cost per tonne (Rs.) . | 331 | 337 | 334 | 280 | 280 | 286 | 292 | 364 | 317 | 291 | 343 | 447 | 595 | 576 |
| (iv) Bagging (Rs.) . | 48 | 48 | 52 | 50 | 50 | 49 | 52 | 65 | 62 | 60 | 63 | 60 | 63 | 64 |
| (v) Selling and distribu- tion expenses (Rs.) . | 6 | 3 | 5 | 5 | 7 | 6 | 10 | 12 | 13 | 10 | 8 | 11 | 27 | 26 |
| Total cost (Rs.) per tonne (Gross) . | 385 | 388 | 391 | 335 | 337 | 341 | 354 | 441 | 392 | 361 | 414 | 518 | 685 | 666 |
| (vi) Net sales realisation (Rs.) . | .. | 446 | .. | 450 | .. | 470 | .. | 611 | .. | 672 | .. | 690 | .. | 761 |
| (vii) Profit per tonne (Rs.) | .. | 58 | .. | 115 | .. | 129 | .. | 170 | .. | 311 | .. | 181 | .. | 95 |

It will be seen that the cost of production after remaining more or less stable upto 1975-76 (except in 1974-75) registered a substantial increase in 1976-77 and 1977-78. The increase in cost in 1974-75 was mainly caused by higher incidence of fixed cost because of the lower volume of production and increase in the cost of bags. With the increase in the volume of production in 1975-76, cost of production again declined. Rise in the cost of production during 1976-77 and 1977-78 was attributed to increase in ratio of inputs and fixed costs e.g. salaries and maintenance expenditure etc. and fluctuation in production. Increase in the net sales realisation during 1977-78 was owing to upward revision of selling price of calcium ammonium nitrate.

(ii) As regards heavy water, the actual cost varied widely from year to year due to production fluctuations. The cost of production and sale price of heavy water during 1971-72 to 1977-78 were as follows :—

| Year | Cost of pro- duction | Sale price (Rupees per Kg.) |
|---------|-------------------------|--------------------------------|
| 1971-72 | 401.43 | 566.50 |
| 1972-73 | 320.48 | 676.00 |
| 1973-74 | 275.02 | 629.00 |
| 1974-75 | 381.09 | 871.00 |
| 1975-76 | 253.36 | 566.00 |
| 1976-77 | 322.24 | 632.09 |
| 1977-78 | 515.67 | 1000.00 (Provisional) |

8. Inventory control

The stocks held by the Unit as at the end of each year were as follows :—

(Rupees in lakhs)

| | As on 31st March | | | | | | | |
|--|------------------|--------|--------|--------|--------|--------|--------|---------|
| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
| 1. Stores and Spares (excluding material in transit) . . . | 267.84 | 251.20 | 220.33 | 220.84 | 225.71 | 232.02 | 217.56 | 214.21* |
| 2. Raw materials (excluding materials in transit) . . . | 3.11 | 3.62 | 3.08 | 2.42 | 5.35 | 3.00 | 2.07 | 6.23 |
| 3. Packing materials . . . | 0.98 | 24.67 | 5.17 | 2.78 | 1.13 | 13.97 | 10.43 | 27.59 |
| 4. Finished goods . . . | 20.74 | 6.63 | 0.05 | 0.66 | 0.79 | 62.09 | 39.21 | 47.08 |

*Includes stand-by assemblies of Rs. 20.96 lakhs.

The following facts are relevant :—

- (a) Out of the stores and spares of the value of Rs. 214.21 lakhs as on 31st March 1978, spares accounted for Rs. 158.50 lakhs (indigenous spares—Rs. 65.97 lakhs and imported spares—Rs. 92.53 lakhs). According to the reply furnished by the Ministry (November 1978), spares included insurance items of the value of Rs. 47.15 lakhs including stand-by assemblies of the value of Rs. 20.96 lakhs.
- (b) Stores and spares valued at Rs. 78.24 lakhs had not moved for 3 years and more as on 31st March 1978, some details are given below :—

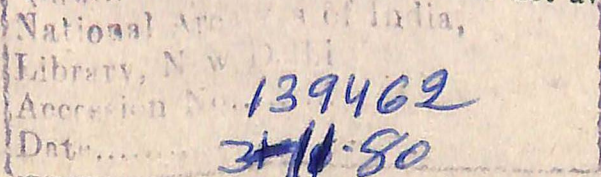
| | (in lakhs of rupees) | |
|------------------|----------------------|---------------|
| | Indige- nous | Im- ported |
| Spares | 9.39 | 57.66 |
| Stores | 8.75 | 2.44 |
| | <u>18.14</u> | <u>60.10</u> |

- (c) Compared to the norms for holdings fixed by the Corporation, the value of the excess inventory of the Unit stood at Rs. 43.82 lakhs, after taking into account the extent of inventory holdings less than the norms (Rs. 37.32 lakhs).

