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STAFF APPRAISAL REPORT

INDIA

THAL FERTILIZER PROJECT

June 14, 1979

Industrial Projects Department

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Currency Equivalents

Rs 1.0	=	US\$0.1163
Rs 8.6	=	US\$1.0
Rs 1,000,000	=	US\$116,300
(As of March 1979)		

Weights and Measures

All weights and measures are in metric units.

1 Metric ton (t)	=	1,000 Kilograms (Kg)
1 Metric ton (t)	=	2,204 Pounds (lb)
1 Kilometer (km)	=	0.62 Miles
1 Hectare (ha)	=	2.47 Acres
1 Cubic Meter (m <sup>3</sup> )	=	35.32 Cubic Feet

PRINCIPAL ABBREVIATIONS AND ACRYONYMS USED

AY	Agricultural Year Ending in June
BMRDA	Bombay Metropolitan Regional Development Authority
FAI	Fertilizer Association of India
FCI	Fertilizer Corporation of India
FPDIL	Fertilizer (Planning and Development) India, Ltd.
Government	Central Government of India
HFL	Hindustan Fertilizer Company, Ltd.
HYV	High Yielding Varieties
IFFCO	Indian Farmers and Fertilizers Cooperative, Ltd.
KV	Kilovolts
K <sub>2</sub> O (Potash)	Potassium Oxide Content in Fertilizers
Mgd	Million Gallons Per Day
MIDC	Maharashtra Industrial Development Corporation
MPWPB	Maharashtra Prevention of Water Pollution Board
MSCF	Thousand Standard Cubic Feet
MSEB	Maharashtra State Electricity Board
MW	Megawatts
Mwh	Megawatt hour
N	Nitrogen Content in Fertilizers
Nm <sup>3</sup>	Normal Cubic Meters
NFL	National Fertilizers Limited
ONGC	Oil and Natural Gas Commission
Ppm	Parts per Million
P <sub>2</sub> O <sub>5</sub> (Phosphate)	Phosphorous Pentoxide Content in Fertilizers
RCF <sup>5</sup>	Rashtriya Chemicals & Fertilizers Ltd.
tpd	(Metric) Tons Per Day
tpy	(Metric) Tons Per Year
Trombay IV	Trombay Nitrophosphate Project
Trombay V	Trombay Ammonia/Urea Project

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This report was prepared by Messrs. Rakesh Bhan, Ramon Beteta, David Caplin and S. Venkataraman of the Industrial Projects Department.

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IBRD 13342R	- India - Major Fertilizer Plants - Present and Proposed
IBRD 14286	- Thal Plant Location and Infrastructure
IBRD 13340R	- Crude and Gas Pipelines - Bombay Offshore Area
IBRD 14284	- Statewise Availability of Fertilizers
IBRD 14246	- Thal Fertilizer Project Plant Layout

DOCUMENTS AVAILABLE IN THE PROJECT FILE

<u>Reference</u>	<u>Title, Date and Authors</u>
A.	Thal Fertilizer Project - Techno-economic Feasibility Report September 1978 by The Rashtriya Chemicals and Fertilizers Ltd.
B.	Thal Fertilizer Project - Marketing Feasibility Report September 1978 by The Rashtriya Chemicals and Fertil- izers Ltd.
C.	Rewas Project - Marketing Research Statistical Information November 1977 by the Fertilizer Corporation of India
D.	Fertilizer Situation in India - By The Fertilizer Association of India
E.	Thal Fertilizer Project - Updated Folder of Documents February 1979 by the Rashtriya Chemicals and Fertil- izers Ltd.

- F            Distribution Patterns From West Coast Plants -  
             Urea and Complex Fertilizers -- February 1979
  
- G            Report of the Task Force on the Siting of the  
             Bombay High Fertilizer Project - April 1978 and  
             Addendums - May 1978
  
- H            Consultants' Report on Environmental and Pollution  
             Control Aspects of the Thal Fertilizer Project  
             May 1979

## I. INTRODUCTION

1.01 The Government of India (the Government) has requested Bank financing for the Thal Fertilizer Plant (the Project) to be located at Thal, about 25 km south of Bombay (Map IBRD 14286). The Project will be owned and operated by the Rashtriya Chemicals and Fertilizers Ltd. (RCF, the Company), a wholly government owned company. The proposed Bank loan of US\$250.0 million would cover approximately 31% of the estimated total financing requirements of US\$812.3 million and about 73% of the total foreign exchange needs of US\$343.1 million. The remaining foreign exchange and the entire local cost financing would be provided from RCF's internal resources and by the Government, either from its own resources or with other external credits.

1.02 The Project will be based on associated gas from the Bombay High offshore oil fields supplemented with non-associated gas from the South Bassein offshore fields, and will produce approximately 1.34 million tons per year (tpy) of urea for sale to farmers and 27,000 tpy of ammonia for sale to other fertilizer plants and industrial consumers in India. The development of these offshore oil fields, production platforms, the oil and gas pipeline transport and shore facilities was partly financed by a Bank loan of US\$150 million (Loan 1473-IN). The Project will include two single-train ammonia units - each of 1,350 tons per day (tpd) capacity - along with three urea units - each of 1,500 tpd capacity, as well as utilities and a large portion of the infrastructure requirements of the relatively undeveloped location. By 1985, about 35% of project output is expected to be absorbed by farmers in Maharashtra, where the plant is to be situated, and the rest will be marketed in Uttar Pradesh. The Project will create directly some 1,600 jobs and indirectly support up to 5,000 jobs in transportation, marketing and communications. In addition, during construction up to 5,000 workers would be employed.

1.03 The Bank Group has been actively involved over the past twelve years in assisting India's fertilizer sector; this loan would be the tenth operation in fertilizer production facilities, including two by IFC, and eight by Bank/IDA. At present, there are 20 major operating fertilizer companies in India, with 26 plants having a total annual capacity of about 3.3 million tons of nitrogen (N) and 1.2 million tons of phosphate ( $P_2O_5$ ). Although the Project will substantially contribute to the country's domestic production of nitrogenous fertilizer accounting for 12% of the 1985 production, imports are still expected to account for 12% of total consumption in that year.

1.04 The Project was identified in October 1977 by a mission consisting of Messrs. H. S. Kohli, D. Caplin and Y. T. Shetty, and appraised in January 1978 by Messrs. Eus Tortorelli and Ramon Beteta, all of the Industrial Projects Department. With the change in project location announced in August 1978, the Project was reappraised in February 1979 by Messrs. Rakesh Bhan and S. Venkataraman of the Industrial Projects Department, Mr. J.M.H. Tixhon of the Office of the Environmental and Health Affairs and Mr. N.E. Krogh-Poulsen of the Transportation Division of the South Asia Projects Department.

## II. THE FERTILIZER INDUSTRY

### A. The Fertilizer Industry

2.01 The Indian fertilizer industry, which provides a major input to the agricultural sector, is a key industry in the country. The Government has, therefore, closely guided its development and formulated policies concerning investments, product pricing, choice of feedstock, etc. necessary for supporting its growth. The industry has also received high priority in the Government's investment plans. The general approach of the Government has been to aim at efficient self-sufficiency in fertilizer production, adopting technologies appropriate to Indian raw material resources and following closely the international technological improvements and innovations. The Government has continued to regulate fertilizer distribution and pricing to ensure that fertilizer is delivered to the farmer at the lowest possible cost. A detailed review of the Indian fertilizer industry is available in Report No. 928-IN, dated November, 1975 "Appraisal of a Project to Improve Fertilizer Production - Fertilizer Industry Credit: India." The following paragraphs review the highlights of the developments within the Indian fertilizer industry and in the Government's approach to it during the last twelve years.

#### 1. Past and Future Capacity Growth

2.02 Since 1949/50 there has been rapid growth in both nitrogenous and phosphatic fertilizer capacity in India, as shown in the following table:

India - Installed Fertilizer Capacity a/  
('000 tpy of nutrient)

<u>Fiscal Year</u> (April/March)	<u>Nitrogen</u>	<u>Phosphate</u>
1949/50	10	56
1966/67	548	237
1971/72	1,520	500
1976/77	2,988	801
1977/78	3,028	915
1978/79 (actual)	3,259	1,236
1982/83 (projected)	5,349	1,354
1984/85 (projected)	6,825	1,354

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a/ All potash ( $K_2O$ ) is imported.

A large expansion program now underway is expected to raise the installed nitrogen capacity to 6.8 million tpy of nutrient by fiscal year 1984/85 - more than twice the 1978/79 capacity - and phosphate capacity to 1.4 million tpy of  $P_2O_5$  - about 50% above the 1977/78 capacity (Annex 2-1). The locations

of the fertilizer plants and projects are shown in Map IBRD 13342R. There is no domestic production of potash; about 600,000 tons of K<sub>2</sub>O were imported in 1977/78 for direct application and for domestic production of multinutrient complex fertilizers. By 1966/67, urea and calcium ammonium nitrate formed 32% and 15% of the total nitrogen capacity, respectively. The share of urea increased to 72% by 1978/79 and is expected to further increase to 78% by 1982/83. Complex fertilizers formed 75% of the phosphate capacity in 1977/78 and their share is expected to be maintained during the 1980s.

## 2. Feedstock

2.03 About 22% of India's 1966/67 nitrogen capacity was based on naphtha as feedstock, using the partial oxidation technology, with the rest based on other feedstocks - coke oven gas, coke, electricity and lignite. With availability of a commercially well-proven naphtha reformation catalyst and attractive pricing of naphtha in international trade, a large part of the nitrogen capacity in the late 1960s was built on the use of naphtha, so that by 1977/78, naphtha was used for about 71% of the country's nitrogen capacity. Past and projected feedstock usage is shown in the following table.

India - Nitrogen Capacity by Feedstock Employed: 1961/62-84/85  
(in thousand tons of N per year)

<u>Feedstock</u>	<u>1961/62</u>		<u>1966/67</u>		<u>1972/73</u>		<u>1977/78</u>		<u>1984/85</u>	
	<u>Cap.</u>	<u>%</u>								
Naphtha	22	9	120	22	1,053	69	2,150	71	2,423	36
Natural Gas	-	-	-	-	141	9	508	17	2,194	31
Fuel Oil	-	-	-	-	-	-	-	-	1,644	24
Coal	-	-	-	-	-	-	-	-	456	7
Coke	127	53	127	23	80	5	80	3	10	-
Coke oven gas	13	5	140	25	92	6	96	3	54	1
Lignite	-	-	70	13	70	5	70	2	-	-
Electrolysis	80	33	91	17	84	6	84	3	4	-
Ammonia	-	-	-	-	-	-	40	1	40	1
Total	<u>242</u>	<u>100</u>	<u>548</u>	<u>100</u>	<u>1,520</u>	<u>100</u>	<u>3,028</u>	<u>100</u>	<u>6,825</u>	<u>100</u>

During the early 1970s, about 2 million tpy of new nitrogen capacity was planned based on fuel oil and coal, to reduce the naphtha import bill. By 1984/85, about 1.6 million tpy of fuel oil-based capacity will be in operation, resulting in an annual net foreign exchange saving of about US\$90 million (in 1978 prices) due to the lower cost of importing fuel oil. The first fuel oil-based plant at Nangal, commissioned in January 1978, is now operating satisfactorily after overcoming some initial commissioning problems. The second fuel oil-based plant at Sindri, also financed by the Bank (para 2.08) is currently under commissioning. The coal-based plants at Talcher and Ramagundam, also now being commissioned, will contribute to an annual net

foreign exchange saving (in 1978 dollars) of about US\$55 million. The Government intends to plan further capacity based on coal only when adequate experience is available from these plants. Finally, natural gas from the large offshore oil and gas reserves being developed near Bombay and onshore Assam reserves will provide feedstock for about 2.1 million tpy of nitrogen capacity including the Project, a similar plant being planned in Gujarat and a smaller expansion project at Namrup. This will represent about 31% of the nitrogen capacity by 1984/85, when the share of naphtha will drop to about 36% of the nitrogen capacity.

### 3. Plant Capacities and Technologies

2.04 The small plants operating in 1966/67 used a range of technologies including partial oxidation of naphtha, coke and lignite gasification, fractionation and cracking of coke oven gas and electrolysis of water. Adoption of the naphtha reformation technology, with experience already available outside India, enabled larger ammonia plants of 300 to 500 tpd capacity to be constructed in the late 1960s at Visakhapatnam, Kota and Kanpur. The first large capacity naphtha-based ammonia plant (750 tpd capacity) with all centrifugal compressor drives was commissioned in Madras in 1971/72. All subsequent natural gas and naphtha based plants, other than expansions, have capacities ranging from 600 to 1,100 tpd; in 1978/79 nine such plants were in operation and two under construction. India's fertilizer capacity expansion in the early 1970s included six large fuel oil based plants at Haldia (600 tpd), Nangal, Sindri, Bhatinda, Panipat (900 tpd each) and Broach (1,350 tpd). Together with the two 900 tpd coal gasification-based ammonia plants now nearing completion at Talcher and Ramagundam, the Indian fertilizer industry has during the past decade gained substantial experience in building and operating ammonia plants over a range of capacities and with different feedstocks, as well as plants for the production of finished fertilizers such as urea, calcium ammonium nitrate, ammonium sulphate, superphosphates, nitrophosphates and complex fertilizers.

### 4. Capacity Utilization

2.05 An important factor affecting domestic availability of nitrogenous fertilizers has been the relatively low average capacity utilization of the Indian plants, especially in the public sector. Overall capacity utilization reached a peak of 74% in 1972/73, but declined sharply to 58% in 1973/74 as new units at Goa, Durgapur and Cochin initiated production. The capacity utilization improved steadily during the next four years and in 1977/78 the industry matched the earlier peak capacity utilization rate of 74%. However, in 1978/79 the average capacity utilization of the industry dropped back to 72%. A detailed analysis of the capacity utilization for the period 1971-79 is given in Annex 2-2 and summarized below:

India - Percentage Utilization of Nitrogenous Fertilizer Capacity

<u>Fiscal Year</u>	<u>Private</u>	<u>Joint</u>	<u>Cooperative</u>	<u>Public</u>	<u>Total</u>
1970/71	71	69	-	58	63
1971/72	76	76	-	64	70
1972/73	86	81	-	62	74
1973/74	61	76	-	49	58
1974/75	76	64	17	49	60
1975/76	74	71	54	61	70
1976/77	80	69	74	69	73
1977/78	86	73	95	64	74
1978/79 (actual)	77	73	108	52	72

2.06 The low capacity utilization cannot, however, be explained entirely in a public versus private sector ownership framework. In addition to management, other key factors which have affected capacity utilization of both public and private sector plants are plant design and age, size of plant, power availability, transport bottlenecks and feedstock.

2.07 The private sector plants are generally of smaller capacity (300-500 tpd), based on older proven design and engineering supplied by foreign engineering firms. As a group they have been in operation longer and have solved initial teething problems. While their overall capacity utilization has consistently been better than public sector plants as a group, they have also suffered temporary drops in capacity utilization due to interruptions in power supply or non-availability of adequate railway transport for feedstock and product movement.

2.08 The public sector plants are generally of more recent origins, are generally significantly larger, use a more varied range of feedstocks and were built with a much greater involvement of local engineering and equipment supplies. Four of the eleven public sector plants (Nangal, Trombay, Gorakhpur, and Namrup) have generally shown satisfactory capacity utilization rates equal to or better than plants in the private sector, though production at even these plants has at times suffered due to periodic power supply and transport problems. The original plant at Sindri also showed satisfactory performance until the mid-1970s when the age of the facilities and difficulties in obtaining continued supplies of quality raw materials combined to limit production (the plant is now temporarily shut down awaiting commissioning of the IDA-financed modernization project). The overall unsatisfactory capacity utilization of the public sector plants, occurring during a period of substantial expansion, can in part be attributed to the managerial limitations of the Fertilizer Corporation of India (FCI), which has led to its restructuring (paras 2.17 and 2.18). Perhaps more importantly, however, have been severe technical problems which have resulted in difficult commissioning at the new plants (e.g., Nangal, Sindri, etc.) and continuing operating problems at the five older plants (Cochin, Durgapur, Udyogmandal, Rourkela, and Neyveli). Design defects have plagued certain of these plants and the foreign firms, where involved, have moved to rectify these deficiencies. Other problems, however, have resulted from a specific policy of using indigenous resources leading to maximum employment of local engineering and locally supplied equipment in a technologically

difficult industry. Experience has modified this policy but resolving the resulting technical problems through redesign, replacement and "debottlenecking" programs, has taken time, while problems related to raw materials supply, power, etc. have, as previously mentioned, in some cases also constrained operations. A more detailed description of the problems faced at these plants is given in Annex 2-2.

2.09 Of the unscheduled production losses of about 350,000 tpy of nitrogen in the last three years, equipment failures in aged plants and in recently commissioned new plants accounted for about 70% and power problems for another 20%. Problems affecting the performance of the public sector fertilizer plants were studied by a Government committee in 1978 and several remedial measures recommended. Its recommendations, including those for plant modifications and better planning of preventive maintenance to minimize such unscheduled losses, have been adopted. The full impact of these efforts should be reflected in higher capacity utilization gradually during the next few years.

2.10 The Bank has also assisted the Government efforts to improve fertilizer production. As part of the Trombay IV Project (Credit 481-IN) a credit of US\$17 million was made available to revamp the Durgapur and Cochin plants. In addition, two credits were designed to increase production at Nangal (Credit 357-IN) and Sindri (Credit 520-IN). Finally, the Fertilizer Industry Credit of US\$105 million, approved in 1975, was specifically designed to improve capacity utilization of the Indian fertilizer industry. The Credit covered a large number of projects involving eleven plants including (a) changeover to fuel oil feedstock at Neyveli (b) a naphtha reformer at Rourekela, (c) captive power plants at Durgapur, Gorakhpur, Trombay and Visakhapatnam to meet the critical plant loads and reduce production losses due to power fluctuations, (d) purge gas recovery units planned at Baroda, Goa, Kalol and Vizag to increase ammonia production, and (e) debottlenecking of the phosphoric acid plant at Baroda. Since none of these IDA financed facilities were operational before 1977/78, their beneficial effect on capacity utilization has not yet been fully felt.

2.11 To take full advantage of existing investments, the Government has established a control and monitoring system to review performance against unit-wise monthly production targets developed after detailed discussions with plant managements. Weekly production statistics are now being received and reviewed by the Ministry of Chemicals and Fertilizers to monitor progress and identify constraints to better production and to evolve solutions. Foreign exchange for import of normal maintenance and emergency spares is now more readily available. These efforts have been reflected in recent production improvements and overall capacity utilization is targeted to increase from 72% in 1978/79 to a satisfactory average level of about 84% by 1984/85, after providing for possible unforeseen losses, as shown in the following table for different plant categories. Since both public and private sector plants without technical problems have, as explained above, shown satisfactory capacity utilization and considering that the proposed Project is based on gas as feedstock, the 90% average capacity utilization rate assumed for the Project (para 8.01) is considered reasonable.

India - Nitrogen Capacity Utilization by 1984/85

Category	Capacity in Operation (000 tons Nitrogen)				Percentage Utilization			
	-----Actual-----			Planned	-----Actual-----			Planned
	1975/76	1976/77	1977/78	1984/85	1975/76	1976/77	1977/78	1984/85
Stabilized plants <u>a/</u>	1,188	1,359	1,574	6,129	77	84	86	85
New Plants								
First year	258	464	40	-	29	27	45	-
2nd year	215	258	464	-	53	58	35	-
3rd year	171	215	258	-	66	73	71	-
Old plants and plants with tech- nological prob- lems <u>b/</u>	<u>692</u>	<u>692</u>	<u>692</u>	<u>692</u>	46	48	45	75
TOTAL	2,524	2,988	3,028	6,821	70 <u>c/</u>	73 <u>c/</u>	74 <u>c/</u>	84

- a/ Plants in operation for over three years and having no technological constraints. The 1985 planned rate is after an allowance of 3.5% for unexpected losses.
- b/ Includes Sindri, Udyogamandal, Rourekela, Neyveli, Durgapur, Cochin, Varanasi, Ennore.
- c/ Calculated on the basis of available capacity of 50, 70 and 80 percent of the rated capacity during the initial three years of operation.

5. Local Plant Building Capabilities

2.12 Faced with a large fertilizer expansion plan, government policies from the mid-1960s have promoted domestic engineering and construction capabilities and facilities for the local fabrication of plant and machinery. The earlier public sector projects implemented in this manner suffered considerable completion delays, cost overruns and commissioning difficulties due to lack of local experience with large projects, inadequate coordination with site management, excessive premature reliance on local supplies and use of tied financing from various sources. The Bank's discussions with the Government and FCI have resulted in improvements in project implementation by strengthening the capabilities of the public sector engineering companies and improving project coordination procedures. As a result, the more recent Bank-financed projects are being physically completed with minimum delays and cost overruns. The development and use of local capabilities to carry out detailed engineering and project management has reduced the foreign cost of engineering consultants in recent projects by about 40%.

2.13 India's large fertilizer program has promoted domestic capabilities in several allied fields. India now manufactures a large range of equipment and supplies for fertilizer and chemical plants, often in collaboration with experienced foreign manufacturers. These include offsite and process boilers with Combustion Engineering (US), centrifugal and reciprocating compressors with Pignone (Italy), process pumps with Pignone (Italy) and Klein, Schanzlin and Becker (Germany), cooling towers with Morley (US), instruments with Taylor (US), etc. The local manufacturers initially had problems in making timely deliveries due to poor materials planning, inadequate work scheduling and difficulties in working with special alloys. Deliveries have since improved, though there is room for further improvement. Workmanship has been good and prices are competitive. Indian suppliers are now providing about half of the total supplies required for a fertilizer project. India has also developed a competent construction industry to carry out plant civil works and erection at substantially below international costs. The share of civil works and erection costs tends to be low in Indian projects, only about 6% and 4%, respectively, of total project costs, compared to about 10% and 15% in most developed countries. As a result, costs of Bank-financed projects in India compare favorably with projects of similar capacities elsewhere.

2.14 The Indian fertilizer industry employed in 1978 over 60,000 people, about 15% of them in the managerial and supervisory categories. Several of the major plants have facilities to recruit and train managers, supervisors and technicians. As a result, recruitment of reasonably qualified and experienced staff for operating new projects has not been difficult.

## 6. Product Pricing Policies

2.15 Farm gate urea prices, controlled by the Government, determine the ex-factory prices allowed to fertilizer producers. Up to mid-1973, the international urea prices were lower than the ex-factory prices allowed to the Indian plants, mainly due to the large world surpluses that were available for international trade. Between mid-1973 and early 1976, when international urea prices were much higher than domestic ex-factory prices, the Government introduced a system of "pooled" pricing to bring the fertilizer to the farmer at the lowest possible price. Urea was made available to the farmer at Rs 1,820 (US\$212) per ton, 1/ even when the landed cost of imported urea was around Rs 2,680 (US\$312) per ton. At that time, sale of locally produced urea, which had an ex-factory price of Rs 1,095/ton, provided Rs 610/ton to the pool to subsidize imports. As the imported urea price dropped, the cross subsidy has been reduced, and urea is now available to the farmer at Rs 1,297/ton. 1/ With the sharp increases in input prices following the 1973 oil price increases, the ex-factory realization per ton of urea only increased from Rs 808/ton in 1972/73 to Rs 1,158/ton in 1978/79; even this substantial increase was not adequate to cover the cost increases.

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1/ Excluding dealer's margin and freight which total an additional Rs 153/ton.

2.16 In November 1977, the Government announced a new fertilizer pricing policy, covering straight nitrogenous fertilizers, which ensures a predetermined return to the manufacturer without increasing the farm gate prices. The policy has been extended to phosphatic fertilizers in early 1979. The revised pricing policy provides a 12% after tax return on net fixed assets plus working capital less long-term borrowings when the plant is operated at 80% capacity. Although the pricing formula provides only a modest financial rate of return (in constant terms) for a new project, it provides adequate cash flow in the initial operating years and due to the high pretax returns of 28.4% encourages reinvestment. In addition, it provides a strong incentive to the producers to improve capacity utilization. The fertilizer pricing policy is further discussed in para 4.23.

## 7. Restructuring of Public Sector Companies

2.17 In 1978/79, about 49% of the total installed nitrogen capacity of 3.3 million tpy, was in the public sector and about 0.2 million tpy in the cooperative sector (Annex 2-3). Including the cooperative and joint sector capacity of 1.03 million tpy, the public sector directly or indirectly accounted for about 81% of the domestic nitrogen capacity and the share is expected to increase further to about 90% by 1984/85. The large public sector expansion program had mainly been implemented through the Fertilizer Corporation of India (FCI). In 1977/78, the FCI had an installed capacity of 0.92 million tpy of nitrogen (30% of the total) and another 1.25 million tpy of capacity was under construction. As a result of the rapid expansion during the 1970s, management capabilities within FCI had been overstretched.

2.18 During the past few years, the Government and the Bank have been discussing the need for decentralized decision-making in FCI. As a first step, to improve the organization of the public sector industry and thereby its performance, in 1975 the Government formed a new public sector company - National Fertilizers Ltd. (NFL), to implement the Bhatinda and Panipat Projects. This approach was successful and a scheme for further restructuring the public sector fertilizer units was evolved during 1976-77 and formally announced in January 1978. This scheme regroups the units earlier managed by FCI and NFL into four separate geographically oriented companies. The existing Trombay plant along with the proposed Thal Project forms a West Coast company, called the Rashtriya Chemicals and Fertilizers Ltd. (RCF). The remaining plants and related marketing activities have been assigned to the other three regional companies - National Fertilizer Ltd. (North), Hindustan Fertilizer (East), and Fertilizer Corporation of India (Central). The erstwhile Planning and Development Division of FCI has become an independent company - Fertilizer (Planning and Development) India Ltd. (FPDIL). The new companies were legally formed in April 1978. The above scheme is expected to improve delegation of responsibility and authority to the unit/project level and thus ensure better performance.

## B. Bank Group Role

2.19 The Bank Group has so far participated in the financing of nine fertilizer projects in India with a total contribution of US\$473.4 million. The financing has been through IDA for six public sector projects, IFC for two private sector projects and IBRD for a cooperative sector project, as shown in the table on the following page.

2.20 In the case of the first three IDA financed projects at Gorakhpur, Cochin and Nangal, there have been completion delays of between 16 to 31 months and cost overruns of 35%-45%. While delays in finalizing engineering arrangements delayed the Gorakhpur Project, the Cochin II Project suffered from poor project management and the company's financial problems. The Nangal Project was affected by delayed delivery of equipment and cost increases following the 1973 oil crisis. However, performance has substantially improved in the more recently financed projects. The Sindri and Trombay Projects have been physically completed with only 3 and 6 months delay, respectively and at or close to appraisal cost estimates. After an initial delay of 12 months when the feedstock was changed from fuel oil to naphtha, the Phulpur Project is now expected to be completed within original cost estimates and on the revised completion schedule. Project completion and the OED report finalized for the Gorakhpur Project have not brought out any major issues.

2.21 The Fertilizer Industry Credit included several sub-projects mainly for improving fertilizer production from existing plants. There have been delays in the start of some of the sub-projects. Replacement of those sub-projects, not being implemented, by others with similar objectives was approved by the Executive Directors in March 1978 (IDA/R78-23). The sub-projects are now generally proceeding satisfactorily. As part of this Fertilizer Industry Credit, three important studies relating to timely availability of fertilizers to the farmers are being carried out. The National Council of Applied Economic Research (NCAER) is carrying out a Fertilizer Demand and Marketing Study which includes considerable field survey. The draft report is nearing completion, and preliminary demand projections have become available. Rail India Technical and Economic Services Ltd. (RITES) has completed a Fertilizer and Raw Material Transportation Study, and the findings, after discussions with the industry, are now being reviewed by the Government for the implementation of the recommendations. The Administrative Staff College, Hyderabad is carrying out a Fertilizer Warehousing Study. Its draft report is scheduled to be available to the Government shortly.

2.22 Despite the various difficulties, all the projects so far financed by the Bank Group remain economically justified, in part due to substantial increases in projected long-term international fertilizer prices in real terms since the projects were originally appraised. The Bank's major objective in all the above projects has been to assist India in building up its domestic fertilizer capacity. The Bank-financed projects have also aimed at improving project management capabilities in the public sector, project implementation time and fertilizer capacity utilization. On the whole, these objectives have been satisfactorily achieved, particularly in the more recent projects. At

INDIA - THAL FERTILIZER PROJECT  
INDIA-FERTILIZER PROJECTS FINANCED BY THE BANK GROUP

Project	Date of Signing	Amount of Financing (US\$Million)	Project Capacity (000 tpy)	Estimated Capital Cost (US\$Million)		Percentage Ovarium (US\$Million)	Mechanical Completion Date		Completion Delay (months)	Appraisal Economic ROR %	Economic Price Expected at b/ Appraisal (US\$/ton)	Current Economic Price Expected c/ (US\$/ton)	Project Status
				Appraisal	Current		Original	Current					
<b>A. International Finance Corporation</b>													
1. IEL - Kanpur Project	April 1967	11.5	207 (N)	82	82	-	March 1970	March 1970	-	-	-	-	Operating at over 90% of capacity.
2. Zuari - Goa Project	March 1969	18.9	170 (N)	75	75	-	April 1972	June 1973	14	-	-	-	State's water supply scheme was delayed. Operating at about 80% of capacity.
<b>B. International Development Association</b>													
1. FACT - Cochin II Project	July 1971	20.0	47 (N) 115 (P <sub>2</sub> O <sub>5</sub> )	41.2	59.7	45	March 1974	Oct. 1976	31	15	108	185	Acid plants operating satisfactorily. Complex plant being stabilized for some grades.
2. FCI - Gorakhpur Project	Jan. 1972	10.0	51 (N)	16.0	23.0	44	Aug. 1974	Dec. 1975	16	19	75	137	Commissioned and operating satisfactorily.
3. FCI - Nangal Project	Feb. 1973	58.0	152 (N)	105.6	142.7	35	Aug. 1975	Dec. 1977	28	15	67	160	Commissioned successfully in January 1978. Has reached rated capacity.
4. FCI - Trombay IV Project	May 1974	50.0	a/ 75 (N) 75 (P <sub>2</sub> O <sub>5</sub> )	57.0	60.9	7	June 1977	Dec. 1977	6	16	135	160	Mechanically completed and being commissioned.
5. FCI - Sindri Project	Nov. 1974	91.0	145 (N)	162.7	155.8	-	Nov. 1977	Feb. 1978	3	16	184	170	Mechanically completed and commissioned. Produced first urea in March 1979.
6. Various companies - Fertilizer Industry Credit	Dec. 1975	105.0	222 (N) 31 (P <sub>2</sub> O <sub>5</sub> )	225.0	160.3	-	Dec. 1978	Mar. 1980	16	-	260	-	Affected by delays in project preparation and approvals.
<b>C. International Bank for Reconstruction and Development</b>													
1. IFFCO- Phulpur Project	Jan. 1975	109.0	228 (N)	239.0	239.0	-	Oct. 1978	Aug. 1979	10	17	196	185	Progressing satisfactorily after initial delay of one year caused by change in feedstock.

a/ Includes US\$17.0 Million for Plant Operation Improvement Project

b/ Escalated to first year of operation

c/ During first year of operation

the same time, considering that during the next ten years India plans to invest over US\$5.0 billion in new fertilizer production and related gas development facilities and that the next generation of plants, to be based mainly on the newly found offshore natural gas, would involve larger and more complex plants than now existing in India, continued Bank assistance is necessary and justified.

### III. THE RASHTRIYA CHEMICALS AND FERTILIZERS LIMITED (RCF)

3.01 Rashtriya Chemicals and Fertilizers Limited (RCF), the proposed borrower, is a new public sector fertilizer company which emerged from the restructuring of the public sector companies (para 2.18) and is responsible for the operation of the Trombay unit (earlier with FCI) and the implementation of the Project. RCF became an independent legal entity in April 1978. A Government-appointed Board of Directors is responsible for the corporate management of the Company and for coordination with the Government (Annex 3-1). Most senior managers and technical personnel of RCF have been allocated and appointed from the FCI staff. Trombay and Thal units of the Company will operate as separate profit centers, each headed by a general manager.

3.02 The Trombay unit has shown good production performance with capacity utilization consistently exceeding 80% of the capacity during the last six years. The Trombay unit has also diversified and expanded its capacity to include several industrial chemicals. The plant facilities now in operation and under construction, along with the expected 1979 production, are shown in Annex 3-2.

3.03 Since 1966, when the first plants were commissioned at Trombay, several diversification and expansion projects, including production of argon, concentrated nitric acid, sodium nitrate, ammonium bicarbonate and methylamines have been implemented there. The Trombay unit has also commissioned a 100 tpd phosphoric acid plant and expanded the Suphala (NPK) production to 330,000 tpy. The existing sulphuric acid plant has been converted to the double catalyst process to expand capacity and reduce pollution. Trombay IV - an IDA-financed project - is mechanically complete and is currently being commissioned. The Trombay V Project, which includes a natural gas-based 900 tpd ammonia plant and a 1,000 tpd urea plant, is under construction. All the above projects have been implemented satisfactorily, though with some delays, by the staff and management of the Trombay unit. The proposed Project will be managed by a team staffed mainly by those now working on the Trombay expansion projects and having adequate capabilities in project and construction management.

3.04 The good performance of the Trombay unit within FCI is also demonstrated by the following table, which gives key financial indicators of the Trombay unit, over the past four years (1975/76 to 1978/79). The relevant full financial statements for the same period are shown in Annex 3-3.

Financial Indicators of the Trombay Unit during 1976/77 to 1978/79  
(in million Rupees)

	<u>1975/76</u>	<u>1976/77</u>	<u>1977/78</u>	<u>1978/79</u> (Estimate)
Capacity Utilization (Nitrogen)	98	126 /a	106	100
Net Sales	542	735	778	873
Cash Generation (after Interest)	20	99	100	109
Net Profit (Loss)	(14)	76	69	69
Ratios:				
Current Ratio	3.72	2.87	3.15	2.86
Debt/Equity	37/63	36/64	40/60	33/67
Debt Service Coverage	1.80	11.00	12.30	6.81
Net Profit (Loss)/Sales	(0.03)	0.10	0.09	0.08
Net Profit (Loss)/Capital	(0.02)	0.06	0.04	0.04

/a Using imported ammonia to supplement in plant production.

RCF's financial position is expected to improve with the recent government decision on fertilizer price revision (para. 2.16) which will increase RCF's net realization price per ton of nitrophosphate by about 25%, combined with the commissioning of new Trombay V facilities in 1981.

IV. FERTILIZER MARKET, MARKETING AND PRICES

A. Fertilizer Use in Agriculture

4.01 With a cropped area of about 174 million hectares (ha), India ranks third in the world in cultivated area (after the USSR and the US) and has one of the two largest irrigated areas. About 72% of India's labor force depends on agriculture, while only about 42% of the country's GDP is derived from the agricultural sector. While the population increased annually at about 2.0% during the decade ending in 1976, food-grain output increased during the same period at 2.4% annually - about two-fifths each due to higher productivity and cropped area increase, and the balance due to crop pattern changes. <sup>1/</sup> Higher productivity was largely achieved with increased use of fertilizer and irrigation, as well as the spreading cultivation of high yielding varieties (HYV), particularly of wheat and rice.

4.02 India's total cropped area has been increasing for some time, mainly with expansion of the multiple sown area. Between 1971 and 1978, gross cropped area increased from 165 million to 174 million ha, of which about 75% is under food-grain. Only a limited further increase in cropped area is planned in the

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<sup>1/</sup> Estimated on the basis of a regression equation.

next five years to 181 million ha in 1985. Since possibilities of further increases in cropped area are limited, food-grain production can only grow significantly with increased productivity through more intensive use of water, fertilizer and HYVs. Although per hectare fertilizer (total nutrients) consumption has increased substantially in recent years, the 1978 all India average of 25.0 kg/ha of arable land is still far below the level of consumption (1977) of even some developing countries (Pakistan 32.3; Mexico 41.9; Philippines 33.6; Egypt 175.1).

4.03 Fertilizer consumption is concentrated in a few states. While states such as the Punjab recorded total fertilizer nutrient usage of 72.4 kg/ha in 1977/78, five others (Madhya Pradesh, Rajasthan, Orissa, Bihar and Maharashtra), which account for more than 45% of gross cropped area, used less than 18 kg/ha (Annex 4-1). The same pattern emerges if the consumption of nitrogenous fertilizer is examined. The following table, which arranges the states in order of increasing nitrogenous fertilizer use intensity (kg/ha), shows that the five states with the lowest use intensity account for over 40% of the cropped area while consuming less than 18% of total nitrogen. The five states with the highest use intensity account for less than 33% of gross cropped area, but consume 60% of total nitrogen.

India - Statewise Breakdown of Nitrogen Consumption in 1977/78

	<u>Nitrogen Consumed</u>		<u>Cropped Area</u>		<u>Use Intensity</u>
	(000 tons N)	(%)	(Million ha)	(%)	(Kg/ha)
1. Madhya Pradesh	100	3.4	21.4	12.5	4.7
2. Rajasthan	90	3.1	17.2	10.0	5.3
3. Orissa	46	1.6	7.7	4.5	5.9
4. Maharashtra	228	7.8	19.7	11.5	11.6
5. Bihar	23	0.8	11.3	6.6	12.2
Subtotal 1-5	<u>487</u>	<u>16.7</u>	<u>77.3</u>	<u>45.1</u>	6.3
6. Other States	<u>690</u>	<u>23.7</u>	<u>38.6</u>	<u>22.6</u>	17.9
7. Haryana	150	5.2	5.5	3.2	27.6
8. Andhra Pradesh	352	12.1	13.0	7.6	27.1
9. Uttar Pradesh	648	22.2	23.3	13.6	27.8
10. Tamil Nadu	266	9.1	7.2	4.2	36.7
11. Punjab	<u>320</u>	<u>11.0</u>	<u>6.3</u>	<u>3.7</u>	51.1
Subtotal 7-11	<u>1,736</u>	<u>59.6</u>	<u>55.3</u>	<u>32.3</u>	29.2
Total	<u>2,913</u>	<u>100.0</u>	<u>171.2</u>	<u>100.0</u>	17.0

In the last three years, this concentration has diminished only slightly. While some of this disparity is due to differences in climatic conditions and irrigation availability, there is need to broaden the fertilizer demand base by promoting increased fertilizer use in the low fertilizer consumption

areas and by less affluent farmers through improvement in farm management practices and farmer education. Preliminary findings of the NCAER Survey (para 2.21) have indicated that if the farmers have adequate and timely access to the fertilizers and credit for buying it, the smaller farm owners take to intensive fertilizer application as rapidly as the larger farm owners. Government's plans include improved fertilizer availability nearer to the fertilizer users (para 4.17) and better credit facilities for the smaller farmers (para 4.22). Government authorities believe that the highest future fertilizer consumption growth will occur in areas other than those now having high fertilizer application rates.

4.04 Nitrogenous fertilizer is available as four main products: urea (46% N); ammonium sulphate (20.6% N); ammonium sulphate nitrate (26% N); and calcium ammonium nitrate (21%-26%N). The pattern of consumption has changed markedly over the years; in 1961/62 half the nitrogen was consumed in the form of ammonium sulphate, with only 22% being supplied in the form of urea. Since then, due to the cost savings in bagging, storage and transport per unit of nutrient, high analysis material such as urea has been dominating the market, with 72% of total nitrogenous fertilizers being supplied as urea. The other straight nitrogenous fertilizers now account for only 14% of the consumption, with about the same amount of nitrogen now being supplied in the form of NPK complex fertilizers (Annex 4-2). A substantial part of the nitrogenous fertilizer is applied directly as top dressing, and urea is often preferred for this application. Urea is also compatible with diammonium phosphate for the production of complex fertilizers used as basal dressing. The selection of urea as the nitrogen fertilizer product by the Project is, therefore, considered appropriate.

#### B. Historical Growth of Fertilizer Consumption and Production

4.05 Historical fertilizer consumption, production and imports are given in Annex 4-3 and summarized below.

India - Historical Fertilizer Consumption, Production and Imports  
(in thousand tons of nutrients)

Agricultural Year	Nitrogen			Phosphate			Potash <sup>a/</sup>	
	Cons.	Prod.	Imp.	Cons.	Prod.	Imp.	Cons.	Imp.
1961/62	250	154	307	60	65	-	28	75
1971/72	1,798	949	481	558	290	248	300	268
1972/73	1,839	1,054	665	581	330	204	367	325
1973/74	1,829	1,050	659	650	324	213	360	370
1974/75	1,766	1,186	884	471	331	286	336	437
1975/76	1,990	1,535	996	430	320	361	278	278
1976/77	2,457	1,857	750	635	478	23	318	278
1977/78	2,913	2,000	758	867	670	164	506	599
1978/79 (est.)	3,418	2,171	NA	1,043	771	NA	603	NA

Growth Rates (%)

1961/62-								
71/72	21.6	19.9	-	25.0	16.1	-	26.8	-
1971/72-								
76/77	6.4	14.4	-	2.7	10.7	-	1.2	-
1961/62-								
78/79	16.6	16.8	-	18.2	15.7	-	19.8	-

a/ All potash requirements are imported since there is no domestic production.

Consumption of plant nutrients increased annually at 22.9% in the decade 1961/62-71/72 and nitrogen at about 21.6%. Thereafter, nitrogen consumption became static for three years (1972/73-74/75) due to sharp increases in prices and poor monsoons but took off again in 1975/76 when nitrogen prices were reduced, with a further upsurge between 1976/77 and 1978/79 reaching 3.42 million tons of nutrient by 1978/79. The nitrogen consumption growth rate in the last four years has been about 18% per year. Consumption of phosphatic fertilizers did not start recovering until 1976/77 but reached 1.04 million tons of P<sub>2</sub>O<sub>5</sub> by 1978/79; potassic fertilizer consumption recovered from the slump only in 1977/78 and reached about 603,000 tpy of K<sub>2</sub>O in 1978/79.

4.06 Fertilizer production in India increased significantly during the last 15 years. Nitrogen production rose from 154,000 tons of nutrient in 1961/62 to 2.17 million tons in 1978/79, equivalent to an average annual growth rate of 17%. Phosphate production reached 771,000 tons of nutrient in 1978/79, with an average annual growth rate of 16% over the same period. The lower growth rates in the period 1971/72-76/77 compared with those in the previous decade are associated with delays in project completion and lower capacity utilization achieved after 1972/73 (para. 2.05).

4.07 Fertilizer production has generally lagged behind domestic consumption as shown in the table of para 4.05. In the period 1971/72-77/78 annual imports averaged 742,000 tons of N, 214,000 tons of P<sub>2</sub>O<sub>5</sub> and 376,000 tons of K<sub>2</sub>O.

(All potash requirements are imported as there is no domestic production). Over this period nitrogen imports were equivalent to 36% of domestic consumption, while phosphate imports were equivalent to 34% of domestic consumption. The share of imports is expected to decline in the next five years. India's fertilizer import policy is centered on supplementing domestic production with imports to ensure adequate availability. The actual product mix of imports is largely determined by availability and prices in the international market. Greater emphasis is being given to import of fertilizers in bulk to reduce the foreign exchange cost and to generate more local employment in bagging.

C. Projected Growth of Fertilizer Demand and Production

4.08 The projected demand and production of fertilizers are summarized in the table below.

India - Projected Growth of Fertilizer Demand and Production  
(in thousand tons of nutrients)

	<u>Nitrogen</u>		<u>Phosphate</u>		<u>Potash</u>
	<u>Demand</u>	<u>Production</u>	<u>Demand</u>	<u>Production</u>	<u>Demand</u>
1977/78 (actual)	2,913	2,000	867	670	506
1978/79 (est.)	3,418	2,171	1,043	771	603
1982/83	4,840	4,830	1,220	1,050	660
1984/85	6,000	5,310	1,410	1,050	850
1987/88	8,160	5,450	1,840	1,050	960
<u>Growth Rates %</u>					
1962-79 (actual)	16.6	16.8	18.2	15.7	19.8
1979-83	9.1	22.1	4.0	8.0	2.3
1979-88	10.2	a/	6.5	a/	5.3

a/ Not included since information on additional capacity likely to be commissioned beyond 1983 is uncertain.

The above future fertilizer demand estimate has been prepared by the Bank using the trend analysis, modified to allow for predicted changes in multiple cropping practices, special irrigation programs, fertilizer promotion campaigns and changes in materials in the pipeline from the producer to the ultimate consumer. Three other estimates of future fertilizer demand, prepared by the Fertilizer Association of India, the RCF and the Ministry of Agriculture (Reference D, A and B - Project File), are presented along with the Bank estimates in Annex 4-4. These estimates are more optimistic than the Bank's estimates regarding future fertilizer demand. Preliminary estimates of the NCAER's Fertilizer Demand Study (para 2.21) also place the projected 1987/88 nitrogen demand at around 8.0 million tons. The Bank's

projected nitrogen demand growth rate for the period 1978/79-82/83 is 10.2% - against 16.6% achieved in the period 1961/62-78/79. The Bank's estimated 1984/85 nitrogen demand, about 4% lower than the average of the other four estimates, is considered reasonable.

4.09 The projected growth in fertilizer demand is based on several assumptions. High fertilizer application levels are mainly in irrigated areas cultivated with HYV seeds. In the period 1972-77, about half the increase in fertilizer consumption was due to the increase in irrigated area by 8 million ha and extension of the HYV area by 16 million ha. In the likelihood of a slower than planned implementation of Government's irrigation plans and HYV increases, the future fertilizer demand will be adversely affected. As mentioned in para 4.03, the current fertilizer demand base is narrow and will require to be broadened with adequate fertilizer supplies and intensive promotion campaigns. The relative prices of the fertilizer to the crops on which fertilizer is used were quite high in the early 1960s, but fell during the 1960s and early 1970s. The recovery of the fertilizer demand indicates that increased fertilizer application is still profitable to the farmer. The demand forecasts assume that the price ratios will continue at the present or improved levels. Increase in effective fertilizer demand also requires strengthening of credit institutions, since about 70% of the fertilizer purchases are on credit. The above constraints to fertilizer consumption have also been identified during the Bank's economic work and are taken into consideration in the Government's programs for promoting fertilizer consumption.

4.10 The fertilizer production estimates given in para 4.08 take into account plants already in operation, under construction and firmly planned (Annex 2-1). The estimates include production from the three major projects now in the planning stage and expected to come on stream by 1984/85 - Kakinada (228,000 tpy N), Namrup III (152,000 tpy N) and Surat (624,000 tpy N); the proposed Surat Project, similar in scope to the proposed Project, is also being considered for Bank financing. The newer plants are assumed to operate at 90% of their capacity from their third year of operation. For the older and problem plants, past performance and the effect of modification schemes have been reviewed to assess the likely production levels. An allowance has also been made for possible losses in production due to unforeseen factors and somewhat lower capacity utilization in the coal-based plants. The projected production in 1985 is about 85% of the overall nitrogen and phosphate capacities and is considered achievable if the Government continues its efforts, as is expected, to increase capacity utilization (paras 2.07 to 2.11).

4.11 The comparison of nitrogen demand and production estimates shown in para 4.08 indicates that a shortfall in domestic supply is likely to continue. The above table also shows that even including production from the planned new projects - Thal, Kakinada, Surat and Namrup III - the projected demand will be higher than anticipated production by about 12% in 1985. If nitrogenous fertilizer demand during 1978/79-1984/85 grows only at 9% annually, instead of the 10.2% derived from the Bank projections, due to the constraints mentioned in para 4.09 and even assuming that there will be no

slippage in the completion of new plants, production will be just adequate to meet demand; thus indicating that not only the Project but also the other large plants now being planned will be required.

D. Ammonia

4.12 At 90% production level, the Project is expected to have 26,730 tpy of excess ammonia available for sale to other fertilizer plants and industrial users. At current production levels of existing facilities and 90% production levels of the Trombay IV and Trombay V plants (now being commissioned and expected to come on stream in 1983, respectively), Trombay will have a shortfall of 50,000 tpy which it intends to meet partly with ammonia from Thal supplemented with imports. The Cochin II NPK fertilizer plant presently operating on imported ammonia, also requires about 50,000 tpy of ammonia at its rated capacity, and some additional ammonia will be needed in the Cochin I facilities to improve urea production. Even at 80% production level at least 40,000 tpy of ammonia would be used in the Cochin plants.

4.13 In addition, potential industrial users for Thal's ammonia include the Hindustan Organic Chemicals Ltd. and explosives producers, who will respectively use 6,000 tpy and 4,000 tpy of ammonia for nitric acid production. There is, thus, an identified market for about 100,000 tpy of ammonia. Furthermore, a committee formed by the Ministry of Chemicals and Fertilizers has recommended the construction of three major phosphatic fertilizer plants, which together will require about 240,000 tpy of ammonia. The Bank's own analysis of India's phosphatic fertilizer supply and demand situation in the early/mid-1980s establishes the need for at least one of these plants to be commissioned by 1982/83. Thus, there should be no difficulty in finding an adequate market for the Project's ammonia. The pool of ammonia tank wagons now available with RCF will be adequate for moving the ammonia to the industrial buyers and to Trombay.