In addition, the Unit had surplus stores of the value of Rs. 13.68 lakhs (including imported items valued at Rs. 8.61 lakhs).

A Committee was constituted by the Corporation, in April 1975, to review the existing norms for inventory holdings in Fertilizer Corporation of India units. The Committee, while recommending norms, had stated (January 1976) as follows :—

- (i) It was difficult to recommend a workable norm in respect of regular spares, as detailed information regarding periodicity of their use was not available.



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

The Ministry have stated (April 1979) that the Bureau of Public Enterprises has carried out the study in respect of some of the units of Fertilizer Corporation of India but no such study has so far been taken up in respect of the Nangal Unit.

9. Nangal Expansion Project

9.1 Background

The Techno-economic Feasibility Report for the expansion of the Nangal Unit to use surplus oxygen from the existing plant and heavy petroleum fractions available from the domestic refineries, was submitted to Government in September 1968. The Report envisaged the setting up of production facilities for 600 tonnes per day of ammonia (maximum capacity that could be installed as per the availability of oxygen admixed with air) and 1000 tonnes per day of urea using LSHS as feedstock. After discussions, the World Bank who had been approached for financing the project, accepted, in July 1970, the Montedison process for production of ammonia and urea and, in November 1970, agreed to Shell Gasification for partial oxidation of heavy stock.

Meanwhile, as mentioned in para 3, the Bhakra Beas Management Board began restricting power supply to the Nangal Plant from the year 1970. To safeguard against the consequences of shortage in availability of power and thereby of oxygen, which would result in reduced capacity utilisation of the proposed 600 tonnes per day Ammonia Plant, it was considered prudent to de-link the Ammonia Plant completely from the existing Plant for supply of oxygen. Since this involved putting up an independent oxygen Plant for meeting the requirement of the Expansion Plant, it was considered advisable to increase the capacity of Ammonia Plant to 900 tonnes and urea to 1500 tonnes to partially off-set

the incidence of increased capital cost and also to have the advantage of economies of scale. Accordingly, a revised Feasibility Report based on Shell Process for partial oxidation of heavy stock and Montedison process for Ammonia and Urea Plants was submitted to Government in May 1971.

The World Bank Mission visited India in August/September 1971 to appraise the project. During discussions the following alternatives were considered :—

| | |
|------------------------|---------------------|
| I. Ammonia | 600 Tonnes per day |
| Urea | 1000 Tonnes per day |
| II. Ammonia | 900 Tonnes per day |
| Urea | 1500 Tonnes per day |
| III. Ammonia | 900 Tonnes per day |
| Urea | 1000 Tonnes per day |
| IV. Ammonia | 1200 Tonnes per day |
| Urea | 1500 Tonnes per day |

In case of alternatives III & IV, 300 tonnes per day of ammonia were to be made available to the existing Plant for production of calcium ammonium nitrate, and the production of ammonia from the existing Plant, based on electrolysis, was to be discontinued after the expansion project went into production. The option to close down the electrolysis plant or not was, according to the Ministry, kept open to be exercised later as per the power situation.

It was finally decided to set up a larger ammonia capacity in an integrated manner in one go and the alternative III, as favoured by the Bank (February 1973) which agreed to give a loan of \$ 58 million, was accepted by Government.

The project was sanctioned by Government in April 1973 at a capital cost of Rs. 75.60 crores (including Rs. 39.05 crores in foreign exchange).

In pursuance of the discussions with the Bank, Fertilizer Corporation of India contacted reputable design engineering firms such as Topsoe, Kellog, CF Braun, Uhde, etc. to explore their

participation with Fertilizer Corporation of India in design and engineering of the Ammonia Plant. Uhde/Lurgi/Topsoe were selected, on the basis of this exercise, as contractors for design and engineering of the Ammonia Plant. In regard to Urea Plant, collaboration with Montedison was agreed to.

As already mentioned in para 3.1, agreement has since been reached between the Corporation and the Bhakra Beas Management Board, regarding supply of power upto 31st December 1985. The Ministry have intimated (December 1978) that, as decision on availability of 98 MW had already been finalised, production of ammonia from the existing Plant, by electrolysis, would continue.

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

“The additional ammonia available from the electrolysis plant would be of the order of about 180 tonnes/day. This would meet any imbalance up to 80 per cent (25,000 tonnes per annum) between the ammonia and urea plants in each of the NFL plants, viz., Nangal, Bhatinda and Panipat. This is in line with the projections prepared by the Project Appraisal Division of the Planning Commission in September/October 1978.

Action for setting up necessary facilities for unloading and storage of ammonia at each of the plants has been initiated”.

A separate agreement for the supply of 35 MW power to meet the power requirement of the Expansion Plant has since been executed with the Punjab State Electricity Board.

The Expansion Plant was completed in June 1977 and commissioned in January 1978. 1st November 1978 has been declared as the date of commencement of commercial production.

9.2 Participants in the execution of the Project

As already mentioned in the above para, the Expansion Project is based on Shell partial oxidation of fuel oil. Technical designs, etc. for the gasification and purification system of the Ammonia Plant were furnished by M/s. Shell and Lurgi and those for ammonia synthesis by M/s. Fredrich Uhde of West Germany. For the Urea Plant, technical designs etc. were provided by Technimont of Italy.

Detailed engineering of the Ammonia Plant was the responsibility of the Planning and Development Division of the Corporation under the supervision of M/s. Uhde. The detailed engineering of the Urea Plant was also the responsibility of the Planning and Development Division, but drawings were to be checked by M/s Technimont. Equipment for both Plants have been procured by the Planning and Development Division with the assistance of M/s. Uhde and Technimont.

9.3 Feedstock

Specifications.—Negotiations for supply of fuel oil to the Project were held by the Corporation with the Indian Oil Corporation in March 1973. During negotiations, Indian Oil Corporation agreed to supply fuel oil with a sulphur content of 3.5 per cent as the maximum, 2.5 per cent as the minimum and 3.00 per cent as the average. Accordingly M/s. Uhde and M/s. Lurgi, suppliers of technical designs etc. for Ammonia Plant, were asked in March 1973 to design the Plants on the basis of fuel oil containing 3.5 per cent sulphur content. In May 1973 however, the Indian Oil Corporation, revised the specification relating to sulphur content to 4 per cent and, as a result, the Corporation had to make additional payment of DM 45,000 (Rs. 1.34 lakhs) to M/s. Uhde who contended that the process data and design condition of certain plants needed recalculation in the light of the revised specifications. The revision of specifications also led to a delay of 4 weeks in completing the design.

The matter regarding recovery of additional expenditure of Rs. 1.35 lakhs was taken up by the Corporation with Indian Oil Corporation in August 1975 but (according to the Ministry) the same was not pursued in view of the position explained by Indian Oil Corporation that the availability and specification of feed-stock depended on the source of crude, refining capacity, product mix, etc.

While the project based on fuel oil containing 4 per cent sulphur and other specifications given by the Indian Oil Corporation in March 1973, has been completed, an agreement incorporating these and other terms such as fixation of sale price, etc. has not yet been executed.

The Ministry have stated (November 1978/April 1979) as follows :—

- (i) Indian Oil Corporation forwarded their draft agreement on 5th June 1975, with proposed date of effect of the agreement from 1st July 1976. The specifications of the feed stock were not mentioned as the same were to be finalised by the Ministry of Petroleum and Chemicals. The feed stock specifications were finalised in a meeting held in the Ministry of Chemicals and Fertilizers in July 1976. It was mentioned during these discussions that, in all probability, supplies prior to 1980 would be that of LSHS, the viscosity of which will not be higher than 150 CST at 50°C. Regarding the indicative properties as covered in the record note of discussion held in Ministry in July 1976, Indian Oil Corporation agreed to incorporate the same only as a side letter to the contract and also confirming that pour point of LSHS would not exceed 60°C. A mutually agreed draft contract between Fertilizer Corporation of India, Nangal Unit and Indian Oil Corporation was finalised only in January 1978. With effect from 1st April 1978,

Nangal Unit became a part of the NFL. It was, therefore, considered advisable to execute a joint agreement covering supplies to Nangal as well as Bhatinda and Panipat. The details were, therefore, sorted out with Indian Oil Corporation and a composite agreement for supply of feed stock to Nangal, Bhatinda and Panipat Project is in the final stage of execution.