E. Marketing and Distribution in the Project's Market Area

1. Distribution Model

4.14 As part of an overall fertilizer transportation study (Reference F - Project File), a joint group of the Ministry of Chemicals and Fertilizers and the Railway Board developed a preliminary overall fertilizer distribution strategy keeping in view the new capacities in the Western region of India. The underlying methodology in developing the overall distribution plan took into account the following major considerations: (i) to minimize cross movements of similar fertilizer products from different producers, (ii) as far as possible, to move fertilizer in unit train loads to reduce movement time and (iii) to avoid where possible transshipment from one gauge to another. The distribution plan also aimed at (a) minimizing the average freight of the individual fertilizer producing units, (b) spreading out dispatches uniformly throughout the year, (c) keeping in view market requirement of various products and market size, (d) ensuring that no factory relies entirely on the market in

only one state and no state draws its entire requirements from one plant, and (e) ensuring that there are no radical changes from year to year on the marketing areas of the individual producers. These considerations are the same as those used by the Government in developing biannual plans for allocation and movement of fertilizers in zonal conferences. The findings of a preliminary study relating to the producing plants in the western region and imports through Kandla and Bombay prepared by an inter-ministerial group are summarized in Annex 4-5. As may be seen from the annex and Map IBRD 14284, the major markets in 1984/85 proposed by this study for the project output will be Maharashtra mainly supplied by road, and Uttar Pradesh supplied by movement through the Central Railway system. Given the large projected gaps between demand and production in Northern States by 1984/85, a large part of the production from the plants based on the Bombay High gas and of imports would be marketed in Uttar Pradesh, Rajasthan, Punjab and Haryana. While plants located in Gujarat would move the fertilizer through the Western Railway system mainly to Punjab, Haryana and Rajasthan, the project output not consumed in Maharashtra would be transported through the Central Railway system to Uttar Pradesh. As demand grows in the Southern States during the late 1980s, a part of the project output is likely to be sold in the Southern States again through the Central Railway system. The Government is expected to further review and discuss with the Bank more detailed findings of the inter-ministerial group, which are expected in late 1979.

## 2. Marketing Organization

4.15 Until the mid-1960s, all fertilizers were distributed by the Government Central Fertilizer Pool; a revised policy instituted in 1965 permitted domestic fertilizer units to market their products, while the Pool continued to distribute imported materials (except potash, which is distributed by Indian Potash Limited). The marketing organization of FCI, which was set up in 1966, grew rapidly and by 1977 had a network of over 4,500 dealers, each covering a Block 1/ of about 100 villages with an average of about five retail outlets. In accordance with government policy about half of the sales are made through cooperatives and other institutional outlets, while the rest is distributed through the private sector. With the restructuring of FCI, its Western Marketing Division, which was responsible for marketing the Trombay's products, has become part of RCF.

4.16 Although RCF already has an established marketing organization it recognizes that considerable strengthening and expansion of the services, especially in Uttar Pradesh, will be necessary to meet its future marketing needs. An increase in Western Marketing Division's marketing staff by 150 people is envisaged. Currently, over 2,000 dealers market RCF products (Reference B and C - Project File); this number is expected to increase to over 4,500 by the early 1980s. RCF's market promotion, in operation for several years under FCI, already includes programs such as field demonstrations, free soil testing services, "fertilizer festivals," mass training programs for farmers at the village level, crop care services, experimental trials, agronomic guidance, and comprehensive services to selected villages.

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1/ Administrative unit corresponding to a county.

The programs are implemented in coordination with the state governments, which already have extension programs of their own. Many states are reorganizing and strengthening their extension services through training and visits, and extension reorganization in most states is receiving Bank consideration for assistance.

4.17 The Government's pricing policy on urea allows a margin of Rs 100/ton to private dealers and Rs 115/ton to cooperative and other institutional buyers. While this margin continues to be adequate if the fertilizer is distributed close to railheads, the margin does not include adequate incentives to extend the marketing to areas away from railheads. The Government and the industry do not favor a general increase in the dealer's margin, since such an increase, while providing a larger profit to the dealers, may still not encourage the marketing of fertilizers in interior locations. The Government is aware of the importance of modifying the fertilizer price build-up to promote its increased use in areas away from the Indian railway system. The Government plans to rely mainly on promotional and extension efforts in these areas to develop increased fertilizer consumption and to encourage the growth of a dealership network to make the fertilizer more easily available. As against the notional freight provisions of Rs 38 per ton used earlier as the urea pricing formula, the Government now reimburses the manufacturer with the actual freight based on the previous years' average freight for delivery to the dealers. This measure is expected to remove the constraint of inadequate freight provision on the marketing of fertilizers at locations away from the railway network.

### 3. Product Movement

4.18 Current expectations indicate that only about 10% of the Project's urea output may be moved out of Thal by road; this proportion could be expected to increase in later years, but would most likely not exceed 15%. The remaining urea and ammonia will be moved by rail. Because of the seasonal nature of fertilizer demand, up to 200,000 tons per month of urea may have to be moved by rail, equivalent to 200-250 wagon loads per day. The Railway authorities have studied the strengthening of the Railway systems required to handle the large fertilizer movement from the Western region. Certain important line capacity works such as provision of a third line on each of the two ghat sections of the Central Railway, doubling on the Nagda-Kota Section of the Western Railway, automatic signalling on the Mathura-Palwal Section and remodelling of the Jalgaon and Bhusawal yards, are already in progress but would have to be speeded up. These schemes will require an allocation of about Rs 100 million (US\$ 12 million) during the next three years and would be part of the normal Railway plans. In addition, certain works of yard modelling and strengthening of track capacity on the concerned sections of the Central and Western Railways have to be planned and executed as soon as possible. These will include improvement in track standard and capacity of the Apta-Panvel-Dina Section, development of the Panvel yard, bypass lines at Dina and Vadodara, additional bypass lines at Godhra and Ratlam, intermediate block signalling works on the Kalyan-Kasara, Igatpuri-Jalgaon, Udhua-Vadodara, Kandla-Anand-Godhra, Godhra-Ratlam, Mathura-Palwal and Udhna-Jalgaon Sections

and a third line on the Jalgaon-Bhusawal Section. The above schemes will require another Rs 300 million (US\$35 million) during the next three years. Agreement has been reached with the Government that it will take all actions necessary to provide the railway facilities adequate for the movement of raw materials required for the Project and for finished products to be manufactured at the Thal Unit, in accordance with a program agreed upon with the Bank. The Government has also confirmed that it will take all actions necessary to ensure that adequate railway wagons are available to RCF for the operation of the Thal Unit at full capacity. Wagon allocation for fertilizer movement has a high priority and is coordinated by the Ministry of Agriculture. The urea will be moved in bags since specially designed wagons for bulk shipment of urea are not available, but the Railways intend to carry out investigations on suitable systems so that the open rail wagons bringing in coal can be used to move out urea. Railhead warehousing space will be used to mitigate extreme seasonal fluctuations. Warehouse capacity for about 150,000 tons, which is already available, will be rented from the Central and State Warehousing Corporations. While no major difficulties are expected in the transport and storage of the Project's output, due to the number of government entities involved, RCF will have to plan in advance for the required fertilizer warehousing. RCF has agreed to provide the Bank with its detailed plans for warehousing the Thal urea before December 31, 1980.

#### 4. Fertilizer Credit

4.19 Credit in fertilizer marketing is needed at two stages: (i) credits for farmers to enable them to invest in inputs until the harvest is sold; and (ii) distribution credits to the dealers for stocking fertilizers at various points. Farm credits come from three official sources - cooperatives, commercial banks and government short-term credit. The village moneylender still plays a, though diminishing, role in providing loans. Although credit has been expanding, there are indications that it is still insufficient to cover the needs. In fact, the cooperatives are consistently falling short of their lending targets, and other sources are not filling the gap, in many instances for reasons other than shortage of funds e.g., Reserve Bank of India restrictions because of high overdues.

4.20 Credit requirements for fertilizers in 1978 were estimated at Rs 10,500 million (US\$1,220 million) by the Ministry of Agriculture, on the assumption that 70% of total fertilizer sales are made on credit. The Government aims at substantially increasing credit available to the agricultural sector, both for fertilizers and other purposes, by progressively institutionalizing the sources of credit and adopting a multiple agency approach. The cooperative sector provides about 80% of the agricultural credit. Short-term credit through the cooperatives increased from Rs 7,830 million (US\$910 million) in 1975 to about Rs 13,400 million (US\$1,560 million) in 1978. The cooperative credit is expected to increase to Rs 25,000 million (US\$2,910 million) by 1983, out of which about Rs 16,500 million (US\$1,920 million) will be available for fertilizers. The government plans aim at increasing the share of credit going to small farmers (owning less than 2 ha

of land each, totalling 70% of the farm holdings) from the existing level of 30% to 50%. Agriculture Refinance and Development Corporation schemes now cover most of the districts in India.

4.21 The share of commercial banks for agricultural credit continues to be relatively meager, mainly due to the banks' unwillingness to enter into high risk areas. Their lending procedures, though gradually improving, still involve delays in clearance, emphasis on provision of security, and high margins on credit advanced. On the other hand, the role of cooperatives--especially the cooperative banks--in providing credit has been increasing over the years. Although they cover only a small section of the rural population, cooperatives are the major organized source of agricultural finance. An agricultural credit intensive development scheme has been taken up by the state governments in some 40 districts. Under this scheme, the structure of some 10-15% of the cooperative credit institutions will be strengthened on a selective basis for intensive agricultural credit.

4.22 Institutional agencies and private dealers engaged in fertilizer distribution receive distribution credits from the suppliers. For imported fertilizers, the Central Fertilizer Pool allows 55 days credit to re-allottees of the state governments, while private manufacturers allow credit ranging from 15-60 days to dealers and cooperatives. RCF intends to ease its standard secured credit terms (currently 30 days) to distributors to 45 days credit. The rate of interest on distribution credit ranges between 14.5% and 15% p.a., although some of the commercial banks have charged as much as 18% p.a. These rates are high compared to interest rates charged elsewhere in the economy. Adequate and timely availability of both production and distribution credit is essential to widen the demand base of fertilizer districts where fertilizer usage is still limited. The Government's fertilizer credit plans will significantly affect fertilizer consumption growth rates; current constraints in credit availability have been considered in deriving fertilizer demand forecasts in para 4.08.

#### F. Product Prices

4.23 As mentioned, urea and other straight nitrogenous fertilizer prices are statutorily controlled by the Government. The retail price of urea, which had remained virtually stable since the mid sixties, increased sharply in 1973 and again in 1974. Contrary to expectations that fertilizer price increases would not depress demand, fertilizer offtake continued to fall during the 1975 Kharif season, despite ideal rainfall conditions. In response to this the urea price was first reduced in July 1975 and further reductions have been made since that time with the retail price now standing at Rs 1,450/ton. The following table compares urea retail prices in India (exclusive of local sales tax) with the (notional) prices of urea on the basis of CIF India prices plus an average margin for port handling and internal distribution within the country, exclusive of import duties.

India - Comparison of Domestic Retail Prices and Import Prices of Urea  
(in current Rupees per ton)

	<u>Retail Price</u> a/	<u>Import Price</u>	<u>Difference</u>
March 1972	850	660	190
October 1973	928	1,164	(236)
May 1974	1,215	2,820	(1,605)
July 1975	1,365	2,620	(1,255)
March 1976	1,400	1,215	185
February 1977	1,400	1,295	105
October 1977	1,311	1,455	(144)
March 1979	1,311	1,530	(219)

a/ Excludes excise duty, pool equalization surcharge and local taxes totalling Rs 239 in February 1977 and Rs 139 from March 1979.

From the above table it can be deduced that the domestic retail prices have been generally in line with import prices except during 1973-75, when import prices were much higher.

4.24 With the rise in equipment costs and raw material prices - both in India and internationally - it became apparent that the prices received by the Indian urea manufacturers since 1974 were inadequate and, therefore, discouraged investment in new capacity. A committee under the chairmanship of Mr. S. S. Marathe, set up in 1976 to develop a rational system of pricing, recommended a system of retention prices for individual production units in the nitrogenous fertilizer industry. The system introduced in November 1977 allows an ex-works retention price per ton of urea, for each producing unit, based on efficient operation at 80% capacity utilization, an after tax return of 12% or a before tax return of 28.4% on net worth, whichever is higher. The part of the sale price retained by the industry is at present Rs 1,158/ton of urea. The difference between the retail price (Rs 1,450/ton) and the price retained by the producers (Rs 1,158/ton) covers excise duty, the Fertilizer Pool Equalization Charge, freight and dealer's margin as shown below.

India - Build-up of Retail Price of Urea - March 1979

	<u>Rs/ton</u>
Price retained by industry	1,158
Excise duty @ 7.5% ad valorem	87
Fertilizer Pool Equalization Charge	52
Equated freight	38
Dealer's margin	<u>115</u>
Maximum retail (sale) price	<u>1,450</u>

Manufacturers with allowed ex-works prices (so-called retention prices) lower than Rs 1,158/ton are required to credit the difference to a Fertilizer Price Fund account, which is used to reimburse those producers whose allowed prices are higher than Rs 1,158/ton.

4.25 Deducting the freight and dealer's margin elements (Rs 38 and Rs 115 per ton, respectively) - which are cost elements outside the factory - from the retail price (Rs 1,450/ton) gives Rs 1,297/ton which can be viewed as a surrogate ex-factory price or farmer price less distribution cost. This price can then be compared with the average producer retention price and the cost of imported fertilizer to determine if there are any subsidies in the system. The estimate of the average allowed retention price to be received by the fertilizer industry in March 1979 was Rs 1,462/ton while the landed cost of urea, which may be viewed as the opportunity cost, was Rs 1,530/ton (at current prices). Thus, in March 1979:

	<u>Rs/ton</u>	<u>Differences</u>
Ex-factory equivalent of Farmer price	1,297 )	)
	)	165 )
Industry retention price	1,462 )	) 233
	)	68 )
Opportunity cost of urea	1,530 )	)

The above indicates that while the farmer paid ex-factory Rs 233/ton of urea less than the landed price, the industry received Rs 68/ton less than the landed cost of urea. In early 1979, the Government extended the pricing scheme to complex fertilizers also. The new policy substantially improves the financial situation of the manufacturers and at the same time maintains fertilizer prices attractive to farmer. The Government is reviewing several improvements to the pricing scheme to speed up price adjustments following cost escalations and to provide a minimum capital base equal to the equity funds for purposes of calculating the return on the capital employed. The Government has agreed that it will not take or cause to be taken any action which, assuming production under conditions of efficient operation, would prevent fertilizer manufacturers from meeting all their expenses, servicing their debts, and earning a reasonable return on invested capital.

## V. THE PROJECT

### A. Project Scope and Location

5.01 The Project consists of two natural gas-based ammonia units, with a capacity of 1,350 tpd each, and three urea units with a capacity of 1,500 tpd each. It is part of an overall plan to use most economically the associated and non-associated gas from the recently developed Bombay High and South Bassein offshore oil and gas fields, which as mentioned were partly financed by a Bank loan (Loan 1473-IN). Based on 330 stream days per year operations,

the project facilities will be designed to produce 1,485,000 tpy of urea and 29,700 tpy of ammonia at 100% rated capacity. The saleable ammonia will be produced partly as a result of the gas composition, which does not allow full conversion of ammonia produced in the synthesis section into urea for lack of carbon dioxide and partly due to the possible differences in stream efficiencies between the ammonia and urea plants.

5.02 The proposed ammonia plant will be the largest steam reforming unit yet to be built in India, even though similar capacity plants are successfully in operation elsewhere. A steam reformation plant of 1,100 tpd capacity is operating satisfactorily at Tuticorin in India after some of the heat exchangers, considered inadequate, were replaced. A fuel oil-based ammonia plant of 1,350 tpd capacity is currently under construction near Broach in India. The use of the larger ammonia plant capacity as compared to the previously more common 900 tpd capacity is expected to reduce the project cost by about US\$30 million and improve the economic rate of return by about 0.7 percentage points. Based on experience available in and outside India, the larger plant capacity will not significantly increase the technical risks, either during construction or during operation. The Project also includes all necessary auxiliary and offsite facilities for smooth and efficient operation, such as steam boilers, power generators for critical services, product storage and loading facilities, and maintenance shops.

5.03 In addition, a substantial portion of the infrastructure, (consisting principally of township, rail spur and power link), estimated to cost about US\$26 million, has been included in the project scope, as the project site is located in an undeveloped area (para 5.04). Investment in a rail spur will be ultimately shared by other economic and commercial developments that may be located in the area, and half of the advances for the power line will be adjusted against the tariff for power supply from the grid. The plant layout is shown in Map IBRD 14246, and the location of the Project and related infrastructure in Map IBRD 14286.

5.04 The Project will be constructed at Thal, in the district of Kolaba, Maharashtra, 25 km south of Bombay (Map IBRD 14286) and 20 km from Uran, where the pipeline terminal for the off shore Bombay High fields will be located. Various plant locations north and south of Bombay were considered. The selection of Thal as the ultimate project site followed a survey and evaluation of alternative sites in the region carried out by a government constituted expert team (References A and G - the Project File), and is based on the following major factors: (i) comparative closeness to the gas terminal at Uran; (ii) low land development cost; (iii) advantages of a seaside location with respect to the transportation of equipment and the disposal of liquid effluents after treatment; and (iv) location outside the command area for irrigation, not agriculturally important and away from large communities. After a detailed evaluation of the findings of the team by Senior State and Central Government officials, RCF and the Government decided on the selection of Thal as the project site. The Bank has carefully reviewed the government decision on the selection and has confirmed that the Thal site is acceptable, from technical, economic and environmental point of view (para 5.17).

5.05 About 320 ha are available at Thal for the Project and additional land is available nearby for the development of a company township for its employees. A Special Land Acquisition Officer, appointed by the Maharashtra Government, was entrusted with the responsibility of land acquisition for the Project. The project authorities already have completed acquisition of the land and have full access to the site. Detailed soil investigation work of the entire area has also been completed.

## B. Gas and Coal Supply

### 1. Gas

5.06 As noted above, the natural gas required for the Project will be supplied by the Oil and Natural Gas Commission (ONGC) from the Bombay High and Bassein fields located about 160 km and 100 km, respectively, offshore of Bombay. At present the offshore fields have total proven recoverable reserves of oil estimated at about 250 million tons with an additional 85 million tons likely if "probable" reserves are confirmed. The availability of associated gas from the two fields is expected to rise gradually in line with the fields' oil production from about 0.95 million normal cubic meters (Nm<sup>3</sup>) per day in mid-1978, to 1.75 million Nm<sup>3</sup> per day in 1980 and 2.70 million Nm<sup>3</sup> per day by 1982-83, when oil production would reach the planned level of 8.2 million tpy (180,000 barrels/day). In addition, the South Bassein fields are anticipated to produce up to about 10 million Nm<sup>3</sup> per day of non-associated gas.

5.07 The first two phases of development of the reserves have been completed, and the crude oil production is now about 3.9 million tpy (or 80,000 barrels per day). The associated gas is now used in the Trombay fertilizer plants and the Tata thermal power station. The third phase of this development, partly financed by the Bank (Bombay High Oil Development Project: Loan No. 1473-IN) consists of the drilling of about 20 development wells and the construction of five well platforms to raise production to 7 million tpy (140,000 barrels per day) as well as the construction of three processing platforms, permanent pipeline transport facilities and shore facilities. Phases IV and V will include additional facilities to develop the capacity to the planned 1982-83 level of 8.2 million tpy. The entire program is expected to be completed by the early 1980s.

5.08 The oil pipeline system included in Phase III consists of submarine and land pipeline at a total cost of US\$138 million and has an ultimate capacity of 29 million tpy. The system also includes gas pipelines linking Bombay High through the Bassein fields to Uran and linking Uran with Trombay (Map IBRD 13340R). The gas pipeline system, estimated to cost US\$111.5 million, has a capacity of 7.5 million Nm<sup>3</sup> per day. The pipeline projects were completed in May 1978. To supply gas to the Project, ONGC will build at its own cost (estimated at US\$10 million) a 10 km long 18" diameter

pipeline from the Uran gas terminal to Thal. The Government is also proposing to connect the free gas wells in South Bassein to the gas pipeline system. The pipeline and this connection can also be completed within 12 months.

5.09 The shore terminal at Uran will include a crude stabilization unit, a gas processing plant and storage facilities. The offshore associated and non-associated gas conveyed by the pipeline and the gas produced at the crude stabilization unit will be processed in a gas fractionation plant. The plant will initially be a liquefied petroleum gas recovery unit but will be designed so that additional facilities can be added later when demand develops for petrochemical feedstocks. The methane rich residual gas, piped to the Trombay and Thal fertilizer plants, will have the following approximate composition: methane 93.0%, ethane 5.0%, propane 0.5%, butane 0.1% and inerts 1.4%. Gas with the above analysis, is suitable for ammonia production by the steam reformation process. The gas will be supplied to the Project at the battery limit at a pressure of 43 atmospheres, which is adequate.

5.10 At full capacity operation, the Project will require about 2.8 million Nm<sup>3</sup> per day of natural gas, and the Government has allocated this quantity to the Project. RCF has initialled an agreement with ONGC for the gas supply. The gas price has been determined by the Government on parity with delivered naphtha cost (about Rs 590/ton) based on the recommendations of a government committee, and is expected to be about Rs 626/1,000 Nm<sup>3</sup>, in 1978 rupees (equivalent to Rs 878 in 1983/84 rupees). As the needs of potential customers already identified exceed expected associated gas production and to ensure that the Project's production is not dependent on maximum oil production at all times, ONGC has agreed to connect the South Bassein gas wells to the Uran pipeline before January 1, 1982. ONGC has also agreed to complete the gas pipeline from the Uran terminal to the Thal project site before June 30, 1981. The agreement includes adequate provisions for increasing the gas supply, when, for environmental reasons, the boilers have to use gas instead of coal. Agreement has been reached with RCF that conclusion of a satisfactory gas supply contract with ONGC, which would include contract quantity and quality as well as arrangements for tying-ins of the non-associated gas fields and for contingency gas supply for steam generation, will be a condition of effectiveness of the Bank loan. Finally, assurances have also been obtained from the Government that it will ensure adequate supplies of natural gas for the Project.

## 2. Coal

5.11 Grade I coal (with 19-22% ash and 0.3-0.7% sulphur) will be used to generate the steam required in the urea plant as well as for captive power generation; use of coal is consistent with government policy that restricts the use of gas to feedstock only and promotes use of domestic coal for power generation. The allocation of Grade I coal to the Project is in recognition of the Government's anxiety to keep down the particulate matter and sulphur dioxide contents of the steam generation unit stack emissions. About 1,800 tpd of coal needed by the Project will come from the Bistrampur, Kumda and

Bhatgaon coal fields of Central India, about 800 km from Thal. As confirmed by the Railway authorities, coal transport from those coal fields to Thal is not expected to pose problems especially after the third railway track now under construction across the Western Ghats is completed by 1980/81. RCF and Coal India Ltd. have been authorized by the Government to conclude the commercial agreement for the coal supply. RCF has initialled a satisfactory agreement for coal supply and will sign it as a condition of effectiveness of the Bank loan. The coal supply contract will include the quantity and quality of coal supply and linkage with the supplying collieries. Agreement has been reached with the Government that it will assure adequate supplies of coal for the Project.

## C. Utilities and Infrastructure

### 1. Power

5.12 The Project will require about 30 MW of power, of which 15 MW will be generated within the plant to meet the Project's critical process requirements, and the rest will be supplied from the grid of the Maharashtra State Electricity Board (MSEB). The outside power supply is not expected to become a bottleneck as adequate additional state grid capacity is under implementation. To transmit the power to the site, a double 220 KV line will be laid between the Apta substation of MSEB and Thal over a distance of about 48 km (Map IBRD 14286). MSEB has asked RCF to provide Rs 20.6 million (US\$2.4 million) as an advance against the full power line cost; later half of the above amount will be credited against power charges. An initial payment of Rs 1.5 million has been made by RCF, and the MSEB is proceeding with the arrangements for power supply. The Project will also have two power generators, including one as standby, to meet the requirements of the two ammonia plants and related offsites. These arrangements are necessary to ensure that ammonia plants--which are more difficult and time consuming to restart than the rest of the plants--continue operating during external power interruptions/fluctuations. The generators will be adequately sized so that with both generators in operation all process plants and related facilities can be operated on self-generated power. RCF has agreed to conclude a satisfactory power supply contract with MSEB, which would include the quantum of power supply and the schedule for the Apta-Thal transmission line, as a condition of effectiveness of the Bank loan.

### 2. Water

5.13 The estimated total water requirements of the Project are 20 million gallons/day (Mgd), including one Mgd for the township. The Maharashtra Industrial Development Corporation (MIDC) will be responsible for implementing a water supply scheme based on water from the nearby river, Amba. A barrage (dam) across the Amba River will be constructed by the State Irrigation Department for MIDC which would construct the intake works, the 32 km pipeline and the filtration plant. The investment requirements of the Amba water scheme are estimated at Rs 100 million (US\$12 million) which will be financed from the internal resources of MIDC (Rs 15 million), by bonds floated to the public (Rs 10 million) and a loan of Rs 75 million from the State Bank of India. With an annual capital works program of MIDC of about Rs 120 million,

MIDC should be able to mobilize the necessary financial resources for the water supply project. MIDC has already invited bids for steel plates and for pipe fabrication work. Agreement has been reached that RCF will conclude with MIDC a satisfactory contract for the water supply, which should include the supply quantity and MIDC schedule for completing the supply arrangements, as a condition of effectiveness of the Bank loan.

### 3. Other Infrastructure

5.14 The infrastructure needs of the Project include the gas pipeline from Uran, the construction of a 45 km railway spur between Apta railway station and the project site, strengthening of the road between Khopoli and Thal, and the water supply scheme (para 5.13). These facilities will be shared by other economic developments expected to be located later in the region. In addition, the Project includes a township (financed and implemented within the Project), and powerline from Apta. The total infrastructure development cost is estimated at about Rs 350 million (US\$40 million). The implementation schedule for the major facilities is shown in Annex 5-1. In particular, the construction of the railway spur is critical for movement of the finished product (urea) and raw materials, especially coal and fertilizer bags. The third railway track, which would relieve the track capacity constraints on moving material across the Western Ghats, is expected to be completed by December 1981. The three major bridges on the Apta-Penn Section are already under construction, and the railway line is expected to be completed by June 1980. Survey work on the siding from Penn to Thal, to be financed within the Project, is nearing completion. Contract for the bridge on river Amba has been awarded and soil testing work is in progress. The railway siding, with a total estimated cost of Rs 78 million (US\$9.1 million), is scheduled for completion by June 1981. Finally, road strengthening work mainly for the movement of construction materials and equipment to the project site is already being carried out by the State Government and will be completed in time. The Maharashtra State Government has provided satisfactory written confirmation to the Government of India that it will ensure that all concerned State government agencies are given the necessary facilities and resources to complete the water supply scheme, the power connection and the road restructuring works in time for the Project.

### D. Operational Manpower and Training

5.15 The Project will employ about 1,565 people most of whom will be skilled or semi-skilled technicians. The staff will be recruited from the existing fertilizer and chemical plants in the Bombay area as well as from the Kolaba region in which the Project is located. Indirect employment of up to 5,000 people is expected in transportation, marketing and communications. Preliminary training plans for the technical operating and maintenance staff have been prepared and will be finalized before December 31, 1979. The Indian fertilizer industry presently employs about 60,000 people including about 9,000 managers and supervisors. About 75% of this employment is in the public sector including ex-FCI units. The key managers and supervisors needed

for the Project will be drawn from existing public sector companies; if necessary, they will be trained overseas in ammonia and urea plants similar to the Project. The invitations for proposals for ammonia and urea process consultants include provisions for such training outside India.

5.16 The remaining staff will be recruited from technical universities and schools and trained in three categories - engineers/managers, supervisors and technicians. RCF has well equipped and staffed training centers in its plants at Trombay. After initial orientation in the training centers, the trainees will be allocated to specific responsibilities and trades and given on-the-job training in RCF's plants. The trainees, most of whom will come from RCF's Trombay Training Center, will be in Thal well before the various project units are ready for testing and commissioning, to become familiarized with these units and with their operating and maintenance instructions. Several of the maintenance supervisors and technicians will participate in the erection and testing of the specialized equipment. RCF has already hired an experienced Training Manager to formulate its training plans for the operational staff of the Project. RCF has agreed that it will complete and discuss with the Bank the detailed training plans before December 31, 1979, and subsequently take timely action to implement the plan.

#### E. Environmental Aspects

5.17 Considering that the Project will create a major industry in a relatively underdeveloped and rural area, the Bank has carefully reviewed all environmental aspects during the appraisal of the Project to ensure that project design and location will not adversely affect the region. The major potential pollutants from the complex are ammonia and urea from the main process plants and the fly ash dust and sulfur dioxide from the coal fired boilers. The only other important effluent will be the waste from the water treatment and demineralizing facilities. The plants will be designed and engineered to minimize the introduction of ammonia and urea into the liquid effluent streams. Effluents containing ammonia and urea will be collected separately, hydrolyzed to decompose the urea to ammonia and stripped. The effluent leaving the plants will contain less than 25 ppm of ammonia and 200 ppm of urea. The urea dust escape from the prilling tower into the atmosphere will be reduced by scrubbing the dust laden gases with water. The combined liquid effluent of the Project will be monitored, treated suitably and let into the sea. The coal fired boilers will use Grade I coal and will change over to natural gas if and when the particulate level from coal burning exceeds agreed levels. The boilers fitted with electrostatic precipitators and stacks of minimum 150 meters height will minimize fly ash dust allowed into the atmosphere. The pollution control and monitoring arrangements planned by the Project have been reviewed by the Maharashtra Prevention of Water Pollution Board, which has issued a no-objection certificate prescribing the norms and conditions to be followed by the Project (Annex 5-2). The prescribed norms are generally in conformity with internationally accepted standards and in some cases are even more stringent. The Bank staff have reviewed the arrangements made for the Project and the norms prescribed by the State authorities, and are satisfied that the standards can be met and

that the pollution levels stated previously are within these norms and are acceptable to the Bank. The pollution control measures adopted for the project were also reviewed by independent specialized consultants from the International Fertilizer Development Center, who have confirmed (Reference H - Project File) that these measures along with implementation of certain other recommendations will assure that the Thal facilities can be operated with pollution levels well within acceptable limits. Assurances have been obtained from RCF that all the required measures will be adopted. RCF has agreed to appoint before December 31, 1979 competent independent consultants satisfactory to the Bank to design overall project pollution control systems, and present the designs for review by the Bank before June 30, 1980. RCF will install a sufficient number of monitoring stations in the area and employ a qualified manager to be in charge of implementing the pollution control measures and continuing to monitor them. RCF's training plans for the operating and maintenance personnel will include adequate emphasis on the importance of adequate pollution monitoring and control.

5.18 Safety norms in industrial plants are formulated and monitored in India by the State Inspectorate of Factories. The plant design and plans will be reviewed by the State authorities, as part of their normal industrial safety responsibilities, for conformity with these norms. The Project's firefighting system includes emergency pumps, overhead reservoir and fire hydrants. The system will also include facilities for fighting chemical fires. As Indian practice requires, these systems for the Project will be engineered to standards prescribed by the state-owned General Insurance Company, which are satisfactory. RCF's staffing will include a qualified and trained safety officer assisted by safety and fire fighting personnel. Key operating and maintenance staff will be given training in safety and fire-fighting. Operating and maintenance manuals prepared by the engineering firms will be reviewed by RCF engineers for safety considerations to include required procedures to handle accidents. Training of RCF's operating and maintenance personnel will also include adequate emphasis on plant and personnel safety.

5.19 The project site has been identified keeping in view the importance of minimizing adverse environmental and social impact on the community. Except for one family in a small orchard, no other families are living within the plant site. However, 366 families own land within the project site and will lose part or whole of their land holdings. The State Government has reached agreement with the farmers on the level of adequate compensation for the acquired land and RCF has accepted the above level, which is significantly higher than the land prices in the area. The State Government and RCF have each appointed a Rehabilitation Officer who will assist the families concerned in relocation. These officers have completed a survey of the families to identify their members who can be provided employment in the Project, after suitable training if required. RCF has undertaken to provide employment to at least one person from each family whose land has been partially or entirely acquired. Assurances have been obtained from RCF that it will continue to employ as long as necessary its Rehabilitation Officer to assist the affected families in their relocations. The State Government, through its

Development Corporation of Konkan, will assist the above families to promote self-employment ventures by providing up to 15% of seed money as grant and assisting in obtaining commercial bank financing for 75% of the remaining needs for schemes costing up to Rs 100,000.

5.20 The growth in economic and commercial activity in the area following the Project could rapidly increase the population in the nearby Alibag town. The Government of Maharashtra has provided assurances that it will keep a close watch on the impact of the Project on neighboring Alibag town and ensure that adequate water supply, sewerage and other civic amenities are developed in time, so that the possible increase in Alibag population due to the Project will not result in unsatisfactory living conditions. The Government of Maharashtra also plans to initiate immediately a study through the Bombay Metropolitan Regional Development Authority (BMRDA) of the urban infra-structural requirements of the area during the next five to seven years and prepare an action program including an implementation schedule by June 30, 1980. The impact of the fertilizer project will also be studied by BMRDA and taken into account in updating the regional development plans. Other possible environmental effects of the Project have also been reviewed by the Bank to confirm that the Project will not adversely affect the region. Finally, the construction of the Project will bring to the area within a short period a large construction work force (about 5,000 people) and it is necessary to ensure that they are housed properly to prevent slum conditions in the construction camps. RCF has agreed to ensure that the construction camps will be provided with protected water supply, adequate sanitary facilities and clean surroundings. The pollution control and environmental measures adopted for the project area are, thus, acceptable and will continue to be monitored during project implementation.

## VI. PROJECT MANAGEMENT AND EXECUTION

### A. Project Management

6.01 RCF, which will be responsible for implementing the Project, became a separate legal entity in April 1978 (para 2.18). The Government has already appointed Mr. Duleep Singh, who was until recently the General Manager of FCI's Trombay Unit, as the Chairman and Managing Director of RCF, and the Finance Director has been selected. The RCF management has also made appointments to the senior positions in the Project (Annex 6) including the key positions of General Manager and the Project Manager. The overall coordination of the Project with the process engineering firms, Fertilizer (Planning and Development) India Ltd. (FPDIL), and other contractors will rest with the project authorities. RCF has appointed a person with extensive experience in project implementation and plant operations, as the General Manager in charge of the Project. He will be assisted by a Project Manager having experience in coordinating and monitoring project construction using project teams drawn from engineering and scheduling disciplines. This management team, supplemented with additional persons as required, will have direct responsibility for project implementation. Satisfactory assurances

have been obtained from RCF that it will establish and maintain a Project implementation Unit staffed with adequate personnel and headed by a suitably qualified and experienced Project Manager.

6.02 The proposed project implementation staff organization is given in Annex 6 . The General Manager, who will be in charge at the project site, will be assisted by a Project Manager, who will plan, coordinate and schedule all site construction activity. Individual project management teams will be responsible for different plant areas, such as ammonia, urea, steam generation, water treatment, material handling, etc. The Project Manager will also be assisted by a project team which will be responsible for project studies, revisions, schedule and cost monitoring and management reporting. The site project organization will include an operations management team with a Training Manager, who will develop and implement a training plan so that the team complemented with trained operating and maintenance personnel, can take over the operation of the facilities after commissioning. RCF has prepared a draft Project Implementation Manual and has agreed to finalize the same for Bank's review before November 30, 1979.

6.03 Even though India has developed considerable local capabilities in design, engineering and project management of fertilizer plants (para 2.12), it does not at present possess process know-how for ammonia and urea plants of the size involved. RCF, therefore, is in the process of selecting two foreign engineering firms, with direct experience in building similar capacity plants, to provide the process know-how (para 7.05). Invitations for proposals for the ammonia plant were issued in March 1978 to six internationally known process engineering firms, and invitations for the urea plant were issued in late 1978 (Reference E - Project File). RCF is finalizing its selection of the ammonia engineering firm and expects to enter into a contract by August 1979 after consultation with the Bank. The contract is expected to become effective by October 1979. The urea engineering proposals were opened in January 1979 and the selection of the urea engineering firm is expected by September 1979. The selected engineering firms will be fully responsible for sound engineering, timely completion of the plants, training of personnel in similar plants, and process guarantees. They will utilize the services of the FPDIL to the extent possible for detailed engineering, procurement, shop inspection, etc. Plant civil works and construction will be carried out by experienced Indian contractors, who will be technically supervised by RCF engineers and by engineers from the process engineering firms. The plants will be tested and commissioned by RCF engineers and technicians with technical supervision of expatriate engineers.

#### B. Engineering and Transfer of Technology

6.04 The arrangements proposed for implementing the Project are similar to those used successfully in Bank-financed expansion projects at Nangal, Sindri and Trombay. FPDIL has also carried out such work for other public sector units and has the capacity to undertake the project assignment. Contracting arrangements with the foreign process engineering firms would provide for FPDIL involvement during all facets of project implementation. The contracts will also permit reuse of the design and engineering by FPDIL in other similar projects in India with reduced expatriate assistance; the proposed Surat fertilizer complex is likely to be the first project to benefit from

this technology transfer arrangement. RCF will use competent Indian consultancy firms who will be responsible for the design, engineering and implementation of the offsites and utilities. FPDIL is carrying out the soil investigations and is expected to assist RCF in planning and design of the township.

### C. Project Schedule

6.05 The first stream of ammonia and urea plants along with required project offsites is expected to be mechanically completed by February 1983--42 months from the zero date of August, 1979, (as shown in the project schedule on the following page). The second stream of ammonia and urea plants is scheduled to be completed six months later in August 1983. <sup>1/</sup> Thus the entire Project would be completed in 48 months from the date the ammonia engineering firm is appointed (currently estimated to be August 1979), provided the ammonia engineering firm starts designs by the end of August 1979 and the orders for the steam generation units are placed before the end of September 1979. The project is expected to be in commercial production by February 1984. Considering the importance of the start of ammonia plant design work to the project schedule the appointment of the ammonia engineering firm will be a condition of Bank loan effectiveness. Agreement has also been reached with RCF that it will place order for the steam generation unit before September 30, 1979. The schedule is tight considering the size of the Project and the green-field site. However, considering the project preparation work already completed and the provision of good project management, emphasizing effective coordination with other agencies, it is considered achievable.

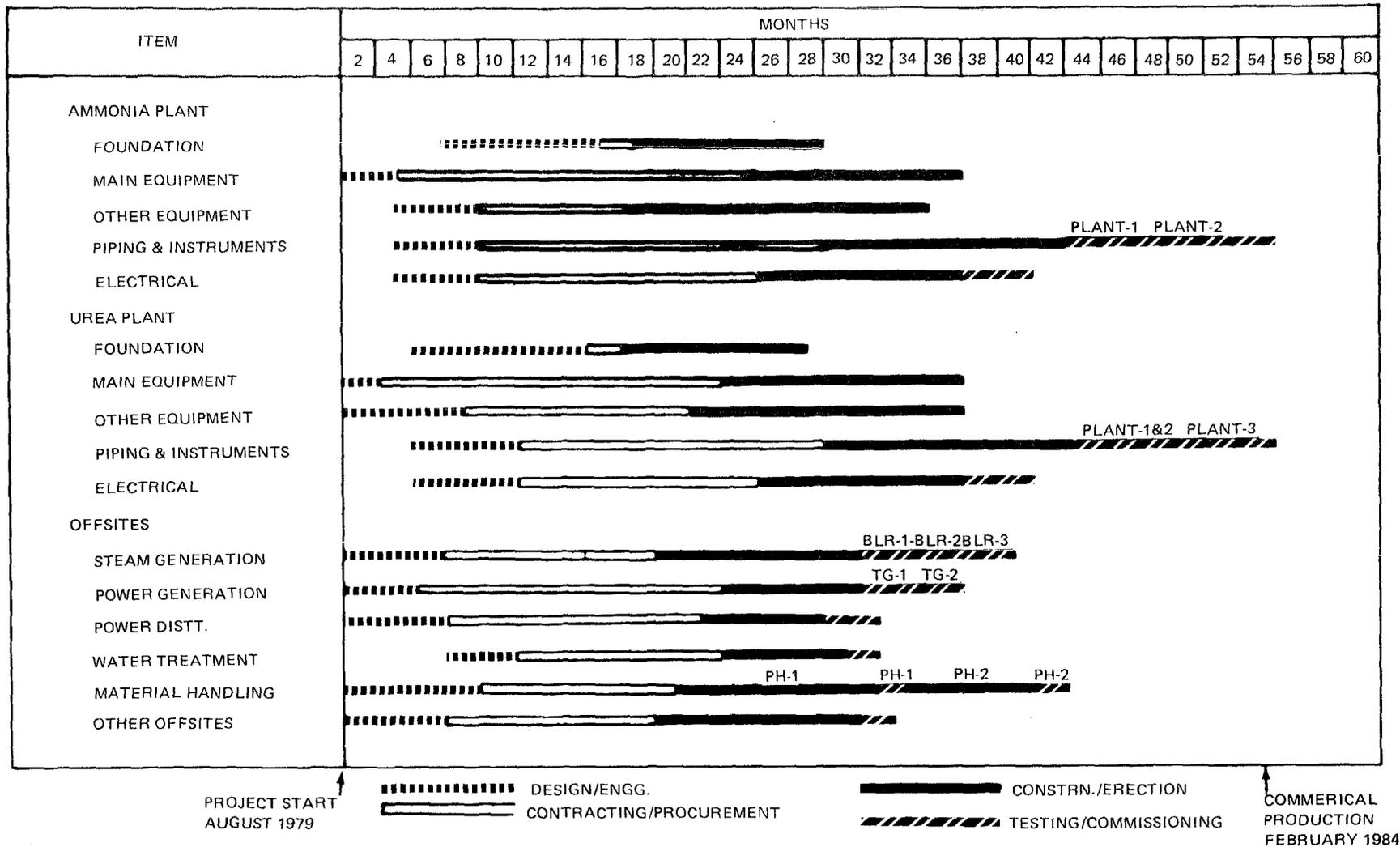
6.06 As several important equipment items for the ammonia plant and other facilities have deliveries of 16 months or longer, it is essential that bid documents be prepared before November 1979. To facilitate timely placing of orders with maximum use of international competitive bidding, the project authorities have already placed international advertisements for vendor registration. It is expected that a satisfactory vendor list will be ready for the Project by August 1979.

6.07 The Project relies on several other government agencies for timely completion of schemes which will provide the Project with land, water, electricity, road and rail links; delays in one or more of them could delay project completion. To coordinate progress of work by the various agencies, the State Government has formed a Coordination Committee, headed by the Secretary (Industries) of the Maharashtra Government and includes representatives of RCF, MIDC, Maharashtra State Electricity Board, Bombay Metropolitan Regional Development Authority, Maharashtra Prevention of Water Pollution Board and the Central Railways. The Government of Maharashtra has assured that the above committee will continue for the duration of the Project and will provide all the required support to the above agencies to carry out their respective obligations in a timely and efficient way.

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<sup>1/</sup> Project will be deemed completed when each of the facilities included has been in operation satisfactorily for at least 60 consecutive days at an average daily capacity utilization of not less than 80%.

## INDIA – THAL FERTILIZER PROJECT PROJECT IMPLEMENTATION SCHEDULE



VII. CAPITAL COST, FINANCING PLAN AND PROCUREMENT

A. Capital Costs

7.01 The total financing required for the Project, including working capital and interest during construction, is estimated at US\$812.3 million, of which US\$343.1 million is in foreign exchange. This includes the infrastructure investments for the rail spur from Penn, township and advance against cost of power connection from Apta, but excludes the costs of the gas pipeline from Uran, the water supply scheme and road strengthening. The base capital cost estimates are in October 1978 prices, as detailed in Annex 7-1 and summarized below:

Thal - Capital Cost Estimates

	Rs million			US\$ million			%
	Local	Foreign a/	Total	Local	Foreign a/	Total	
Equipment & Spares	693	1,666	2,359	80.6	193.7	274.3	53.3
Freight, Duties & Taxes	676	145	821	78.6	16.9	95.5	18.6
Engineering Services	157	203	360	18.3	23.6	41.9	8.1
Project Services, Management	108	4	112	12.6	0.5	13.1	2.5
Erection	272	-	272	31.6	-	31.6	6.1
Land & Civil Works	322	17	339	37.4	2.0	39.4	7.8
Commissioning Charges	85	-	85	9.9	-	9.9	1.9
Township	69	4	73	8.0	0.5	8.5	1.7
Base Cost Estimate (BCE)	<u>2,382</u>	<u>2,039</u>	<u>4,421</u>	<u>277.0</u>	<u>237.2</u>	<u>514.2</u>	<u>100.0</u>
Physical Contingencies (PC) (10% of BCE)	238	204	442	27.7	23.7	51.4	
Price Contingency (17% of BCE + PC)	445	381	826	51.7	44.3	96.0	
Total Installed Cost	<u>3,065</u>	<u>2,624</u>	<u>5,689</u>	<u>356.4</u>	<u>305.2</u>	<u>661.6</u>	
Working Capital	608	32	640	70.7	3.7	74.4	
Total Project Cost	<u>3,673</u>	<u>2,656</u>	<u>6,329</u>	<u>427.1</u>	<u>308.9</u>	<u>736.0</u>	
Interest During Construction	233	294	527	27.1	34.2	61.3	
Advances for - Rail Track	108	-	108	12.6	-	12.6	
Power Connection	<u>21</u>	<u>-</u>	<u>21</u>	<u>2.4</u>	<u>-</u>	<u>2.4</u>	
Total Financing Required	<u>4,035</u>	<u>2,950</u>	<u>6,985</u>	<u>469.2</u>	<u>343.1</u>	<u>812.3</u>	

a/ Including US\$93.0 million of indirect foreign exchange.

7.02 The above estimate is based on preliminary design of major equipment, and on cost data of recent equipment orders placed for the Sindri Modernization, Trombay IV and Phulpur Projects (Project File-Reference A). The estimate was also cross-checked by FPDIL with budgetary offers received from major international licensors and engineering firms for both the ammonia and the urea

plants. Physical contingencies are calculated at 10% on main plant equipment and supplies, offsites, civil works and plant erection. The estimates include annual price escalation of 7.5% for 1979 and 1980 and 7% thereafter for all imported items and local equipment, and 9% for 1979 and 1980 and 8% thereafter for local civil works and erection as well as other local cost items other than equipment. The project cost estimates have been reviewed against cost estimates indicated by the major plant contractors and are considered satisfactory. They will be detailed further for project control purposes when the engineering contracts for the ammonia and urea plants have been awarded. The working capital of US\$74.4 million in current prices, is based on 45 days of receivables, and 15 to 30 days of accounts payable. Interest during construction, at US\$61.3 million, is derived from the total project cost, the four years construction schedule, and the Government's on-lending rates to the Project of 10.25%.

B. Financing Plan

7.03 The financing plan of the Project is shown below and detailed terms of the financing are given in the text below:

<u>Thal-Financing Plan</u> (in US\$ million)				
<u>Source</u>	<u>Local</u>	<u>Foreign</u>	<u>Amount</u>	<u>Percentage</u>
<u>Equity</u>				
Government of India	326.2	-	326.2	40.2
RCF's Internal Resources	65.0	-	65.0	8.0
Total Equity	<u>391.2</u>	<u>-</u>	<u>391.2</u>	<u>48.2</u>
<u>Debt</u>				
Government of India/Bilateral	22.2	93.1 <sup>a/</sup>	115.3	14.2
World Bank	-	250.0	250.0	30.8
Total Long-term Debt	<u>22.2</u>	<u>343.1</u>	<u>365.2</u>	<u>45.0</u>
Short-term Debt <sup>b/</sup>	55.8	-	55.8	6.8
Total	<u>469.2</u>	<u>343.1</u>	<u>812.3</u>	<u>100.0</u>

<sup>a/</sup> Includes possible ODM (UK) financing of about US\$45 million.

<sup>b/</sup> May be met by RCF's internal resources.

The equity financing, equivalent to US\$391.2 million and 48.2% of total financing required, will be provided partly by RCF from its internal resources (US\$65 million) <sup>1/</sup> and partly by the Government (US\$326.2 million) both for local

<sup>1/</sup> Conservatively estimated at 60% of the accumulated cash from the present operations at Trombay during fiscal years 1982 and 1983.

currency expenditures. The Government's equity contribution will come from its development budget (US\$227.9 million); duties and taxes on equipment and materials (US\$71.2 million); and interest during construction (US\$27.1 million). The Government will also provide US\$115.3 million of debt financing (32% of required long-term debt financing) for both local and foreign currency expenditure. The short-term financing of US\$55.8 million will be available either from RCF's internal resources or from commercial banks and forms 75% of the working capital requirements. The Government has agreed to provide adequate funds to RCF to complete its ongoing projects and to finance the Project including any cost overruns and to meet any shortfalls in the availability of internal resources from RCF's operations or in short-term funds expected from commercial banks.

7.04 The proposed Bank loan of US\$250 million equivalent will cover 73% of total foreign financing requirements of the Project. The Bank loan will be lent to the Project through the Government relending the amount to RCF under a Subsidiary Loan Agreement with a repayment period of 15 years including 5 years grace and a net interest rate of 10.25%. Agreement has been reached with the Government that appropriate ratification of the Subsidiary Loan Agreement will be a condition of effectiveness of the Bank loan. The Government is discussing with the UK Government possible financing of about £ 45 million which it plans to use for financing part of the foreign exchange financing gap (US\$93.1 million). To the extent UK assistance is not available and to bridge the rest of the gap, the Government will use its own free foreign exchange reserves.