- (ii) Regarding price, it was stated that "Indian Oil Corporation in their letter dated 27th February 1978 stated that the Government of India have frozen the prices effective from 16th December 1977 and the same would be Rs. 766.70 per M.T. Ex-Koyali and Rs. 722.83 per M.T. Ex-Barauni, applicable for use as feed stock. The contract is under finalisation and is expected to be signed shortly".
- (iii) "For the initial period of trial runs, Fuel Oil of the agreed specifications were supplied. The plant has now switched over to LSHS as feed stock. So far, no special difficulties have been encountered regarding the specifications of feed stock".

It may be mentioned that the switchover from fuel oil to LSHS as feed stock necessitated modifications in the existing feed stock handling system, which were carried out by the Unit at a cost of Rs. 24.95 lakhs.

9.4 Capital Expenditure decisions

9.4.1 *Project estimates.*—As mentioned earlier, the project was approved by Government in April 1973 at a total cost of Rs. 75.60 crores. These estimates were further revised upward by the Corporation from time to time and approved by Government in October 1978, *vide* details given below :—

(In crores of Rupees)

| Sl. No. | Item | Estimates of September 1972 as approved by Govt. in April, 1973 | | | Estimates as revised in November 1975 | | | Estimates as approved by Govt. in October 1978 | | | Expenditure upto 31-3-1978 | | |
|---------|------------------------------|---|-------|-------|---------------------------------------|-------|--------|--|-------|--------|----------------------------|-------|--------|
| | | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total | F.C. | I.C. | Total |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| 1. | Total fixed cost | 32.54 | 26.10 | 58.64 | 42.04 | 63.34 | 105.38 | 40.05 | 75.25 | 115.30 | 38.87 | 77.86 | 116.73 |
| 2. | Margin on working capital | .. | 1.57 | 1.57 | .. | 2.33 | 2.33 | .. | 1.52 | 1.52 | .. | .. | .. |
| 3. | Interest during construction | .. | 3.73 | 3.73 | .. | 9.01 | 9.01 | .. | 12.15 | 12.15 | .. | 11.73 | 11.73 |
| 4. | Marketing & training | .. | .. | .. | .. | 0.30 | 0.30 | .. | 0.46 | 0.46 | .. | 0.45 | 0.45 |
| 5. | Contingencies | 6.51 | 5.15 | 11.66 | 0.62 | 0.94 | 1.56 | 0.10 | 0.30 | 0.40 | .. | .. | .. |
| | | 39.05 | 36.55 | 75.60 | 42.66 | 75.92 | 118.58 | 40.15 | 89.68 | 129.83 | 38.87 | 90.04 | 128.91 |

Note : F.C. stands for foreign exchange component and I.C. for Indian rupee component.

It will be seen that the approved estimates of October 1978 were higher by Rs. 54.23 crores than the original estimates, an increase of approximately 72 per cent.

The following reasons have been assigned by the Ministry for the increase :—

| | (Rupees in crores) |
|--|--------------------|
| 1. Change in scope | 5.14 |
| 2. Change in parity | 11.02 |
| 3. Price escalation | 6.22 |
| 4. Items for which no provision was made in the original estimates | 7.28 |
| 5. Inadequate provision | 6.72 |
| 6. Increase in financing charges | 8.37 |
| 7. Increase in departmental charges | 2.07 |
| 8. Increase in customs duty, sales tax, ocean freight, inland handling, etc. | 3.28 |
| 9. Others | 4.13 |
| TOTAL | 54.23 |

9.4.2 Purchase of construction equipment

In November 1973, the Project Manager floated an enquiry to the Indian Farmers Fertilizers Cooperative Limited (IFFCO) for ascertaining whether one 150 tonne crane and gin poles which had been imported by them from a U.K. firm on rental basis for their Kalol Project, could be lent for erection of towers and column of the Expansion Project. While confirming (December 1973) the availability of these equipment, IFFCO, however, suggested to the Corporation the desirability of their out right purchase for being used in their projects under construction.