### C. Procurement and Disbursement

7.05 The design and engineering services for the ammonia and urea plants will be obtained following the Bank's guidelines for the use of consultants. Proposals have been invited internationally from qualified experienced engineering firms, and contracts will be awarded after evaluation, which will emphasize adequate experience and technical capabilities (para 6.03). Equipment and materials within the battery limits of the ammonia and urea plants will be financed with the Bank loan. International Competitive Bidding (ICB) will be used for all Bank-financed goods and related services, except for critical or proprietary imported items and small items costing less than US\$100,000 up to a combined maximum of US\$25.0 million, which will be procured by prudent international shopping, according to a list of goods to be agreed with the Bank. For purpose of bid evaluation, local suppliers will receive a margin of preference of 15% or the applicable customs duty, whichever is lower. The remaining imported items are expected to be financed using British (ODM) aid or free foreign exchange, using either U.K. (tied) procurement procedures or international bidding. The Government has agreed that any item financed from non-Bank sources, for which the British or Indian delivery schedules are unacceptable for timely project completion, will be procured through international bidding. On this basis, the project authorities intend to purchase the steam generation units and the turbo-generators either from the United Kingdom using ODM funds or from other international sources, if the UK deliveries do not meet the project schedule. The civil works and erection

(financed with local funds) will be carried out by Indian subcontractors who will be selected following competitive bidding procedures normally adopted by Indian public sector units; these are acceptable. The project management and part of the engineering services will be provided by the RCF and FPDIL staff. The above arrangements made for procuring the supplies and services for the Project are satisfactory.

7.06 The allocation of the proposed Bank loan of US\$250 million will be as below:

<u>Allocation of the Bank Loan</u>		
	<u>US\$ Million</u>	<u>Application</u>
Equipment, Materials and Spares		
Procured under ICB	190	100% Foreign and Local <u>/a</u>
Imported Critical, Proprietary or		
Small Items	25	100% Foreign
Services and Erection	25	100% Foreign
Unallocated	10	
Total	<u>250</u>	

/a Foreign = CIF; Local = ex-factory.

Of the total equipment and spares for the Project estimated to cost US\$375 million (including contingencies), it is expected that Indian manufacturers will supply about US\$120 million (or 32%) and the balance (US\$255 million or 68%) will be imported. It is also estimated that the Bank loan will finance local supplies totalling approximately US\$80 million won by Indian suppliers under ICB. It will not finance the remaining local items (about US\$40 million) on which only local suppliers are expected to bid. It is, therefore, anticipated that approximately 68% of the Bank loan will be disbursed against foreign currency expenditures and the remainder against local currency expenditures. The Bank loan is expected to be disbursed by June 30, 1984, in accordance with the disbursement schedule set forth in Annex 7-2.

## VIII. FINANCIAL ANALYSIS

### A. Revenues and Operating Costs

8.01 The assumptions used in the financial analysis of the Project are given in Annex 8-1. The analysis assumes that the first stream of the ammonia and urea plants will start commercial production in August 1983 and the second stream in February 1984. Capacity utilization of each stream is assumed at 60% in the first twelve months of operations, 80% in the second year and 90% in the third and succeeding years. Average 90% capacity utilization from the third year onward should be achievable, since the Project's feedstock, natural gas, is relatively easy to process and considering that project scope, design, and implementation and initial operating arrangements ensure that the

Project will not face technical difficulties which in the past have led to reduced capacity utilization in some other Indian plants. At 90% capacity utilization, the Project will produce 801,900 tpy of ammonia out of which 775,170 tpy will be converted to 1,336,500 tpy of urea and the remaining 26,730 tpy will be sold as anhydrous ammonia. The economic life of the Project is assumed to be 12 operating years with assets depreciated on a straight-line basis.

8.02 Urea prices for the financial analysis have been calculated on the basis of the Government's new fertilizer pricing policy (para 2.16). In 1983/84 the initial ex-factory price for urea from the Project is estimated at Rs 2,511/ton, at an assumed gas price of Rs 878/1,000 Nm<sup>3</sup>, both in current terms (para 5.10). The urea ex-factory price expressed in current terms increases from Rs 2,611/ton in 1983/84 to Rs 3,004/ton in 1993/94. The pricing formula is explained in detail in Annex 8-1 and the year-by-year price calculations are shown in Annex 8-2. The (notional) freight for urea from a fertilizer plant to its market included in the sale price of urea averaged Rs 38/ton in 1977/78. Since the Thal plant will initially market a substantial part of its urea in Uttar Pradesh (para 4.14), its actual average freight cost would be much higher at about Rs 124/ton in October 1978 terms. However, as part of the new pricing system the Government operates a freight equalization pool arrangement, which reimburses the producers the difference between the notional and the actual freight expense.

8.03 The quantity of saleable ammonia available from the Project is quite small and will mainly substitute for ammonia imported through Trombay. The Government has recently extended the fertilizer pricing arrangement to ammonia sold to other fertilizer units for conversion to fertilizers. Based on the present government pricing formula, the ex-factory price of ammonia has been assumed to be lower than the ex-factory retention price of urea by US\$11.6 (Rs 100 per ton in 1978/79 terms), which is the cost of bagging.

8.04 The production costs of ammonia and urea are given in Annex 8-3 and are summarized below:

Thal - Operating Costs Summary  
(Costs per ton in 1978/79 Prices)

	Ammonia			Urea		
	Rs	US\$	%	Rs	US\$	%
Raw materials	648	75.3	49.3	376	43.7	33.5
Utilities	42	4.9	3.2	96	11.2	8.5
Chemicals & Catalysts	32	3.7	2.5	23	2.7	2.0
Bags	-	-	-	100	11.6	8.9
Maintenance materials	128	14.9	9.8	112	13.0	10.1
Labor & Overheads	14	1.6	1.0	18	2.1	1.6
Depreciation	426	49.5	32.3	376	43.7	33.5
Insurance & Taxes	25	2.9	1.9	22	2.6	1.9
<b>Total</b>	<b>1,315</b>	<b>152.8</b>	<b>100.0</b>	<b>1,123</b>	<b>130.6</b>	<b>100.0</b>

The raw materials, utilities, depreciation and insurance and taxes together form about 77% of the cost of production of urea. The project cost, capacity utilization and the gas price will, therefore, be the major factors affecting the production cost of urea.

B. Financial Projections

8.05 The financial projections for the Project are given in Annexes 8-4, 8-5, and 8-6 and the salient financial indicators are summarized below:

Thal - Summary of Financial Projection  
(in millions of current Rupees)

<u>Fiscal Year Ending March 31</u>	<u>1983/84</u>	<u>1985/86</u>	<u>1986/87</u>	<u>1989/90</u>	<u>1991/92</u>
Capacity Utilization (%)	17	86	90	90	90
Sales Volume (tpy):					
(a) Urea	249,000	1,280,000	1,336,500	1,336,500	1,336,500
(b) Ammonia	62,000	23,600	26,730	26,730	26,730
Urea Retention Price (Rs/ton)	2,511	2,611	2,617	2,734	2,926
Sales Revenue	778	3,400	3,563	3,721	3,983
Gross Profit	221	1,247	1,235	985	925
Depreciation	213	512	512	512	512
Net Operating Income before Tax	100	894	945	792	796
Total Income (including reinvestment in Govt. Bonds)	100	964	1,048	1,087	1,220
Net Fixed Assets	6,067	5,043	4,531	2,995	1,971
Long-Term Debt (excl. current portion)	3,088	2,513	2,199	1,257	629
Total Equity	3,464	4,940	5,988	9,343	11,714
Internal Cash Generation	313	1,476	1,560	1,599	1,732
Ratios:					
Net Operating Income/Sales (%)	12.9	26.3	26.5	21.3	20.0
Net Income/Total Assets (%)	1.6	12.4	12.7	10.2	9.9
Debt Service Coverage	3.6	2.7	3.1	3.5	4.2
Current Ratio (including excess cash)	2.1	6.7	9.5	15.2	22.8
Debt/Equity Ratio	47/53	34/66	27/73	12/88	5/95
Profit Break Even (%)	14	48	50	53	53
Cash Break Even (%)	7	28	41	44	44

8.06 The sales revenues are expected to increase from Rs 778 million in 1983/84 to Rs 3,563 million in 1986/87 when the capacity utilization is to reach 90%, while net after tax profits increase from Rs 100 million to Rs 1,048 million. Indian tax legislation would enable RCF to postpone any tax liability on the project unit until after 1991/92. Even though taxes will not be assessed on the Project directly, notional taxes are presented here to show the tax liability due to the Project on RCF's overall corporate taxation.



Financial rates of return of fertilizer projects are generally most sensitive to changes in the fertilizer prices. However, as mentioned the new urea pricing formula assures the Project a 28.4% before-tax return on net worth at 80% capacity utilization. The Project is most sensitive to a decline in capacity utilization and less sensitive to other factors such as operating and capital cost changes. The Project is also quite sensitive to an implementation delay. The increase in capital costs due to a delay would be mostly covered by the compensating effect of the increased urea retention price, but the time slippage still has its negative effect on the financial rate of return. In general, most of the adverse effects are to a great extent compensated by changes in the retention price, except for a drop in the capacity utilization. Since the Project is going to be (i) based on commercially proven technology (ii) implemented and operated by RCF's personnel with experience in this field and (iii) assured of a large enough market for the plant's products, the Project should encounter no major financial problem.

8.09 Using the urea retention price formula (para. 8.02) the profit and cash break-even points in terms of capacity utilization in 1986/87 are 50% and 41%, respectively.

D. Analysis of RCF with the Project

8.10 Details of the consolidated financial projections for RCF with the Project are given in Annexes 8-7, 8-8 and 8-9 and summarized below:

RCF - Financial Summary of the Consolidated Financial Projections  
(in million of current Rupees)

<u>Fiscal Year Ending March 31</u>	<u>1978/79</u>	<u>1983/84</u>	<u>1985/86</u>	<u>1986/87</u>	<u>1989/90</u>	<u>1991/92</u>
Net Sales	914	3,409	6,271	6,563	7,150	7,736
Gross Profit	87	788	1,793	1,766	1,519	1,449
Net Operating Income	69	310	1,023	1,054	925	951
Depreciation	45	466	765	765	694	634
Internal Cash Generation	114	1,117	1,909	1,988	2,022	2,148
Net Fixed Assets	1,632	7,833	6,403	5,688	3,631	2,463
Long-Term Debt	397	3,550	2,815	2,421	1,319	629
Total Equity	1,454	5,893	7,761	8,984	12,966	15,929

Ratios:

Current Ratio (including excess cash)	1.5	2.6	5.0	6.4	10.7	13.3
Debt/Equity	21/79	38/62	27/73	21/79	9/91	4/96
Debt Service Coverage	7.3	3.6	2.9	3.2	3.9	4.6
Net Operating Income/Sales (%)	7.5	9.1	16.3	16.1	12.9	12.3
Net Income/Total Assets (%)	3.1	3.4	10.0	10.2	8.9	8.9

8.11 The assumptions used for these projections are similar to those used for the financial projections of the Project (Annex 8-1). The consolidated projections show that between 1983/84-1986/87, when the Project reaches its normal production level, sales revenue will increase by 93%, while gross profit before taxes will increase by 124%. The large increase in profit is due to the higher ex-factory prices available for urea from the new Trombay V and Thal Projects. Up to 1983/84, the projected increase in sales volume will be mainly due to the coming on stream and production build-up of Trombay IV and Trombay V Projects. Net operating income increases from Rs 310 million in 1983/84 to Rs 925 million in 1989/90. Almost 90% of RCF's net operating income during the period 1985/86 and 1989/90 will be due to the Project. All the financial ratios of the consolidated financial statements are satisfactory.

#### E. Financial Covenants

8.12 Satisfactory agreements have been reached with RCF that it will (a) maintain for itself and for the Project, during the life of the loan, a debt/equity ratio of 50/50 or better; (b) maintain a current ratio of at least 1.2; (c) not borrow additional funds if as a result its projected debt service coverage will fall below 1.4; (d) not take any action, such as distribution of funds, dividends or entry into any other financial commitments, or prepayment of debt, that would reduce its current ratio below 1.5; and (e) submit timely periodic progress reports on the Project and its annual audited reports within 4 months of the ending of its fiscal year, in a form satisfactory to the Bank.

#### F. Major Risks

8.13 The Project faces four major potential risks. First, since it is a grass-roots plant in a rural area, delays or problems in the implementation of the Project proper or the infrastructure could seriously affect the Project. This risk is reduced considering that (i) the project site has been acquired, and access to the land is available; (ii) a railroad spur from Apta to Penn is already under construction and preparatory work on the siding from the Penn railhead to the plant site has been completed by the Indian Railways; (iii) ONGC has already carried out the route survey for the gas pipeline from the Uran terminal to the project site; (iv) MSEB has started work on the construction of the power line from Apta substation to the site and (v) MIDC has made preliminary financial arrangements for the water supply system. This risk will be further reduced, as progress of the infrastructure work will continue to be monitored and coordinated by the Coordination Committee constituted by the Maharashtra Government and all the required support will be provided by the State Government to the above agencies to carry out their respective obligations in a timely and efficient way (para 5.14).

8.14 The second risk is a possible delay in the start-up of the Project due to technical problems in the engineering, construction, erection and commissioning of this largest fertilizer complex yet to be built in India. This risk is reduced due to the fact that the Project will use commercially

proven technologies supplied by internationally recognized engineering firms and because RCF's staff, which has adequate experience in building and starting-up similar, although somewhat smaller plants, will implement this Project utilizing FPDIL where required. RCF has agreed to obtain, if necessary, foreign operating and maintenance assistance during the initial year of operation from the ammonia engineering firm. A cost overrun is the third main risk of the Project. This could be caused by a start-up delay, by problems in the construction and transportation of the large pieces of equipment needed for a plant of this size or by a cost overrun in the civil works and erection of the plant. This risk is reduced due to RCF's previous experience in constructing fertilizer plants and by the location of the plant near the ocean where the large pieces of equipment can be unloaded onto a ramp and then easily be transported to the plant site. RCF has agreed to prepare a Project Implementation Manual defining adequately the manner in which the Project will be implemented, and discuss the manual with the Bank.

8.15 Finally, even though the land for the Project has been acquired and the Project is considered environmentally acceptable by the Government and the Bank, its location at Thal has faced some civic group opposition in Bombay City. However, considering that RCF has now completed acquisition, taken possession of the land and has started site work, that the local community welcomes the Project and that both the Maharashtra and Central Governments fully support the Thal location, the risks of further delays are limited.

## IX. ECONOMIC ANALYSIS

### A. Economic Costs and Benefits

9.01 The assumptions used in the economic analysis of the Project are given in Annex 9-1. All economic costs and benefits for tradeable items have been determined by using the Bank's projections of long-term international prices estimated to prevail in the 1980s. For non-tradeable items, domestic prices have been taken and, where applicable, adjusted to reflect the economic price of their internationally traded components.

9.02 The economic capital cost of the Project was obtained from the escalated phased financial capital cost expenditures after deflation to 1978 prices using currency deflation factors and after deduction of import duties and local taxes on equipment and other items. The Project, being a grass-roots project, includes in its capital costs part of the infrastructure, including the township (US\$8.5 million), the railroad spur from Penn to the project site (US\$12.6 million) and the power line from Apta (US\$2.4 million). The infrastructure facilities financed by other agencies include water supply (MIDC) and gas pipeline (ONGC). Since the gas and water prices include the full cost of their delivery to the project site, no further adjustments for arriving at the economic capital costs were considered necessary.

9.03 For calculating economic benefits the future price of bagged urea f.o.b. Europe is assumed to increase from its present price of US\$145-155/ton to US\$165/ton (1978 constant prices) by 1983/84 when the Project will be commissioned, and to US\$180 per ton in 1984/85. The analysis assumes that the urea price (in October 1978 constant prices) will not increase further during the operating life of the Project. With the international freight to India estimated at around US\$30/ton and unloading, port handling and storage charges at around US\$5/ton, the c.i.f. landed price (excluding any import duty) of bagged urea in India is calculated at US\$215/ton in 1978 dollars. The f.o.b. price of ammonia in 1983/84 is expected to be about US\$160/ton and with marine freight to India of US\$35/ton and unloading charges of US\$5/ton, the economic price of ammonia is assumed at US\$200/ton (in 1978 dollars).

9.04 The economic price of the associated gas is assumed to be the cost of substituting fuel oil for steam generation in boilers and has thus been related to the fuel oil price based on its calorific value. On the basis of the projected fuel oil price in 1978 dollars of US\$85/ton, the price of the natural gas is assumed at US\$73.4/1,000 Nm<sup>3</sup>, i.e., US\$2.20/MSCF in 1978 dollars. The economic price of natural gas would increase with any fuel oil price increases (in real terms) in the world markets. The sensitivity of the economic rate of return to the gas price is included in the sensitivity analysis. All other tradeable and non-tradeable items are valued at their respective domestic prices, less local taxes and duties.

#### B. Economic Rate of Return

9.05 The base case economic rate of return has been calculated at 19.9%. The cash flows for the economic rate of return are given in Annex 9-2 and the sensitivity analysis summarized below.

#### Economic Rate of Return - Sensitivity Analysis

<u>Case</u>	<u>Percentage</u>
Base Case	19.9
Capital Costs up 10%	18.3
Operating Costs up 10%	18.7
Capacity Utilization down by 10%	17.8
Delay of Completion (1 Year)	17.2
Economic Product Prices down 10%	16.7
Economic Product Prices up 10%	22.7
Gas Price Increases 50% to US\$110/1,000 Nm <sup>3</sup>	16.6
Gas Price Drops to US\$49/1,000 Nm <sup>3</sup>	21.8

A 10% drop in revenues would reduce the return to 16.7% and a one year delay in project implementation, combined with a 10% capital cost overrun and the ultimate attainment of only 80% capacity utilization (as against 90% assumed), would reduce the economic return to 15.3%. If the price of gas increases by 1984 to US\$110/1,000 Nm<sup>3</sup> in 1978 dollars without any change in

the urea price, the economic return would drop to 16.6%. However, this sensitivity to economic cost of gas should be viewed with caution since any increases in international hydrocarbon prices would also most likely increase the fertilizer prices above the level assessed in this report. Therefore, even under conceivable adverse conditions, the Project yields a satisfactory economic rate of return. A rough assesment of the probabilities of uncertainties associated with the economic costs and benefits of the Project and of the risks associated with the Project (paras 8.13-8.15) indicates that the expected economic return would be close to the base case economic rate of return of about 20%.

9.06 The difference between the financial and the economic rates of return (para. 8.08) is mainly due to the difference between the financial price for urea, calculated according to the retention price formula, and the forecast international urea price. In constant 1978 dollars, the urea retention price drops from US\$200/ton in 1984/85 to US\$127/ton in 1993/94, while the international urea price is assumed to remain at US\$215/ton c.i.f.

#### C. Other Benefits

9.07 The major benefits from the Project will be a more assured supply of fertilizers to the farmer and the foreign exchange savings due to reduced fertilizer imports. Annual urea and ammonia sales from the Project (at 90% capacity utilization) will be about 1.34 million tpy and 0.03 million tpy, respectively. The net annual foreign exchange saving in 1978 dollars, after deducting the foreign exchange component of operating costs but before service of foreign debt, will be about Rs 1,720 million (US\$200 million). Thus the Project's estimated foreign exchange requirement would be covered by savings in about 1.7 years of full operations.

9.08 Direct employment created by the Project would be about 1,500 jobs. At the peak period of construction activity, more than 5,000 people will be employed, largely from the surrounding areas. When the Project goes into operation, it is expected to support through secondary and tertiary employment another 5,000 jobs or more. Kolaba is one of the backward regions of the Maharashtra State and at present has no major economic activities other than agriculture and fisheries in the area. Installation of a large fertilizer complex in the area will help attract several small and medium scale service industries needed to provide maintenance and other services for the complex.

#### X. AGREEMENTS

10.01 The following major assurances and agreements have been obtained from the Government and RCF:

A. From the Government that it will:

- (i) ensure that the Railways will provide adequate facilities for the movement of the raw materials needs of and the products manufactured by the Project, in accordance with a program agreed with the Bank (para 4.18);
- (ii) ensure that adequate railway wagons are made available to RCF for the operation of the Thal unit at full capacity (para 4.18);
- (iii) not take, or cause to be taken, any action which, under conditions of efficient operation, would prevent fertilizer manufacturers from meeting all their expenses, servicing their debts and earning a reasonable return on invested capital (para 4.25);
- (iv) assure adequate supplies of natural gas, and coal for the Project (paras 5.10 and 5.11);
- (v) provide adequate funds, including foreign exchange, to RCF to complete its on-going projects and to finance the Project including any cost overrun and to meet any shortfalls in the availability of internal resources from RCF's operations (para 7.03);

B. From RCF that it will:

- (i) provide the Bank with its detailed plans for warehousing the project output before December 31, 1980 (para 4.18);
- (ii) complete and discuss with the Bank before December 31, 1979, detailed training plan for the operational staff of the Project and subsequently take timely action to implement the plans (para 5.16);
- (iii) carry out and execute the Project with due regard to appropriate safety norms and ecological and environmental standards (paras 5.17-5.20);
- (iv) employ, before December 31, 1979, a competent independent consultant firm to design the pollution control measures for the Project and present the designs for review by the Bank before June 30, 1980, and subsequently implement them (para 5.17);

- (v) continue to employ as long as necessary a Rehabilitation Officer to assist the families affected by the Project in their relocation (para 5.19);
- (vi) establish and maintain a Project Implementation Unit staffed with adequate personnel and headed by a suitably qualified and experienced Project Manager and prepare and furnish to the Bank for its review by November 30, 1979, a Project Implementation Manual (paras 6.01 and 6.02);
- (vii) place order for the steam generation unit before September 30, 1979 (para 6.05);
- (viii) maintain financial covenants described in para 8.12.

10.02 Execution of a subsidiary loan agreement between the Government and RCF (para 7.04), the appointment of the ammonia engineering firm (para 6.05), and the finalization of satisfactory agreements for the adequate supplies of gas, coal, power and water (paras 5.10, 5.11, 5.12 and 5.13) would be conditions of effectiveness of the Bank loan.

10.03 Based on the above agreements and assurances, the Project provides a suitable basis for a Bank loan of US\$250 million equivalent to the Government for a period of 20 years including five years of grace, at 7.9% per annum interest rate, to be onlent to the Company (RCF) on terms spelled out in para 7.04.

Industrial Projects Department  
June 14, 1979

INDIA - THAL FERTILIZER PROJECT

INDIA - Fertilizer Plants in Operation, under Construction and in Planning Stage on 03/31/79

Sector	Unit	Ownership	Feedstock	Product	Nitrogenous Fertilizers				Phosphatic Fertilizers							
					Capacity (000 tpy N)	Production FY 78 (000 tons N)	Under Construction & Planned Capacity (000 tpy N)	Start-up Date FY	Capacity (000 tpy P <sub>2</sub> O <sub>5</sub> )	Production FY 79 (000 tons P <sub>2</sub> O <sub>5</sub> )	Under Construction Capacity (000 tpy P <sub>2</sub> O <sub>5</sub> )	Start-up Date FY				
Public	Sindri	FCI	Coke/coke oven gas	AS	90											
	Sindri extensions	FCI	Fuel oil	Urea			129	1980								
	Nangal	NFL	Electricity	Can	80	71										
	Nangal expansion	NFL	Fuel oil	Urea	152	57										
	Trombay	RCF	Naphtha	Urea, NP, NPK	81	86										
	Trombay IV	RCF	Ammonia	NP	75	26										
	Trombay V	RCF	Natural gas	Urea			130	1981								
	Gorakhpur	FCI	Naphtha	Urea	131	88										
	Namrup	HCF	Natural gas	AS, Urea	197	114	152	1983								
	Durgapur	HCF	Naphtha	Urea	152	38										
	Barauni	HCF	Naphtha	Urea	152	53										
	Talcher	FCI	Coal	Urea			228	1980								
	Ramagundam	FCI	Coal	Urea			228	1980								
	Haldia	HCF	Fuel oil	Urea, NP			152	1980								
	Thal	RCF	Natural gas	Urea, Ammonia			624	1984								
	Udyogamandal	FACT	Naphtha	AS, NP	82	51										
	Cochin	FACT	Naphtha	Urea	152	102										
	Cochin II	FACT	Ammonia	NP, NPK	40											
	Kourkela	SAIL	Naphtha/coke oven gas	CAN	120	68										
	Neyveli	NLC	Lignite/fuel oil	Urea	70	38										
	Bhatinda	NFL	Fuel oil	Urea			235	1980								
	Panipat	NFL	Fuel oil	Urea			235	1980								
	Surat	NFL	Natural gas	Urea, Ammonia			312	1985								
Khetri	HCL															
By-products	SAIL, etc.	Coke oven by-products	AS	28	24											
SSP producers																
Total Public Sector					1,602	816	2,425				546	174	75			
Cooperative	Kaloi/Kandla	IFFCO	Natural gas	Urea, NPK	215	232										
	Phulpur	IFFCO	Naphtha	Urea			228	1980								
	Surat	IFFCO	Natural gas	Urea, Ammonia			312	1985								
Total Cooperative Sector					215	232	540				127	175	43			
Private and Joint	Madras	MFL	Naphtha	Urea, NPK	176	162										
	Varennasi	NCJM	Coke	AC	10	4										
	Ennore	EID	Naphtha	AS, NP	16	8										
	Baroda	GSPC	Naphtha/natural gas	Urea, AS, NP	216	166										
	Vizag	CFL	Naphtha	NP, NPK	83	67										
	Goa	ZAC	Naphtha	Urea, NP, NPK	171	150										
	Kota	SRC	Naphtha	Urea	152	115										
	Kanpur	IEL	Naphtha	Urea	200	185	100	1982								
	Tuticorin	SPIC	Naphtha	Urea	258	145										
	Mangalore	MCFL	Naphtha	Urea	160	121										
	Brooch	CNPF	Fuel oil	Urea			273	1981								
	Kakinada	Nagarjuna	Fuel oil	Urea, NPK			228	1984								
	SSP producers															
Total Private and Joint Sector					1,442	1,123	601				563	422				
Total for Industry					3,259	2,071	3,566				1,236	771	118			

Source: Ministry of Chemicals and Fertilizers Government of India

Notes: 1/ Key to Abbreviations

Company Index

AS - Ammonium Sulphate  
 CAN - Calcium Ammonium Nitrate  
 NP - Complex fertilizers with and P<sub>2</sub>O<sub>5</sub>  
 NPK - Complex fertilizers with N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O  
 AC - Ammonium Chloride  
 RP - Rock Phosphate  
 SSP - Single Superphosphate  
 TSP - Triple Superphosphate  
 2/ - All NPK products use imported potash  
 3/ - Includes 4,000 tons in private and joint sectors  
 4/ - Joint sector ventures  
 5/ - In planning stage

FCI - Fertilizer Corporation of India  
 NFL - National Fertilizers Ltd.  
 RCF - Rashtriya Chemicals and Fertilizers  
 HCF - Hindustan Chemicals and Fertilizers  
 FACT - Fertilizers and Chemicals (T) Ltd.  
 SAIL - Steel Authority of India Ltd.  
 NLC - Neyveli Lignite Corporation  
 HCL - Hindustan Coppers Ltd.  
 CNPF - Gujarat Narmada Valley Fertilizers Ltd.  
 IFFCO - Indian Farmers Fertilizer Cooperative  
 MFL - Madras Fertilizers Ltd.  
 NCJM - New Central Jute Mills  
 EID - EID - Ferrys Ltd.  
 GSPC - Gujarat State Fertilizer Company  
 CFL - Coromandel Fertilizers Ltd.  
 ZAC - Zuari Agrochemicals Ltd.  
 SRC - Shri Ram Chemicals Ltd.  
 IEL - Indian Explosives Ltd.  
 SPIC - Southern Petrochemical Industries Corp.  
 MCFL - Mangalore Chemicals & Fertilizers Ltd.

INDIA-THAL FERTILIZER PROJECT  
Capacity Utilization of Nitrogenous  
Fertilizer Plants in Operation

1. A detailed analysis of unitwise capacity utilization of nitrogenous fertilizer plants during the period 1971/79 is given in the attached table.
2. This analysis indicates that the low average capacity utilization cannot be explained entirely in a public versus private sector ownership framework since, in addition to management, other key determining factors are plant design and age, size of plant, power availability and feedstock. A review of unitwise 1/ capacity utilization reveals that the overall low capacity utilization of the public sector is mainly due to five plants, Sindri, Udyogamandal, Rourkela, Neyveli, Cochin and Durgapur which still do not perform satisfactorily due to various constraints discussed below. In contrast, for example, Nangal's good performance in 1975/76 and 1976/77 as compared to the low capacity utilization in the preceding years was due to better availability of power. Its future production will be protected from power shortages with the IDA-financed Nangal Expansion Project (Credit 357-IN), already commissioned.
3. Sindri's plants which were commissioned in the 1950s have suffered from the poor quality of Rajasthan gypsum and difficulties in developing and obtaining coal blends suited for good quality coke and coke oven gas production. These plants which operated at 73% to 81% of their capacity during 1970/71 to 1974/75, have deteriorated in the last four years due to aging equipment. The IDA-financed Sindri Modernization Project (Credit 520-IN), as mentioned currently under commissioning, will provide the existing finished fertilizer plants with ammonia from a new 900 tpd fuel oil-based plant. Udyogamandal plants, commissioned between 1947/48 and 1967/68, operated at between 38% and 49% of their capacities until 1975/76. Modifications to improve their performance increased utilization to 62% in 1978/79. The Rourkela plant, based on coke oven gas and nitrogen from the Rourkela steel plant, also operated at only 20% of its capacity in 1970/71, due to inadequate coke oven gas availability. Even though a naphtha reformer was commissioned in 1970/71 to supplement the gas availability, further deterioration in coke oven gas availability kept down utilization to about 40%, through 1973/74. In the next two years steps were taken to increase production by using fuel oil to replace coke oven gas, wherever possible, in steelmaking. As a result, Rourkela's fertilizer production increased to 67% of its capacity in 1966/67 but declined to 57% in 1978/79. Under the IDA-financed Fertilizer Industry Credit (Credit 598-IN), an additional naphtha reforming furnace is scheduled to be commissioned at Rourkela in 1979/80, to help improve capacity utilization.
4. Neyveli had faced difficulties in the operation of the Winkler gasifiers with its lignite, so that during the first five years ending in 1975/76, production ranged at only between 21% to 39.1% of capacity. After

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1/ Excluding units commissioned in 1977/78 and 1978/79 and still being stabilized.

revamping of the gasifiers and with plant modifications, the production reached 59% of capacity in 1977/78 and 54% in 1978/79. Fuel oil gasifiers, now being installed at Neyveli as part of the Fertilizer Industry Credit, are expected to be commissioned in 1980 and should improve capacity utilization further. Finally, poor performance at Cochin and Durgapur is mainly due to design defects; these were the first two plants engineered in India with process licenses from several foreign process licensors. Design defects and equipment failures delayed commissioning of the plants and their stabilized operation. The Durgapur plant has also been affected by the poor quality of power supply from the state grid. Even with modifications carried out so far, the Durgapur and Cochin plants operated in 1978/79 only at 25% and 53%, respectively, of their installed capacities. Further plant modifications are now being made based on a Tecnimont (Italy) end-to-end survey. An in-plant power generation unit to be installed at Durgapur will improve the quality of power supply to critical units.

5. Of the unscheduled production losses of about 350,000 tpy of nitrogen in the last three years, equipment failures in aged plants and in recently commissioned new plants accounted for about 70% and power problems for another 20%. Problems affecting the performance of the public sector fertilizer plants were studied by a Government Committee in 1978 and several measures recommended. Many of the recommendations, including those for better planning of preventive maintenance to minimize such unscheduled losses, have been adopted.

6. As described above, since 1969/70 the Government has taken several measures to improve fertilizer production. The Bank has also assisted with a credit of US\$17 million as part of the Trombay IV Project (Credit 481-IN) to revamp the Durgapur and Cochin plants. In addition to the two credits already mentioned to increase production at Nangal and Sindri, the Fertilizer Industry Credit of US\$105 million, approved in 1975, was specifically designed to improve capacity utilization of the Indian fertilizer industry. The Credit covered a large number of projects involving eleven plants including (a) changeover to fuel oil feedstock at Neyveli, (b) a naphtha reformer at Rourekela, (c) captive power plants at Durgapur, Gorakhpur, Trombay and Visakhapatnam to meet the critical plant loads and reduce production losses due to power fluctuations, (d) purge gas recovery units planned at Baroda, Goa, Kalol and Vizag to increase ammonia production, and (e) debottlenecking of the phosphoric acid plant at Baroda.

INDIA - THAL FERTILIZER PROJECT  
INDIA: Capacity Utilization of Nitrogenous Fertilizer Plants in Operation in 1979<sup>1/</sup>  
 (Percent)

Unit	Fiscal Year Ending March 31									
	71	72	73	74	75	76	77	78	79	83 <sup>2/</sup>
<b>A. Private Sector</b> (Projected)										
SCI Kota	102	98	116	100	66	72	79	79	76	90
IEL Kanpur	54	64	78	58	96	89	94	98	93	95
Zuari Goa	-	-	-	37	79	66	72	85	88	95
CFL Vizag	76	81	74	68	59	60	80	73	81	90
<u>Total Private Sector</u>	<u>71</u>	<u>76</u>	<u>86</u>	<u>61</u>	<u>76</u>	<u>74</u>	<u>80</u>	<u>86</u>	<u>77</u>	<u>93</u>
<b>B. Joint Sector</b>										
MFL Madras	-	51	64	76	51	88	78	77	92	90
GSFC Baroda	69	86	94	76	74	73	80	81	77	85
SPIC Tuticorin	-	-	-	-	-	50	66	71	56	90
MCFL Mangalore	-	-	-	-	-	-	64	60	76	90
<u>Total Joint Sector</u>	<u>69</u>	<u>76</u>	<u>81</u>	<u>76</u>	<u>64</u>	<u>71</u>	<u>69</u>	<u>73</u>	<u>73</u>	<u>89</u>
<b>C. Cooperative Sector</b>										
IFFCO Kalol	-	-	-	-	17	54	74	95	108	90
<b>D. Public Sector</b>										
FCI Sindri	73	81	73	79	77	67	47	10	-	- <sup>3/</sup>
Nangal	68	70	66	78	50	98	101	69	88	- <sup>3/</sup>
Trombay	64	82	86	80	84	98	126	106	106	95
Gorakhpur	85	95	86	80	91	72	85	64	67	90
Namrup	64	69	80	82	91	102	104	100	88	100
Durgapur	-	-	-	10	10	24	30	34	25	75
Barauni	-	-	-	-	-	-	66	50	35	90
Namrup Exp.	-	-	-	-	-	-	70	72	49	90
FACT - Udyogamandal	47	49	38	48	46	55	52	61	62	50
Cochin I & II	-	-	-	9	26	44	53	49	53	80
SAIL - Rourekela	20	39	41	38	51	64	67	60	57	80
NLC - Neyveli	46	29	30	21	24	39	61	59	54	80
<u>Total Public Sector</u>	<u>58</u>	<u>64</u>	<u>62</u>	<u>49</u>	<u>49</u>	<u>61</u>	<u>69</u>	<u>64</u>	<u>52</u>	<u>83</u>
<u>TOTAL INDUSTRY</u>	<u>63</u>	<u>70</u>	<u>74</u>	<u>58</u>	<u>60</u>	<u>70</u>	<u>73</u>	<u>74</u>	<u>72</u>	<u>87</u>

<sup>1/</sup> Capacity utilization has been calculated based on available capacity in each year allowing for commissioning date, capacity levels of 50% and 75% in the first and second year after commissioning, and adjusting for industrial nitrogen products.

<sup>2/</sup> Expected capacity utilization level taking into account schemes under implementation.

<sup>3/</sup> Plants will be shut down with commission of the Sindri Modernization and Nangal Expansion Projects.

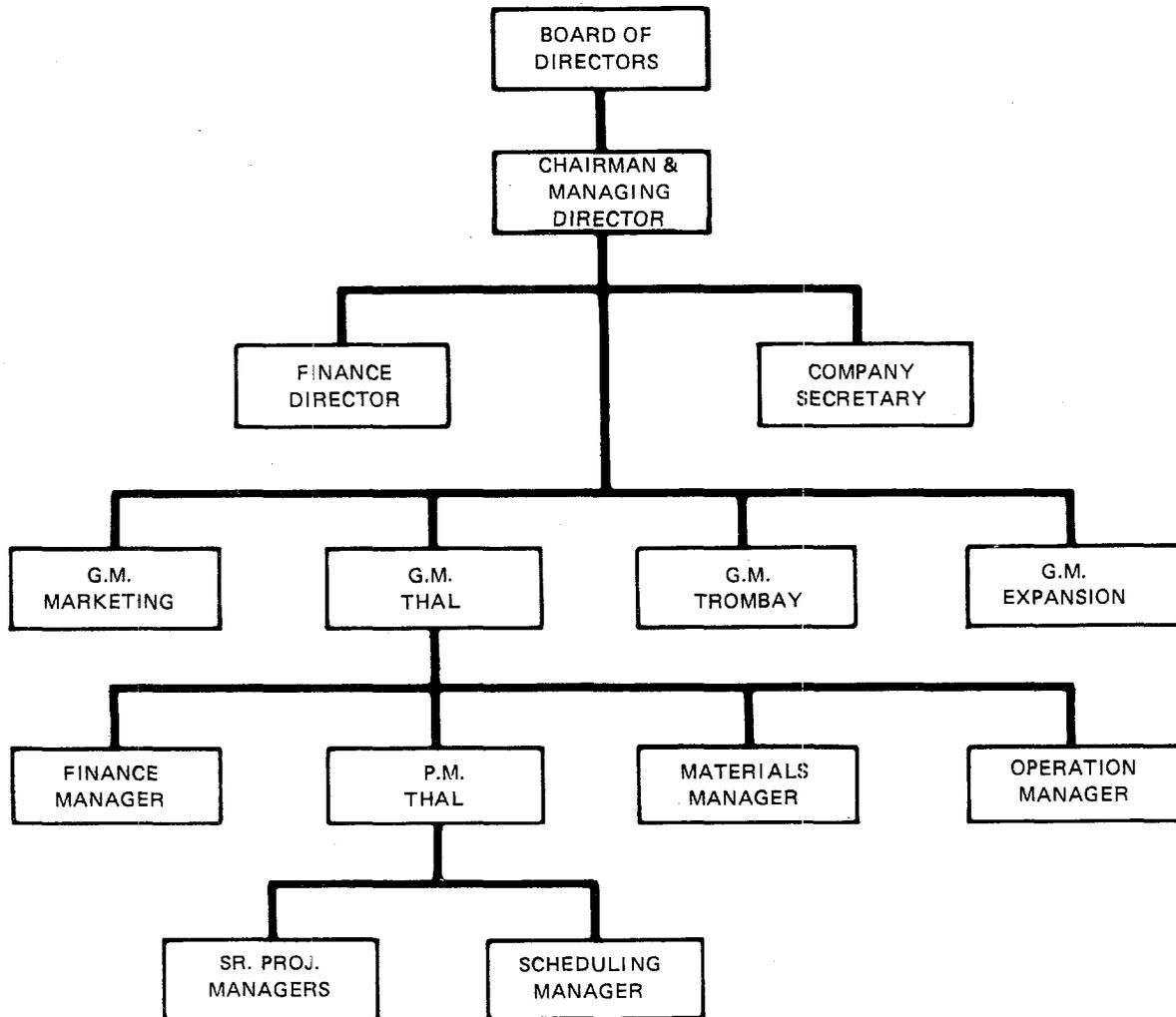
INDIA-THAL FERTILIZER PROJECT

INDIA: Installed Fertilizer Capacity by Sector

Year Ending March 31	Nitrogen Fertilizers (000 tpy N)				Phosphatic Fertilizers (000 tpy P <sub>2</sub> O <sub>5</sub> )			
	Public Sector	Joint and Private Sector	Cooperative Sector	Total	Public Sector	Joint & Private Sector	Cooperative Sector	Total
<u>Actual</u>								
1952	85	-	-	85	19	44	-	63
1957	85	4	-	89	19	44	-	63
1962	228	14	-	242	27	89	-	116
1967	526	22	-	548	73	164	-	237
1968	643	206	-	849	105	298	-	404
1969	688	336	-	1,024	105 <sup>1/</sup>	317	-	422
1970	688	656	-	1,344	98	217	-	415
1971	688	656	-	1,344	98	317	-	415
1972	688	832	-	1,520	98	402	-	500
1973	652 <sup>1/</sup>	812 <sup>1/</sup>	-	1,464	98	402	-	500
1974	956	983	-	1,939	98	402	-	500
1975	956	1,025	-	1,981	98	402	-	500
1976	1,011	1,283	215	2,509	111	454	127	692
1977	1,331	1,442	215	2,938	111	563	127	801
1978	1,371	1,442	215	3,028	230	558	127	915
1979	1,602	1,442	215	3,259	546	563	127	1,236
<u>Expected</u>								
1980	2,809	1,442	443	4,694	621	563	127	1,311
1981	2,939	1,715	443	5,097	621	563	127	1,311
1982	2,939	1,815	443	5,197	621	563	170	1,354
1983	3,091	1,815	443	5,349	621	563	170	1,354
1984	3,715	2,043	443	6,201	621	563	170	1,354
1985	4,027	2,043	755	6,825	621	563	170	1,354

Note: <sup>1/</sup> The installed capacities of the following plants were derated as given below in thousand tons Trombay (9), Sindri (27), Kota (20)

**INDIA – THAL FERTILIZER PROJECT  
RCF AND THAL ORGANIZATION CHART**



INDIA - THAL FERTILIZER PROJECT

RCF-Existing and Expansion Plants at Trombay

<u>1. Existing Units</u>	<u>Capacity (000 tpy)</u>	<u>Expected 1979 Production</u>
Ammonia	115.5	95.6
Nitric Acid I	105.6	61.0
Nitric Acid II	255.5	51.7-Part of Trombay IV
Sulphuric Acid	99	83.8
Phosphoric Acid	30	19.7
Urea	99	95.4
Suphala (NPK)	330	256.2
ANP (NPK)	361	55 -Part of Trombay IV
Methanol	36	35.5
Ammonium Bicarbonate	4	2.7
Conc. Nitric Acid	20	17.3
Sodium Nitrate and Nitrite	4	2.2
Methylamine	4	0.8 <sup>3</sup>
Argon	111000 M <sup>3</sup>	200700 M <sup>3</sup>
<u>2. Units under Construction</u>		
Ammonia	297	-
Urea	330	-

Industrial Projects Department  
June 1979

INDIA - THAL FERTILIZER PROJECT

TROMBAY UNIT - Historical Income Statement  
(In millions of Rupees)

Year Ending March 31	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979<sup>1/</sup></u>
Net Sales	530	542	735	778	873
Variable Costs	362	446	462	427	571
Fixed Costs	<u>120</u>	<u>120</u>	<u>149</u>	<u>157</u>	<u>229</u>
Total Production Costs	482	566	611	584	800
Increase/Decrease in closing stocks	72	42	(28)	(90)	41
Gross Profit	120	18	96	104	114
Selling Expenses	13	13	14	17	29
Interest on long term loan	8	11	9	8	16
Prior period adjustments; Debits (-)/Credits (+)	<u>(2)</u>	<u>(8)</u>	<u>3</u>	<u>(10)</u>	<u>-</u>
Profit/Loss before taxes	101	(14)	76	69	69
Income Tax	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
Net Profit (Loss)	101	(14)	76	69	69

---

1/ Estimated

INDIA - THAL FERTILIZER PROJECTTROMBAY UNIT - Historical Balance Sheet  
(In millions of Rupees)

<u>Year Ending</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u> <sup>1/</sup>
<u>Current Assets</u>					
Cash	2.5	5.8	0.8	0.9	2.0
Accounts Receivable	17.6	0.6	36.4	69.8	52.5
Raw Materials Inventories	56.9	35.2	13.1	31.7	39.2
Finished Goods Inventories	92.5	134.9	107.1	77.7	120.2
Others	<u>104.2</u>	<u>123.7</u>	<u>151.9</u>	<u>171.7</u>	<u>160.2</u>
Total Current Assets	<u>273.7</u>	<u>300.2</u>	<u>309.3</u>	<u>351.8</u>	<u>374.1</u>
<u>Fixed Assets</u>					
Construction in Progress	128.7	214.4	711.5	988.5	453.2
Gross Fixed Assets	604.6	704.4	724.5	780.5	1414.5
Accumulated Depreciation	<u>(388.6)</u>	<u>(422.6)</u>	<u>(445.5)</u>	<u>(476.2)</u>	<u>(516.3)</u>
Net Fixed Assets	<u>216.0</u>	<u>281.8</u>	<u>279.0</u>	<u>304.3</u>	<u>898.2</u>
Total Assets	<u>618.4</u>	<u>796.4</u>	<u>1299.8</u>	<u>1644.6</u>	<u>1725.5</u>
<u>Current Liabilities</u>					
Accounts Payable	117.7	66.3	107.5	111.7	130.8
Current Portion of L.T. Debts	<u>23.8</u>	<u>14.4</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>
Total Current Liabilities	<u>141.5</u>	<u>80.7</u>	<u>107.6</u>	<u>111.8</u>	<u>130.9</u>
Cash Credit with SBI	-	29.0	29.4	-	67.9
Long Term Debts	129.4	226.9	398.6	611.4	505.8
Other Liabilities	<u>15.1</u>	<u>5.5</u>	<u>6.4</u>	<u>12.8</u>	<u>11.7</u>
Total Liabilities	<u>286.0</u>	<u>342.1</u>	<u>542.0</u>	<u>736.0</u>	<u>716.3</u>
<u>Equity</u>					
Paid-in Capital	201.6	339.5	569.8	921.9	955.9
Retained Earnings	<u>130.8</u>	<u>114.8</u>	<u>188.0</u>	<u>(13.3)</u>	<u>53.3</u>
Total Equity	<u>332.4</u>	<u>454.3</u>	<u>757.8</u>	<u>908.6</u>	<u>1009.2</u>
Total Liabilities & Equity	<u>618.4</u>	<u>796.4</u>	<u>1299.8</u>	<u>1644.6</u>	<u>1725.5</u>

<sup>1/</sup> Estimated.

INDIA - THAL FERTILIZER PROJECT

INDIA: Statewise Consumption of Plant Nutrients Per Unit of Gross Cropped Area

(kg per hectare)

State	1973-74				1977-78			
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Total	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Total
Andhra Pradesh	13.4	6.5	2.3	22.2	27.1	10.3	2.9	40.3
Bihar	6.6	1.5	1.0	9.1	12.2	2.0	1.2	15.4
Gujarat	13.9	6.1	1.3	21.3	17.2	8.3	3.0	28.5
Haryana	18.6	3.3	0.9	22.8	27.6	5.3	1.8	34.7
Karnataka	9.8	4.4	3.6	17.8	14.4	5.1	4.6	24.1
Kerala	11.7	7.6	8.3	27.6	12.4	5.4	8.5	26.3
Madhya Pradesh	4.2	2.4	0.1	6.7	4.7	2.3	0.5	7.5
Maharashtra	8.4	4.1	2.4	14.9	11.6	3.6	3.1	18.3
Orissa	6.2	1.7	1.1	9.0	5.9	1.6	0.8	8.3
Punjab	41.4	12.8	4.0	58.2	51.1	16.7	4.6	72.4
Rajasthan	3.4	0.8	0.2	4.4	5.3	1.0	0.3	6.6
Tamil Nadu	26.4	9.3	8.9	44.6	36.7	10.1	12.2	59.0
Uttar Pradesh	14.3	3.8	2.2	20.3	27.8	6.0	3.1	36.9
West Bengal	7.4	2.5	3.7	13.6	14.3	3.6	3.7	21.6
All India	11.2	4.0	2.2	17.4	17.0	5.0	3.0	25.0

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ANNEX 4-1

## INDIA - THAL FERTILIZER PROJECT

INDIA : Breakdown of Nutrient Nitrogen Distribution<sup>1/</sup> by Fertilizer Type  
(For fiscal years ending March 31)

Product	% Nitrogen In Product	1962		1967		1972		1977	
		Quantity <sup>2/</sup>	%						
Urea	46.0	67	22	274	32	1024	63	1703	73
Ammonium Sulphate	20.6	153	50	326	38	177	11	130	6
Ammonium Sulphate Nitrate	26.0	23	8	23	3	11	1	1	-
Calcium Ammonium Nitrate	21.0 - 26.0	57	19	129	15	166	10	182	8
Others	15.0- 26.0	6	1	99	12	252	15	327	13
Total		306	100	851	100	1630	100	2343	100

Notes <sup>1/</sup> The quantities shown refer to nitrogen contained in products distributed. Because of stock changes, the figures differ from the annual consumption figures shown in Annex 4-1.