The matter was pursued further by the O.S.D. (projects) at the Central Office. In July 1974, the Corporation approved, in principle, the acquisition of above referred equipment (subject to settlement of price and release of foreign exchange) on the consideration that these would be very useful for the various projects under construction and could be used immediately at Talcher/

Ramagundam for erection of a number of heavy towers. The equipment were inspected in July 1974 by a team of engineers who opined as follows :—

“We are satisfied that Fertilizer Corporation of India can use these items, particularly the gin poles, where relatively heavy equipment (beyond 200 tonnes range) are to be erected at height above 50.”

“It will be very useful for Fertilizer Corporation of India to acquire the crane and the gin poles in combination of which almost all types of vessels of different height and weight can be installed. Even if the crane is not available, only the poles can be purchased.”

Finally, the Corporation went in for the purchase of gin poles and requested (September 1974) the Ministry for the release of foreign exchange as well as clearance of the Director General Technical Development. The Corporation certified that, having regard to the condition of the equipment and CIF value of Rs. 22.04 lakhs declared at the time of import, the price of £ 40,000 plus customs duty settled by the Corporation was technically reasonable. In addition, the Corporation also contracted liability for rental of £ 574 (subsequently reduced to £412.50 per week) which was to be paid by IFFCO to the U.K. firm from 1st September 1974 till the equipment was returned or acquired. The foreign exchange was released on 30th January 1975 and the purchase price (Rs. 7.57 lakhs) was remitted to the U.K. firm in May 1975 and customs duty (Rs. 6.16 lakhs) and rental charges (Rs. 2.65 lakhs) were reimbursed to the IFFCO in August 1975.

Final inspection and take over of gin poles at IFFCO site at Kalol was arranged in May 1975 and it was decided on 2nd May 1975 to shift these to Nangal for being used in the Expansion Project. Actual transportation, however, took place in December 1975/January 1976 at a cost of Rs. 1.49 lakhs. Meanwhile, in August 1975 the Expansion Project had received

a 200 ton capacity crane from VOLTAS against an order placed by the Project in March 1974. This crane was commissioned in the same month. The erection of towers was taken up in April 1976 and completed in December 1976 with the help of the crane. Although the gin poles had been received at the site much earlier than April 1976, these were not erected at all and were repacked in boxes, after being unpacked and inspected. In fact, the Corporation had decided in January 1976 (i.e. 3 months before erection of towers for Expansion Project) to check with Ramagundam, Talcher, Sindri and Haldia projects whether any of them would acquire the equipment. It was finally transported to Ramagundam Project in September 1976 at a cost of Rs. 1.46 lakhs at the instance of the Bharat Heavy Plate Vessels Limited (another Government Company) who were the supply-cum-erection contractors and were to utilise these for the erection of equipment at Ramagundam Project. Subsequently, however, the Bharat Heavy Plate Vessels Limited intimated (January/June 1977) the Corporation about non-use of gin poles, as their sub-contractors had shifted their own derricks and preferred not taking risk of experimenting with the gin poles. The Corporation recovered the transportation cost from the bills of the Bharat Heavy Plate Vessels but no hire charges could be recovered as the gin poles had not been used. Bharat Heavy Plate Vessels have, however, protested against the deduction of Rs. 1.46 lakhs from their bills.

The gin poles were not also used at Sindri Modernisation and Haldia Projects as the crane released from the Nangal Expansion could be used at these projects.

A Committee was appointed by the Corporation in October 1977 for examination and reporting on the utilisation of gin poles. An interim report was submitted by the Committee in March 1978. As it did not bring out the full aspects referred to the Committee, a fuller report was asked for. The report is yet to be submitted (November 1979).

Thus, the gin poles purchased at a cost of Rs. 16.38 lakhs (including Rs. 7.57 lakhs in foreign exchange) on which avoidable transportation charges amounting to Rs. 2.95 lakhs had been incurred, could not be used till date.

9.5 *Schedule for completion and commissioning*

9.5.1 *Completion*

The time schedule approved by the Corporation in October 1972 envisaged a period of 36 months for completion of the Expansion Project from the zero date (20th March 1973). This period was enhanced to 42 months in August 1974, 52 months in August 1975 and 56 months in July 1977.