<sup>2/</sup> 000 tons of nitrogen contained

INDIA - THAL FERTILIZER PROJECTINDIA: Consumption, Production and Imports of FertilizersANNEX 4-3  
Page 1

Year <sup>1/</sup>	Nitrogen (000 tons N)			Phosphates (000 tons P <sub>2</sub> O <sub>5</sub> )			Potash (000 K <sub>2</sub> O )	
	Consumption	Production	Imports	Consumption	Production	Imports	Consumption	Imports
1952-53	58	53	44	4	7	-	3	3
1953-54	89	53	19	8	14	-	8	7
1954-55	95	68	20	15	14	-	11	11
1955-56	107	77	53	13	12	-	10	10
1956-57	123	79	57	16	17	-	15	15
1957-58	149	81	110	22	26	-	13	13
1958-59	172	81	97	29	31	-	22	22
1959-60	229	84	142	54	51	4	21	33
1960-61	212	112	399	53	54	-	29	20
1961-62	159	154	307	60	65	-	28	75
1962-63	333	194	244	83	88	10	36	41
1963-64	377	219	228	116	108	13	50	40
1964-65	555	243	232	149	131	12	69	57
1965-66	575	238	326	132	119	14	77	73
1966-67	738	309	632	248	146	148	114	118
1967-68	1034	402	867	446	207	349	204	270
1968-69	1209	563	844	382	213	138	170	213
1969-70	1356	730	667	416	224	94	210	120
1970-71	1479	832	477	541	228	32	236	120
1971-72	1798	949	481	558	290	248	300	268
1972-73	1839	1054	665	581	330	204	367	325
1973-74	1829	1050	659	650	324	213	360	370
1974-75	1766	1186	884	471	331	286	336	437
1975-76	1990	1535	996	430	320	361	278	278
1976-77	2457	1857	750	635	478	23	318	278
1977-78	2913	2000	758	867	670	164	506	599

<sup>1/</sup> Years run from April to MarchIndustrial Projects Department  
June 1979

INDIA-THAL FERTILIZER PROJECT  
INDIA: Quantity and Value of Fertilizer Imports

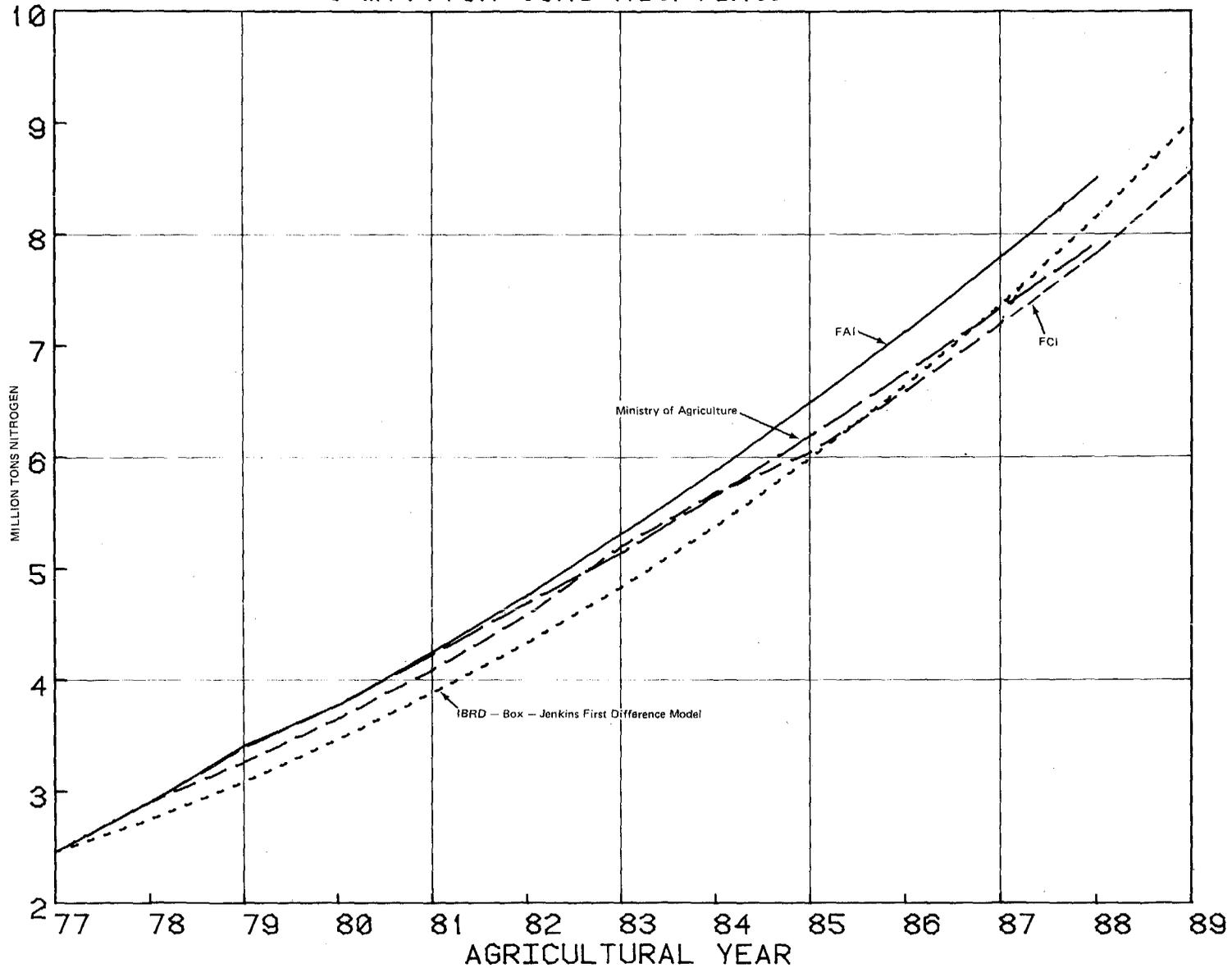
Year <sup>1/</sup>	Quantities (000 tons) <sup>2/</sup>			Total Value of Imports (Million Rupees)
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
1952-53	44	-	3	45.6
1953-54	19	-	7	25.2
1954-55	20	-	11	30.2
1955-56	53	-	10	73.3
1956-57	57	-	15	77.7
1957-58	110	-	13	158.8
1958-59	97	-	23	113.1
1959-60	142	4	33	162.9
1960-61	399	-	20	121.8
1961-66	307	-	75	141.1
1962-63	244	10	41	236.0
1963-64	228	13	40	187.1
1964-65	232	12	57	220.8
1965-66	326	14	73	411.9
1966-67	632	148	118	1288.2
1967-68	867	349	270	1933.1
1968-69	844	138	213	1629.2
1969-70	667	94	120	1167.7
1970-71	447	32	120	767.9
1971-72	481	248	268	899.7
1972-73	665	204	325	1212.6
1973-74	659	213	270	1767.5
1974-75	884	286	437	5991.3
1975-76	996	361	278	7227.7
1976-77	750	23	278	2202.2
1977-78	758	164	599	3064.4

<sup>1/</sup> Year runs from April to March

<sup>2/</sup> Quantities are 000 tons of nutrient contained

Source : India Fertilisers Statistics 1977-78

INDIA:-THAL FERTILIZER PROJECT  
 INDIA: ESTIMATES OF FUTURE NITROGEN CONSUMPTION  
 ( million tons nutrient)



INDIA - THAL FERTILIZER PROJECT

INDIA: Estimates of Future Nitrogen Consumption

(million tons nutrient)

Agency Year	FAI <sup>1/</sup>	RCF	IBRD (Box-Jenkins)	Ministry of Agriculture & Irrigation
1977 <sup>3/</sup>	2.46	2.46	2.46	2.46 <sup>2/</sup>
1978	2.91 <sup>3/</sup>	2.91 <sup>3/</sup>	2.75	2.91 <sup>2/3/</sup>
1979	3.42	3.27	3.09	3.40 <sup>2/</sup>
1980	3.78	3.66	3.47	3.78
1981	4.26	4.10	3.89	4.24
1982	4.77	4.59	4.34	4.70
1983	5.32	5.21	4.84	5.15 <sup>2/</sup>
1984	5.89	5.69	5.39	5.67
1985	6.50	6.05	6.00	6.20
1986	7.13	6.60	6.65	6.76
1987	7.80	7.20	7.37	7.34
1988	8.51	7.84	8.16	7.92 <sup>2/</sup>
1989	-	8.57	9.02	-

<sup>1/</sup> November 1978 projections

<sup>2/</sup> Annual consumptions obtained by interpolating the consumption for marked years.

<sup>3/</sup> Actual

INDIA - THAL FERTILIZER PROJECT

INDIA - Projected Urea Movement from Western Region  
(thousand tons)

State and Unit	Year	Total Quantity	States						
			Punjab	Haryana	Rajasthan	Gujarat	Maharashtra	M.P.	U.P.
<u>Gujarat</u>									
Kalol	1980	300			20	180	35	20	45
	1983	300			30	215		20	35
	1985	300			30	215		20	35
GSFC (Baroda)	1980	300	20	30	20	120	40	40	30
	1983	300	20	30	20	120	40	40	30
	1985	300	20	30	20	120	40	40	30
GNVF (Broach)	1980	-							
	1983	500	180		20	70		30	200
	1985	500	100		100	180		30	90
Surat	1980	-							
	1983	820	90	30	40	95	35	60	470
	1985	1230	340	160	30	140	35	155	370
<u>Maharashtra</u>									
Trombay	1980	102					82	20	
	1983	330					310	20	
	1985	330					240	90	
Thal	1980	-					-		
	1983	840					220		620
	1985	1260					440		820
<u>Imports</u>									
Kandla	1980	564	161	37			10		356
	1983	74	-						74
	1985	561	81						480
Bombay	1980	427					7		420
	1983	95							95
	1985	481							481

**INDIA – THAL FERTILIZER PROJECT  
IMPLEMENTATION SCHEDULE FOR INFRASTRUCTURE FACILITIES**

	1978		1979				1980				1981				1982			
	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b>A LAND ACQUISITION</b>																		
Verification of Land Records	█	█																
Notification Sec. IV A.		█																
Notification Sec. VI A.		█																
Access to Land		█	█															
Legal Possession			█	█	█													
<b>B ROAD STRENGTHENING</b>																		
Survey	█	█																
Widening and Improvement			█	█	█	█	█											
<b>C RAILWAY TRACK</b>																		
Field Survey	█	█	█	█														
Final Report and Estimates		█	█	█														
Provision of Funds							█											
Procurement							█	█	█	█	█	█	█					
Land Acquisition			█	█	█													
Construction			█	█	█	█	█	█	█	█	█	█	█	█				
Testing and Commissioning												█	█					
<b>D GAS PIPE LINE</b>																		
RCF Commitment		█																
Investment Decision		█	█	█														
Survey, Design & Procurement			█	█	█	█	█	█	█	█	█	█	█					
Installation, Testing and Commissioning								█	█	█	█	█	█					
<b>E POWER SUPPLY</b>																		
Transmission Line			█	█	█	█	█	█	█	█	█	█	█					
Procurement			█	█	█	█	█	█	█	█	█	█	█					
Civil Works and Clearances			█	█	█	█	█	█	█	█	█	█	█					
Erection							█	█	█	█	█	█	█	█				
Testing and Commissioning													█	█				
110 KV Substation																		
Civil Works			█	█	█	█	█	█	█	█	█	█	█					
Procurement			█	█	█	█	█	█	█	█	█	█	█					
Erection							█	█	█	█	█	█	█	█				
Commissioning														█	█			
<b>F WATER SUPPLY</b>																		
Survey and Designs		█	█	█														
Procurement			█	█	█	█	█	█	█	█	█	█	█					
Construction			█	█	█	█	█	█	█	█	█	█	█	█				
Testing and Commissioning														█	█			

INDIA - THAL FERTILIZER PROJECT

Pollution Control Norms and Conditions Prescribed by the  
Maharashtra Prevention of Water Pollution Board

I. LIQUID EFFLUENTS

1. The daily quantity of domestic effluent from the factory shall not exceed 0.2 Mgd.
2. The daily quantity of industrial effluent shall not exceed 8.0 Mgd.
3. Separate system shall be provided for collecting industrial and domestic effluents. Terminal manholes shall be provided separately for the industrial and domestic effluent (at the end of collection system) with arrangements for measuring the flow. No effluent shall be admitted in the sewers downstream of the terminal manholes. No liquid effluent shall find its way other than in the designed and provided collection system for the domestic as well as industrial effluents. Separate storm water sewerage system shall be provided.

A. Domestic effluent:

4. Treatment: Since the domestic effluent from the factory is to be treated along with industrial effluent, no separate parameters are specified for domestic effluent.

B. Industrial effluent:

5. Treatment: The level of treatment would depend upon the disposal facilities available. The Company authorities have indicated that sufficient land is available for disposal of treated effluent on land. The effluent after treatment shall comply with the following standards:

1. PH	Between 5.5 and 9
2. Suspended Solids	Not to exceed 50 mg/l
3. B.O.D. 5 days 20°C	-do- 50 mg/l
4. Sulphates	-do- 1000 mg/l
5. Dissolved Solids	-do- 2100 mg/l
6. Chlorides	-do- 600 mg/l
7. Percent Sodium	-do- 60%
8. Total Ammonical Nitrogen	-do- 50 mg/l

6. During the episodal discharges and monsoon period when the effluent is not required for irrigation, it shall be treated and then discharged into the sea. For discharging into the sea it shall be so treated that the final effluent shall satisfy the following standards:

- |  |  |
|--|--|
| 1. PH  | Between 5.5 and 7  |
| 2. Temperature   | Not to exceed by 3° above<br>the receiving water temperature |
| 3. Total Suspended Solids                                      | Not to exceed 50 mg/l  |
| 4. Total Ammonical Nitrogen                                    | -do- 50 mg/l   |
| 5. B.O.D. 5 days 20°C  | -do- 50 mg/l   |
| 6. C.O.D.  | -do- 50 mg/l   |
| 7. D.O.  | Not less than 5 mg/l   |
| 8. Oil and grease  | Not to exceed 10 mg/l  |
| 9. Bio-assay test on fish shall show 90% survival in 96 hours. |  |

7. RCF shall take appropriate measures by way of soil conditioning and/or spread polythene sheets to avoid pollution by percolation of effluent required to be stored in the pond.

8. As regard to arrangements for disposal into the sea through pipeline, the same will have to be taken deep. The point of discharge shall be not less than 4 meters.\*\* A suitable point of discharge shall be selected after carrying out investigations to see that there is proper disposal and diffusion of the pollutants and that there is no building up of pollutants so that the marine and fish life is not affected. Special care should be taken to see that there is no building up of ammonia concentration leading to formation of algae resulting in reduction in fish life. Adequate precaution would be taken to see that the silting does not increase and move towards the Bombay harbour creating operating problems to navigation. In this connection, the National Institute of Oceanography may be consulted to carry out such investigations.

9. The effluent treatment plant and the arrangement for the disposal of the effluent either on land or into the sea as the case may be, shall be completed and commissioned simultaneously with the manufacturing plant so that no untreated effluent will at any time be discharged into the sea or applied on land.

10. RCF shall provide continuous PH monitoring system for water effluent with audio alarm system and control.

## II. AIR POLLUTION:

11. The RCF shall take action to develop system of monitoring stack omissions on the lines given below:

(a) Round the clock monitoring of all stacks for particulate matter, SO<sub>2</sub>, Oxides of Nitrogen and ammonia shall be done, samples being taken for 10 minutes every 2 hours for gaseous pollutants and for 30 minutes every two hours for particulate matter.

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\*\* Also a proper diffuser arrangement shall be provided.

(b) RCF shall establish one year before commissioning of manufacturing plant, minimum of 3 ambient air quality stations in three directions just outside the factory premises to assess the wind velocity and wind direction and for monitoring the present and future particulate matter (including critical analysis)  $SO_2$ ,  $NO_x$  and ammonia, samples being taken continuously for 24 hours. Analysis of gases measured every 24 hours. Monitoring stations shall be operated and maintained by RCF and results produced to State Government authorities/MPWP Board. The temperature inversion studies shall also be carried out for one year from the date of issue of No Objection Certificate with specific objectives of assessing the disposal of air pollutants omitted from stack of 150 meters.

(c) RCF shall permit inspection of their stack monitoring system and equipment as well as their ambient air quality stations by the MPWP Board.

(d) The limits of stack omissions of RCF from all sources shall not exceed 8 tpy in case of particulate matter and 18 tpy in case of  $SO_2$ .

(e) RCF shall adhere to average hourly stack emission limits of air pollutants mentioned in (i) namely 0.35 t/hr. of particulate matter and 0.75 t/hr. in case of  $SO_2$  so that if at any time the limits are exceeded, they shall be brought down within limits within one hour either by closure of plant or reduction of production.

(f) RCF shall install alkali scrubbers for removal of  $SO_2$  if the concentration of  $SO_2$  in the ambient air is found to be  $60 \text{ kg/m}^3$  annual average on 24 hours basis. RCF shall install control equipment having an efficiency of 99% for removal of particulate matter with multicyclones and LSP.

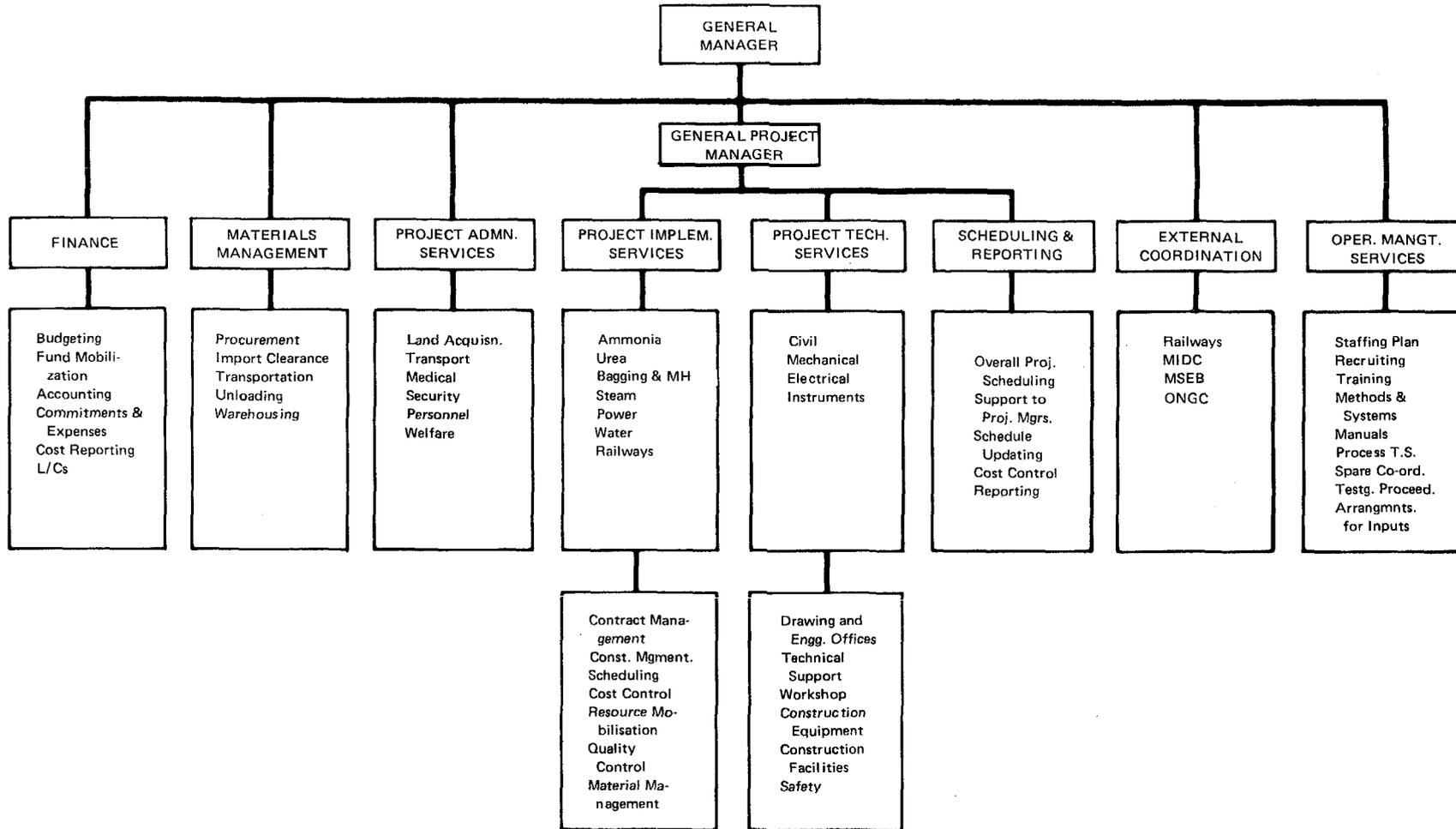
(g) Smoke density meter and automatic recorder shall be provided on all the boiler stacks.

(h) Stacks of not less than 150 meters height shall be constructed for better disposal of pollutants.

12. RCF shall give commitment to restrict the emissions stackwise to the levels of emissions indicated above. In case any stack emission goes above those levels, the RCF would have to shut down the concerned unit or **underrate** production. Also when episodal pollution is anticipated or occurs similar action shall be taken. In addition, if the pollutants concentration in ambient air increases above the permissible levels for Thal-Vaishet area further necessary measures will have to be taken to bring down the level of pollution.

13. Clearances of MPWP Board or its special committee appointed for this purpose shall be obtained at every stage i.e., design, specifications, installations, performance test of the air and water pollution control equipment, etc.
14. RCF shall maintain a green belt round the factory having a minimum width of 100 m.
15. The RCF shall abide by any directions given by the State Government on a report of MPWP Board and/or any such authority as may be appointed by State Government in case of violation of any of the above conditions.
16. The firm shall observe good house keeping in the plant.
17. The firm shall not cause nuisance to the surrounding areas arising from bad smell, gaseous emissions, noise and fouling of water resources nearby.
18. The factory management shall give prior intimation of at least 30 days to this Board about the commissioning of the factory so that the arrangements provided for treatment and disposal of solid and liquid and gaseous wastes can be inspected and final clearance can be given for commissioning the factory.

**INDIA – THAL FERTILIZER PROJECT  
PROJECT EXECUTION STAFF ORGANIZATION**



INDIA - THAL FERTILIZER PROJECT

SUMMARY OF CAPITAL COSTS  
(Millions of Rupee)

	Equipment Cost			Ocean	Custom	Inland	Tax &	Deliv	Engineering Costs			Civil Works	Plant Erec.
	Frgn.	Loc.	Total	Freight & Insurance 1/	Duty 2/	Handling 3/	Duty 4/	Cost	Frgn.	Loc.	Total		
1 Main Plants:													
(a) Ammonia Plant	600	410	1010	66	216	46	37	1375	139	89	228	56	117
(b) Urea Plant	256	255	510	28	92	22	23	675	57	39	96	48	59
2 Utility Plants:													
(a) Urea Handling	6	47	53	1	2	2	4	62		1	1	50	3
(b) Ammonia Storage & Handling	10	20	30	1	4	1	2	38	1	3	4	4	3
(c) Steam Generation	224	52	276	25	81	14	5	401		6	6	30	53
(d) Power Generation & Distribution	52	84	136	6	19	6	7	174		4	4	9	10
(e) Water Supply & Treatment	1	33	34			1	3	38		5	5	27	4
(f) Yard Piping	16	16	32	1	6	1	1	41	1	4	5	5	21
3 Off-Sites:													
(a) Auxiliary Services	20	23	43	2	7	2	2	56		2	2	1	1
(b) Railway and Transport	13	20	33	1	5	1	2	42				24	
(c) Effluent Treatment		7	7				1	8				10	1
(d) Non Plant Buildings												19	
(e) General Welfare		6	6				1						
(f) General Welfare		6	6				1	7					
4 Construction Equipment & Tools:	30	17	47	3	11	2	2	65		1	1	2	
5 Spares <sup>2/</sup>	92	50	142	11	33	7	5	198	5	3	8		
Sub-total	1319	1040	2359	145	476	105	95	3180	203	157	360	285	272
1 Equipment and Supplies	1319				693			2359					
2 Freight, Insurance & Duties	145			347 6/	676			821					
3 Engineering Services	203				157			360					
4 Land and Site Preparation					54			54					
5 Civil Works				17 2/	268			285					
6 Plant Erection					272			272					
7 Project Management		4			108			112					
8 Commissioning Expenses <sup>8/</sup>					85			85					
9 Township				4	69			73					
Total Base Cost (BC)	1671		368		2382			4421					
10 Physical Contingency (10% of BC)(PC)	167		37		238			442					
11 Price Escalation (17% of BC+PC)	312		69		445			826					
Total Installed Cost	2150		474		3065			5689					
12 Working Capital			32		608			640					
Total Project Cost	2150		506		3673			6329					
13 Interest During Construction			294		233			527					
14 Advance for Railway Spur					108			108					
15 Advance for Powerline from Apta					21			21					
Total Financing Required	2150		800		4035			6985					

- 1/ 11% of imported equipment cost.  
2/ 32.5% of landed cost including freight and insurance.  
3/ 5% of landed cost and 3% of local cost.  
4/ 9% of local cost.  
5/ 7.5% of imported supplies, 5.0% of local supplies.  
6/ One third of locally procured supplies.  
7/ 6% of local cost.  
8/ One third of cost of operation less depreciation at 45% of capacity for six months.