The time schedule for completion of the project along with the actual dates of completion is given below :—

| Item | Time Schedule for completion of Project | | | | Actual dates of completion |
|----------------------------|---|-------------------------------|-------------------------------|-----------------------------|----------------------------|
| | Original 12th October 1972 | Ist Revision 30th August 1974 | 2nd Revision 29th August 1975 | 3rd Revision 11th July 1977 | |
| 1. Zero date | March 1973 | March 1973 | March 1973 | March 1973 | March 1973 |
| 2. Erection | 20-10-1975 (31 months) | 20-4-1976 (37 months) | 23-2-1977 (47 months) | 30-6-1977 (51 months) | 30-6-1977 (51 months) |
| 3. Commissioning | 20-1-1976 (34 months) | 20-7-1976 (40 months) | 31-5-1977 (50 months) | 7-9-1977 (54 months) | 6-1-1978* (58 months) |
| 4. Production | 20-3-1976 (36 months) | 20-9-1976 (42 months) | 1-8-1977 (52 months) | 7-11-1977 (56 months) | 1-11-1978** |

*Urea Plant commissioned on 12th December 1977.

**Declared to have gone into commercial production from this date.

The extension of the time schedule by 20 months was caused by :—

- (i) Delay in completion of basic designs by M/s. Uhde because of the change in the specification of the feed-stock.
- (ii) Delay ranging from 6 to 8 weeks in receipt of basic design documents from M/s. Uhde and Technimont on account of delays in post.
- (iii) Delay caused by revision of specifications by M/s. Uhde and M/s. Lurgi for major equipment, such as rectisol towers and instruments.
- (iv) Inadequate response to global tenders, thereby necessitating re-floating of enquiries, and a delay of 3 to 4 months in ordering certain critical equipment.
- (v) Failure of both indigenous and foreign suppliers to stick to the committed delivery schedules. For the Bharat Heavy Plates & Vessels Limited, delay in respect of 63 items of equipment due for delivery by April 1975, was estimated at 58 weeks.
- (vi) The delivery of the equipment for Ammonia and Urea Plants by M/s. Bharat Heavy Plates & Vessels Limited further slipped to 93 weeks. Slippage of delivery schedules had maximum impact of 19 to 26 weeks on the completion schedules of Ammonia and Urea Plants respectively.
- (vii) M/s. Flexitallic Gasket Limited, U.K. supplied lens gaskets for Ammonia Synthesis Section on 24th January 1977 against original date of delivery *i.e.*, 2nd November 1975. This delay had a direct impact of 23 weeks in the erection of piping.

In additions to the delays mentioned above, delay in completion of civil works was also a factor responsible for prolongation of the schedule for completion (refer paragraph 9.5.2.).

The process guarantee for Ammonia Plant obtained from M/s. Uhde expired in March 1977 and performance and workmanship guarantee in respect of certain other equipment also expired before commencement of production.

The Ministry have stated (November 1978/April 1979) as follows :—

The process guarantee for Ammonia Plant had been extended upto 30th September 1978. The guarantee test of Ammonia Plant was planned for September 1978 after successful operation at 90 to 97 per cent load. The guarantee test could not be performed by end of September 1978 because of plant shut down due to certain problems in Co-conversion section. Presently, the negotiations are being held with M/s. Uhde for further extension of guarantees.

In view of the overall slippage in the project schedule, the bank guarantees were allowed to lapse on the expiry of their validity periods in respect of other equipment.

9.5.2 *Factory civil works*

The construction of factory civil works (Part I and II) including additional structural steel work was awarded in February 1974 to the lowest tenderer (M/s. Shah Construction Company) for Rs. 2.75 crores (Rs. 1.69 crores for Part I and Rs. 1.06 crores for Part II). Both parts of the work were to be started not later than March 1974 and Part I works were to be completed in all respects by March 1975 and Part II works by June 1975. The various sections of Part I & II were, however, completed in November 1976 and July 1976 respectively.

The delay in completion of work was attributed partly to inadequate labour employed by the contractor and partly to the Management because of delay in making available the drawings (which were received late from the Planning and Development Division) and 'holds' imposed temporarily by the site management.

The contractor was liable to pay liquidated damages at 5 per cent of the total value of the particular section or sections of work remaining incomplete. The Corporation stated (December 1976) that the contractor had been given notice of the liquidated damages payable by him pending calculation of the actual amount of liquidated damages.

The value of the work executed under Part I & II of the civil works upto March 1978 had exceeded the contract value by Rs. 59.47 lakhs.

The increase of Rs. 59.47 lakhs has been ascribed by the Unit to the change of specification in civil works (Rs. 7 lakhs), labour escalation (Rs. 15 lakhs), increase in the quantity of structural steel work (Rs. 25 lakhs), difference in cost of cement and steel (Rs. 11.75 lakhs) and expenditure on daily rated staff employed by the Corporation (Rs. 0.72 lakh).

The Ministry have stated (November 1978) that the General Manager, Barauni Unit was appointed as sole arbitrator in October 1977 to settle the dispute with M/s. Shah Construction Company, and that the arbitration hearings may continue upto April/May 1979.

The total amount claimed by the contractor was Rs. 64.91 lakhs (including Rs. 7.29 lakhs imposed as liquidated damages by the Corporation for delay in completing the work) and the counter-claims filed by the Corporation amounted to Rs. 17.42 lakhs.

9.6 *Economic viability*

On the basis of the estimates of capital cost (Rs. 75.60 crores), as approved by Government in April 1973, profitability projections of the Expansion project envisaged a net profit of Rs. 7.51 crores assuming that 90 per cent of the capacity would be utilised.

Estimates of capital cost increased from Rs. 75.60 crores in April 1973 to Rs. 118.58 crores in July 1976. Consequent on increase in capital cost, the profitability of the Expansion Project and of the existing Unit together, was computed by the Management on the following basis :—

- (a) utilisation of 90 per cent of the rated capacity both of the Expansion and existing plants;
- (b) adoption of prices of fuel oil (feedstock), urea and calcium ammonium nitrate (finished products), etc., ruling in June-July 1976;
- (c) consumption efficiency as guaranteed by the Plant designers.

The study indicated a net loss of Rs. 193.70 lakhs after providing for depreciation and interest on working capital but without providing for interest on long-term loan. On this basis, the combined Plant was expected to break even at 97.97 per cent of the rated capacity.

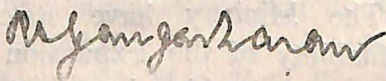
The Ministry have stated (November 1978) that the profitability of the Expansion Plant and existing unit together (but without taking into account of production of ammonia by the old plant) was again computed on revision of cost estimates to Rs. 129.83 crores in October 1978 on the following basis :—

- (a) Utilisation of 90 per cent and 80 per cent of the respective rated capacities of expansion and existing Plants.
- (b) Adoption of prices of fuel oil (feedstock) ruling in January 1978 and of finished products namely, Urea and CAN in accordance with the retention prices fixed by the Marathe Committee from 1st November 1977 and further increased by Government by Rs. 8.70 and Rs. 5.15 per tonne respectively from 1st March 1978 to compensate for the levy of special excise duty.
- (c) Consumption norms as guaranteed by the Plant designers.

Based on the above, the profitability analysis of Expansion Project at 90 per cent and 80 per cent capacity utilisation has been computed as under.

| | 90 per cent | 80 per cent |
|---|----------------|----------------|
| | (Rs. in lakhs) | |
| 1. Operating profit | 1408.5 | 852.6 |
| 2. Interest on long term debt | 578.9 | 578.9 |
| 3. Net income after interest | 829.6 | 273.7 |
| 4. Break even point | 60% | |

The break even point has thus shifted from 97.7 per cent to 60 per cent of utilisation of capacity. This is mainly because of increase in the selling prices of Urea and CAN and decrease in the price of feed stock.

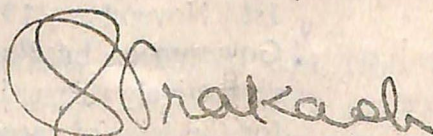


(P. P. GANGADHARAN)

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

New Delhi
The 21-3-1980.

Countersigned



(GIAN PRAKASH)

Comptroller and Auditor General of India

New Delhi
The 21-3-1980.

APPENDIX I

(Referred to in paragraph 5.1)

Statement showing the norms and actual consumption and overall nitrogen efficiency of fertilizer group of plants for the year 1971-72 to 1977-78.

| Item | Unit | Design Norms | Tendolkar norm | A 1971- 72 | C 1972- 73 | T 1973- 74 | U 1974- 75 | A 1975- 76 | L 1976- 77 | 1977- 78 |
|-----------------------------------|--------------|--------------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|-------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Hydrogen | | | | | | | | | | |
| Power—per cubic metre of hydrogen | KWH | 5.3 | 5.55 | 5.355 | 5.274 | 5.437 | 5.058 | 5.582 | 5.585 | 5.269 |
| Ammonia | | | | | | | | | | |
| Hydrogen per tonne of ammonia | cubic metres | 2070 | 2090 | 2130 | 2106 | 2105 | 2103 | 2080 | 2079 | 2100 |
| Nitric Acid | | | | | | | | | | |
| Ammonia per tonne of nitric acid | Tonnes | 0.2868 | 0.293 | 0.292 | 0.291 | 0.2918 | 0.291 | 0.2937 | 0.2919 | 0.2913 |
| Calcium ammonium nitrate | | | | | | | | | | |
| (i) Ammonia per tonne of CAN | Tonnes | 0.3187 | 0.3246 | 0.3259 | 0.3249 | 0.3236 | 0.3233 | 0.3226 | 0.3233 | 0.3232 |
| (ii) Nitric acid per tonne of CAN | Tonnes | 0.5767 | Not fixed | 0.5798 | 0.5798 | 0.5798 | 0.5798 | 0.5798 | 0.5798 | 0.5798 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--|---|--------|---------|-----------|--------|--------|--------|--------|--------|--------|--------|
| (iii) Limestone per tonne of CAN | | Tonnes | 0.2823* | Not fixed | 0.2825 | 0.2825 | 0.2825 | 0.2825 | 0.2825 | 0.2825 | 0.2825 |
| (iv) Power per tonne of CAN | | KWH | 4130 | -do- | 4235 | 4104 | 4178 | 3895 | 4208 | 4207 | 4122 |
| Overall nitrogen efficiency (in terms of percentage) | | | 95.3 | 93.5 | 93.15 | 93.434 | 93.82 | 93.9 | 94.10 | 93.90 | 93.93 |

*As per the Agenda of the Monthly Cost and Budgetary Review Meeting held on 14th May 1975.

Note : As against the norm of 5.55 KWH of power per NM³ of hydrogen recommended by Tendolkar Committee, norm fixed by the Management was 5.58 KWH. Norms fixed by the Tendolkar Committee and the Management in respect of hydrogen per tonne of ammonia and ammonia per tonne of calcium ammonium nitrate were the same.

APPENDIX II

(Referred to in paragraph 5.2)

Statement showing standard and actuals in respect of production of heavy water and consumption of raw materials and utilities.

| Year | H.W. Production (in tonnes) | | Power consumption (in thousand MW) | | Hydrogen consumption (in thousand NM3) | | Nitrogen consumption (in thousand NM3) | | Cooling Water consumption (in lakh M3) | | Steam consumption (in tonnes) | | Ammonia consumption (in tonnes) | |
|---------|--------------------------------|--------|---------------------------------------|--------|--|--------|--|--------|---|--------|----------------------------------|--------|------------------------------------|--------|
| | Standard | Actual | Standard | Actual | Standard | Actual | Standard | Actual | Standard | Actual | Standard | Actual | Standard | Actual |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1971-72 | 12.1 | 12.1 | 25.0 | 24.9 | 320.0 | 354.0 | 400.0 | 444.0 | 33.2 | 32.2 | 136.1 | 123.1 | 1.0 | 2.3 |
| 1972-73 | 12.2 | 10.4 | 25.0 | 23.1 | 350.0 | 361.8 | 380.0 | 495.0 | 33.6 | 31.7 | 150.0 | 112.0 | 1.0 | 2.7 |
| 1973-74 | 12.2 | 11.4 | 25.0 | 23.1 | 350.0 | 338.9 | 380.0 | 494.2 | 33.6 | 31.1 | 150.0 | 123.8 | 2.0 | 2.5 |
| 1974-75 | 12.2 | 8.5 | 25.0 | 22.1 | 350.0 | 328.8 | 380.0 | 448.0 | 33.6 | 32.4 | 150.0 | 112.2 | 2.0 | 2.5 |
| 1975-76 | 8.1 | 14.4 | 25.0 | 23.2 | 350.0 | 333.8 | 380.0 | 433.5 | 33.6 | 31.6 | 150.0 | 103.6 | 2.0 | 3.2 |
| 1976-77 | 12.2 | 13.72 | 25.0 | 24.9 | 350.0 | 278.8 | 380.0 | 508.8 | 33.6 | 31.0 | 150.0 | 117.8 | 2.0 | 3.8 |
| 1977-78 | 8.3 | 9.01 | 25.0 | 23.5 | 350.0 | 339.4 | 380.0 | 590.4 | 33.6 | 32.05 | 150.0 | 127.9 | 2.0 | 2.5 |

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