INDIA - THAL FERTILIZER PROJECT

WORKING CAPITAL

	<u>Basis</u>	<u>Tons</u>	<u>1983/84</u>		<u>1984/85</u>	
			<u>Unit Rate</u>	<u>Amount</u>	<u>Unit Rate</u>	<u>Amount</u>
1. Accounts Receivable						
(a) Urea	1.5 months	165,000	2,511	290	2,576	425
(b) Ammonia	0.5 months	1,200	2,471	2	2,426	3
2. Inventories <sup>/1</sup>						
(a) Finished Goods						
(i) Urea (Bagged)	1.0 month	110,000	1,049	81	1,122	123
Urea (bulk)	0.5 month	55,000	909	35	973	54
(ii) Ammonia		10,000	888	6	950	10
(b) Raw Materials & Consumables						
(i) Coal	1.5 months	66,500	205	10	219	15
(ii) Bags	1.0 month			10		16
(iii) Chemicals & Consumables	2.0 months			5		7
(c) Goods in Process	3 days			8		13
3. Minimum Cash <sup>/1 /2</sup>	1.0 month			48		74
Total Current Assets				495		740
4. Accounts Payable <sup>/1</sup>						
(a) Natural Gas	20 days			30		45
(b) Coal	30 days			7		10
(c) Bags	30 days			12		18
(d) Chemicals & Consumables	30 days			3		4
(e) Power	30 days			1		2
(f) Water	30 days			1		1
(g) Maintenance Materials	-			13		20
Total Working Capital at Current Prices				67		100
				428		640

<sup>/1</sup> 1979 prices escalated to 1983 at 7% per year.

<sup>/2</sup> Cash required against bills for natural gas, water, power, wages, insurance and taxes.

Industrial Projects Department  
June 1979

INDIA - THAL FERTILIZER PROJECT  
Estimated Disbursement Schedule for  
Bank Loan

	<u>Bank Fiscal</u> <u>Year and Quarter</u>	<u>Estimated</u> <u>Disbursements</u> <sup>a/</sup>	<u>Cumulative</u> <u>Disbursements</u>
<u>FY 1980</u>	July - September	-	-
	October - December	8.0	10.0
	January - March	8.0	16.0
	April - June	12.0	28.0
<u>FY 1981</u>	July - September	12.0	40.0
	October - December	13.0	53.0
	January - March	15.0	68.0
	April - June	17.0	85.0
<u>FY 1982</u>	July - September	18.0	103.0
	October - December	20.0	123.0
	January - March	18.0	141.0
	April - June	17.0	158.0
<u>FY 1983</u>	July - September	15.0	173.0
	October - December	14.0	187.0
	January - March	12.0	199.0
	April - June	11.0	210.0
<u>FY 1984</u>	July - September	11.0	221.0
	October - December	10.0	231.0
	January - March	10.0	241.0
	April - June	9.0	250.0

a/ Disbursements for Bank loan are assumed to lag about 3 months behind the disbursements on Bank financed items by RCF, due to the expected delays in Bank reimbursements to GOI.

INDIA - THAL FERTILIZER PROJECT

ASSUMPTIONS USED IN THE FINANCIAL ANALYSIS

OF THE PROJECT

1. In the preparation of the financial projections for the Project, (Annexes 8-4, 8-5 and 8-6), the following assumptions were made: a) all revenues and costs were escalated from 1978 through 1993 in current prices; b) financial projections were calculated for 10 years of operations; c) an inflation rate of 7 percent per annum has been used on all the cash cost items during the plant operation period.

A. Capacity and Capacity Utilization

2. It is assumed that the first stream of ammonia and urea plants will start commercial operation by August 1983 and the **second stream** plants will be in commercial operation by February 1984. The commercial operations are assumed following six months of testing and commissioning after the **plant's** mechanical completion. Projected losses during the above six months have been capitalized. Each stream of the plants is assumed to operate at 60% during the first year, 80% the second year and 90% thereon to: a 90% capacity utilization corresponds to 1,336,500 tpy of urea and 26,730 tpy of ammonia for sale.

B. Revenues

3. All revenues are at the ex-factory level and do not include the Government levy, excise duty, dealers margin, or any other charges that determine the spread between the ex-factory and the retail price. The present retail selling price of urea is Rs 1450/ton of bagged urea. From this, the current average ex-factory price of bagged urea can be derived as follows:

Retail Price	Rs 1450
Less: Fertilizer Pool Equali-	
zation	Rs 52
Notional Freight	Rs 38
Excise Duty	Rs 87
Dealer's Margin	Rs 115
Ex-factory Price	Rs 1158

In November 1977, the Government introduced a new national pricing policy for the main nitrogenous fertilizer which will provide a reasonable return on investment for the fertilizer industry. The scheme was extended to phosphatic fertilizer in February 1979. The new pricing policy calls for ex-factory retention prices that allow each operating unit a 28.4% before-tax return equivalent to a 12% after-tax return, on net worth at 80% capacity

utilization. The relation between the before- and after-tax return is the applicable income tax of 57.75% on taxable corporate income. The 28.4% pre-tax return provided in the pricing formula permits a company to retain the full benefits of any tax incentives it can receive. The urea retention price is calculated using the following procedure (formula):

- i) Net fixed assets used in the production of urea  
(97.78% of the total net fixed assets)
- ii) + Working capital estimated at 4 months cash costs  
of production related to urea at 80% capacity
- iii) = Total capital employed
- iv) - Outstanding borrowings associated with urea  
production estimated at same percentage of the  
total capital employed as that reflected in the  
company balance sheets
- v) = Total Net Worth used in the production of urea
- vi) 28.4% return on the Total Net Worth
- vii) + Interest on borrowings associated with urea pro-  
duction at 10.25% for long-term borrowings and  
13% for short-term borrowings
- viii) + Variable and Fixed Costs related to urea produc-  
tion with depreciation as provided in the fixed  
asset tables of the company balance sheet
- ix) Sum = ex-factory realization to producer
- x) ÷ Production volume of urea at 80% capacity utiliza-  
tion (1,188,000 tpy)
- xi) Urea retention price

The retention price calculation basis is established every three years to take into account the changes in net worth and debt service, but changes in variable and fixed costs are allowed for as and when they occur, especially for costs of major inputs. The retention price calculations for the Project are given in Annex 8-2. This retention price formula provides the Company a large cash flow during the initial years of operation, mainly due to the added benefit of the tax exemptions and thus creates an incentive for reinvestment. If no reinvestment occurs, the decreasing net worth with decreasing net fixed assets reduces the return and thereby also the retention price (and consequently revenues). The Government has under consideration a proposal to

ensure that the net worth remains at or above the share capital of the facilities. In the case of the Thal Project, the retention price increases at about 1.5 percent per year in current prices, since the price escalation of the production costs are larger than the decline in the return on net worth.

4. The Government now allows each company to charge the actual average freight per ton of bagged urea in the retail price build-up, which in the case of Thal would be about Rs 124/ton as compared to the notional freight provision of Rs 38/ton. The difference between this ex-factory price and the retention price will be paid by the Government to RCF.

5. The Government has recently decided to extend the fertilizer pricing formula to ammonia sold for conversion to fertilizers. However, since the available ammonia for sale is only about 3.3% of the total ammonia production, for sake of simplicity, its ex-factory sale price has been assumed to be the same as the ex-factory sale price of unbagged urea.

C. Operating Costs

6. Associated Gas: The Government has announced the basis for the pricing of natural gas supplied for fertilizer production. To maintain financial parity with the naphtha-based fertilizer plants in India the natural gas will be priced on the basis of the delivered cost of naphtha at the same location adjusted for the relative calorific values of the two energy sources. On this basis the gas price will be Rs 626/Nm<sup>3</sup> price escalated at 7% p.a.

7. Coal: The 1978/79 assumed CIF coal price is Rs 148/ton. Since the main factor in the coal price is labor, and its cost is assumed to increase at 7% p.a., the coal price is escalated at that same rate.

8. Other variable costs: The 1978/79 prices for the other variable costs are as follows:

<u>Item</u>	<u>1978/79 Assumed Price</u>
Water	Rs 0.70/M <sup>3</sup>
Purchased Power	Rs 240/MWH
Duty on Generated Power	Rs 20/MWH
Bags	Rs 5/Bag

9. Depreciation: For the financial projections and for the retention price calculation a 12 year straight line depreciation is used.

10. Other income: Considering that a) the high penalty the retention price formula creates if no reinvestment occurs, b) no definite assumption can be made as to the reinvestment opportunities available to the fully Government-owned RCF, and c) the financial projections should give a fair picture of the Project; it has been conservatively assumed that the yearly accumulated surplus cash will be reinvested in government bonds yielding a 5% after tax return.

D. Balance Sheet

11. Working Capital: The working capital for 1983/84 and 1984/85 is given in current rupees in Annex 7-1, page 2.

12. Financing fixed assets: The incremental expenditures amounting to Rs 6,985 million are assumed to be financed in the following way:

<u>Fiscal Year</u>	<u>Equity</u>	<u>Long-term Debt</u>	<u>Short-term Debt</u>	<u>Total</u>
1979/80	529	239	--	768
1980/81	694	488	--	1,182
1981/82	946	630	--	1,576
1982/83	1,195	904	--	2,099
1983/84	-	827	321	1,148
1984/85	-	53	159	212
	<u>3,364</u>	<u>3,141</u>	<u>480</u>	<u>6,985</u>

E. Financial Rate of Return

13. The before-tax financial rate of return in constant terms is calculated at 8.9%.

The cash flow for financial rate of return is the following:

Cash Flow for the Financial Rate of Return  
(in millions of 1978/79 rupees)

<u>Fiscal Year</u>	<u>Fixed Capital Costs</u>	<u>Working Capital</u>	<u>Variable Costs</u>	<u>Fixed Costs</u>	<u>Revenues</u>
1979/80	707		0	0	0
1980/81	989		0	0	0
1981/82	1,199		0	0	0
1982/83	1,460		0	0	0
1983/84	390	305	158	87	555
1984/85		141	644	208	1773
1985/86	0		814	208	2117
1986/87	0		849	208	2074
1987/88	0		849	208	1987
1988/89	0		849	208	1907
1989/90	0		849	208	1768
1990/91	0		849	208	1708
1991/92	0		849	208	1653
1992/93	0		849	208	1520
1993/94	0		849	208	1482
1994/95	(475)	(446)	849	208	1444

14. The sensitivity analysis is presented in the main text of the report. The cash flow for the financial rate of return was calculated by using the revenues and costs of the projected income statements (see Annex 8-4) and discounting them at 7%, the forecasted inflation rate for India, to 1978 constant rupees.

INDIA - THAL FERTILIZER PROJECT

RETENTION PRICE CALCULATION  
(In Millions of Current Rupees)

Fiscal Year ending March 31

	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>
1. Capital Outlay <sup>a/</sup>	6016	5812	5322	4832	4342	3852	3362	2872	2382	1892	1402	912
2. Working Capital	398	426	456	488	522	559	598	640	685	733	784	839
3. Capital Employed	6414	6238	5778	5320	4864	4411	3960	3512	3067	2625	2186	1751
<u>Borrowings</u>												
4. Long Term	3126	3141	2934	2620	2306	1992	1678	1364	1050	736	422	107
5. Short Term	-	321	480	-	-	-	-	-	-	-	-	-
6. Total Loan	3126	3462	3414	2620	2306	1992	1678	1364	1050	736	422	107
7. Notional Loan (Total)	3089	3171	2910	2329	1978	1641	1318	1013	730	471	244	54
8. Net Worth	-	3067	2868	2991	2886	2370	2642	2499	2337	2154	1942	1677
9. Net Worth Allocated to Urea	-	2910	2910	2910	2731	2731	2731	2301	2301	2301	1642	1642
10. Return of 28.4% on Net Worth	-	826	826	826	776	776	776	654	654	654	466	466
11. Variable Cost at 80% Production Level	-	994	1063	1138	1217	1302	1394	1491	1596	1707	1827	1955
12. Selling Expenses	-	42	44	48	51	55	58	62	67	71	76	82
13. Fixed Cost Excluding Depre- ciation	-	285	305	326	349	374	400	428	458	490	524	561
14. Depreciation	-	480	480	480	480	480	480	480	480	480	480	480
15. Interest on Notional Short Term Loan	-	43	52	31								
16. Interest on Long Term Loan	-	<u>313</u>	<u>290</u>	<u>253</u>	<u>236</u>	<u>200</u>	<u>166</u>	<u>133</u>	<u>102</u>	<u>74</u>	<u>48</u>	<u>25</u>
17. Ex-Works Realization		2983	3060	3102	3109	3187	3274	3248	3357	3476	3421	3569
18. Ex-Works Price/Ton of Urea	-	2511	2576	2611	2617	2683	2756	2734	2826	2926	2880	3004
19. Ex-Works Price in 1978 Rupees	-	1790	1716	1626	1523	1459	1401	1299	1255	1214	1117	1089

<sup>a/</sup> Excludes working capital, spares and half the cost of rail siding and power connection.

INDIA - THAL FERTILIZER PROJECT  
Explanatory Notes on Retention Price Calculations

S. No.

- 1 Initial capital outlay is project financing (Rs 6985 million) less working capital (Rs 640 million), spares (Rs 265 million including contingency and escalation) and half the cost of railway siding and power connection (Rs 64 million) deposited as advance. Depreciation of Rs 490 million per year is based on 12 year straight line depreciation for fixed assets excluding spares, land and township (over 40 years).
- 2 Working capital estimated at 4 months cash cost of operations at 80% production level.
- 3 Capital employed is sum of (1) and (2).
- 4,5,6 Borrowings of the Thal unit for its construction and operation.
- 7 Estimated from capital employed (3) using the debt/share capital ratio of the company balance sheet.
- 8 Net worth is capital employed (3) less notional loan (7).
- 9 Average net worth for the three year period is calculated by obtaining the average of the net worth at the beginning and end of each year and then the average for the three consecutive year period. 98.7% of the net worth is allocated to urea production and the rest to the surplus ammonia production.
- 10 28.4% of net worth allocated to urea (9).
- 11 Variable cost estimated at 80% level of operation for urea production only - excluding surplus ammonia.
- 12 Selling expenses estimated for 80% level of urea production.
- 14 Part of the total annual depreciation of Rs 490 million (1) allocated to urea production.
- 15,16 Part of the Thal unit's interest payments pro-rated for notional loan (7).
- 17 Sum of (11), (12), (13), (14), (15) and (16).
18. Calculated per ton of urea based on annual production at 80% of capacity of 1.188 million tons of urea.
- 19 Ex-works price in (18) deflated to 1978/79 rupees at 7% per year.



## INDIA - THAL FERTILIZER PROJECT

## PROJECTED INCOME STATEMENTS

	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
<b>PRODUCTION DATA</b> (in tpy)										
Urea	249,000	1,014,000	1,280,000	1,336,500	1,336,500	1,336,500	1,336,500	1,336,500	1,336,500	1,336,500
Ammonia (Surplus)	62,000	20,000	23,600	26,730	26,730	26,730	26,730	26,730	26,730	26,730
<b>PRODUCT PRICES</b> (Rs./Ton)										
Urea	2,511	2,576	2,611	2,617	2,683	2,756	2,734	2,826	2,926	2,880
Ammonia	2,471	2,426	2,450	2,445	2,499	2,559	2,524	2,601	2,685	2,622
<b>REVENUES</b>										
Urea	625	2,612	3,342	3,498	3,586	3,683	3,654	3,777	3,911	3,849
Ammonia	153	49	58	65	67	68	67	70	72	70
Total Sales	778	2,661	3,400	3,563	3,653	3,751	3,721	3,847	3,983	3,919
<b>PRODUCTION COSTS</b>										
Variable Costs										
Natural Gas	136	592	800	893	956	1,023	1,095	1,171	1,253	1,341
Coal	21	90	122	136	145	155	166	178	190	204
Water	5	21	28	31	33	35	38	41	43	46
Purchased Power	8	34	46	52	55	59	63	68	72	77
Duty on Generated Power	1	3	5	5	6	6	6	7	7	8
Catalysts & Chemicals	8	36	49	55	59	63	67	72	77	83
Selling Expenses	8	38	51	57	61	66	70	75	81	86
Bags	35	152	206	230	246	263	281	301	322	345
Total Variable Costs	222	966	1,307	1,459	1,561	1,670	1,786	1,913	2,045	2,190
Fixed Costs										
Labor & Overhead	14	36	39	41	44	47	51	54	58	62
Depreciation	213	512	512	512	512	512	512	512	512	512
Other	108	276	295	316	338	362	387	414	443	474
Total Fixed Costs	335	824	846	869	894	921	950	980	1,013	1,048
Total Production Costs	557	1,790	2,153	2,328	2,455	2,591	2,736	2,893	3,058	3,238
Gross Profit	221	871	1,247	1,235	1,198	1,160	985	954	925	681
<b>FINANCE CHARGES</b>										
Interest on Short Term Loan	17	53	31	-	-	-	-	-	-	-
Interest on Long Term Loan	104	322	322	290	258	225	193	161	129	97
Total Finance Charges	121	375	353	290	258	225	193	161	129	97
Income/Loss before Tax	100	496	894	945	940	935	792	793	796	584
Income Tax	-	-	-	-	-	-	-	-	-	-
Net Operating Income	100	496	894	945	940	935	792	793	796	584
Other Income	-	16	70	103	165	228	295	358	424	493
NET INCOME	100	512	964	1,048	1,105	1,163	1,087	1,151	1,220	1,077
<b>RATIOS</b>										
Net Operating Income/Sales (%)	12.9	18.6	26.3	26.5	25.7	24.9	21.3	20.6	20.0	14.9
Net Income/Equity (%)	2.9	13.8	21.6	19.2	16.9	15.2	12.4	11.6	11.0	8.8
Net Income/Total Assets (%)	1.6	7.0	12.4	12.7	12.3	11.8	10.2	10.0	9.9	8.2
Profit Breakeven (%)	13.8	48.3	49.4	49.6	49.6	49.6	53.2	53.1	53.0	59.6
Cash Breakeven (%)	7.4	27.7	41.2	41.1	41.0	41.0	44.0	43.9	43.8	49.3

## INDIA - THAL FERTILIZER PROJECT

## PROJECTED BALANCE SHEET

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
<b>CURRENT ASSETS</b>														
Minimum Cash	-	-	-	-	48	74	78	83	89	95	102	109	117	125
Accounts Receivable	-	-	-	-	292	428	434	435	446	458	454	469	486	478
In Process and Finished Goods	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inventories	-	-	-	-	130	200	214	229	245	262	281	300	321	344
Raw Material Inventories	-	-	-	-	25	38	41	44	47	50	54	58	62	66
Total Current Assets	-	-	-	-	495	740	767	791	827	865	891	936	986	1,013
Surplus Cash Balance	-	-	-	-	325	1,392	2,059	3,290	4,569	5,900	7,168	8,482	9,861	11,120
Railway and Powerline Advances	65	65	65	65	53	10	5	3	-	-	-	-	-	-
<b>FIXED ASSETS</b>														
Gross Fixed Assets	691	1,823	3,292	5,206	5,753	5,753	5,753	5,753	5,753	5,753	5,753	5,753	5,753	5,753
Interest During Construction	12	62	169	354	527	527	527	527	527	527	527	527	527	527
Less Accum. Depreciation	-	-	-	-	213	725	1,237	1,749	2,261	2,773	3,285	3,797	4,309	4,821
Net Fixed Assets	703	1,885	3,461	5,560	6,067	5,555	5,043	4,531	4,019	3,507	2,995	2,483	1,971	1,459
TOTAL ASSETS	768	1,950	3,526	5,625	6,940	7,697	7,874	8,615	9,415	10,272	11,054	11,901	12,818	13,592
<b>CURRENT LIABILITIES</b>														
Accounts Payable	-	-	-	-	67	100	107	114	123	131	140	150	161	172
S. T. Loan	-	-	-	-	321	480	-	-	-	-	-	-	-	-
Current Portion of L. T. Loan	-	-	-	-	-	314	314	314	314	314	314	314	314	314
Total Current Liabilities	-	-	-	-	388	894	421	428	437	445	454	464	475	486
<b>LONG-TERM LIABILITIES (excl. curr. portion)</b>														
IBRD Loan (through GOI)	239	727	1,357	1,807	2,150	1,935	1,720	1,505	1,290	1,075	860	645	430	215
GOI Loan	-	-	-	454	938	892	793	694	595	496	397	298	199	100
Total Long-Term Liabilities	239	727	1,357	2,261	3,088	2,827	2,513	2,199	1,885	1,571	1,257	943	629	315
TOTAL LIABILITIES	239	727	1,357	2,261	3,476	3,721	2,934	2,627	2,322	2,016	1,711	1,407	1,104	801
<b>EQUITY</b>														
Share Capital	529	1,223	2,169	3,364	3,364	3,364	3,364	3,364	3,364	3,364	3,364	3,364	3,364	3,364
Retained Earnings	-	-	-	-	100	612	1,576	2,624	3,729	4,892	5,979	7,130	8,350	9,427
Total Equity	529	1,223	2,169	3,364	3,464	3,976	4,940	5,988	7,093	8,256	9,343	10,494	11,714	12,791
TOTAL LIABILITIES AND EQUITY	768	1,950	3,526	5,625	6,940	7,697	7,874	8,615	9,415	10,272	11,054	11,901	12,818	13,592
<b>RATIOS</b>														
Current Ratio	-	-	-	-	1.3	0.8	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.1
Current Ratio (incl. surp. cash)	-	-	-	-	2.1	2.4	6.7	9.5	12.3	15.2	17.8	20.3	22.8	25.0
Debt/Equity Ratio	-	-	-	-	47/53	42/58	34/66	27/73	21/79	16/84	12/88	8/92	5/95	2/98

INDIA - THAL FERTILIZER PROJECT

PROJECTED SOURCES AND USES OF FUNDS STATEMENTS

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
<b>SOURCES</b>														
Net Income	-	-	-	-	100	512	964	1,048	1,105	1,163	1,087	1,151	1,220	1,077
Depreciation	-	-	-	-	213	512	512	512	512	512	512	512	512	512
Internal Cash Generation	-	-	-	-	313	1,024	1,476	1,560	1,617	1,675	1,599	1,663	1,732	1,589
Interest	-	-	-	-	121	375	353	290	258	225	193	161	129	77
Repayment of Advance	-	-	-	-	12	43	5	2	3	-	-	-	-	-
Increase in Accounts Payable	-	-	-	-	67	33	7	7	9	8	9	10	11	11
S.T. Loan	-	-	-	-	321	480	-	-	-	-	-	-	-	-
IBRD Loan (through GOI)	239	488	630	450	343	-	-	-	-	-	-	-	-	-
GOI Loan	-	-	-	454	484	53	-	-	-	-	-	-	-	-
Share Capital/Internal Resources	529	694	946	1,195	-	-	-	-	-	-	-	-	-	-
<b>TOTAL SOURCES</b>	<b>768</b>	<b>1,182</b>	<b>1,576</b>	<b>2,099</b>	<b>1,661</b>	<b>2,008</b>	<b>1,841</b>	<b>1,859</b>	<b>1,887</b>	<b>1,908</b>	<b>1,801</b>	<b>1,834</b>	<b>1,872</b>	<b>1,677</b>
<b>USES</b>														
Interest	-	-	-	-	121	375	353	290	258	225	193	161	129	77
Repayment S.T. Loan	-	-	-	-	-	321	480	-	-	-	-	-	-	-
Repayment IBRD Loan	-	-	-	-	-	-	215	215	215	215	215	215	215	215
Repayment GOI Loan	-	-	-	-	-	-	99	99	99	99	99	99	99	99
Debt Service	-	-	-	-	121	696	1,147	604	572	539	507	475	443	391
Increase in Current Assets	-	-	-	-	495	245	27	24	36	38	26	45	50	27
Increase in Advance	65	-	-	-	-	-	-	-	-	-	-	-	-	-
Increase in Gross Fixed Assets	691	1,132	1,469	1,914	547	-	-	-	-	-	-	-	-	-
Interest during Construction	12	50	107	185	173	-	-	-	-	-	-	-	-	-
Increase in Surplus Cash	-	-	-	-	325	1,067	667	1,231	1,279	1,331	1,268	1,314	1,379	1,259
<b>TOTAL USES</b>	<b>768</b>	<b>1,182</b>	<b>1,576</b>	<b>2,099</b>	<b>1,661</b>	<b>2,008</b>	<b>1,841</b>	<b>1,859</b>	<b>1,887</b>	<b>1,908</b>	<b>1,801</b>	<b>1,834</b>	<b>1,872</b>	<b>1,677</b>
<b>RATIOS</b>														
Debt Service Coverage					3.6	3.7	2.7	3.1	3.3	3.5	3.5	3.8	4.2	4.3

Industrial Projects Department  
June 1979

INDIA - THAL FERTILIZER PROJECT

PROJECTED CONSOLIDATED INCOME STATEMENTS OF RCF

	<u>1978/79</u>	<u>1979/80</u>	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>	<u>1983/84</u>	<u>1984/85</u>	<u>1985/86</u>	<u>1986/87</u>	<u>1987/88</u>	<u>1988/89</u>	<u>1989/90</u>	<u>1990/91</u>	<u>1991/92</u>	<u>1992/93</u>
<u>SALES</u>															
Net Sales Revenue	914	1,380	1,749	2,174	2,451	3,409	5,409	6,271	6,563	6,789	7,030	7,150	7,434	7,736	7,846
<u>PRODUCTION COSTS</u>															
<u>Variable Costs</u>															
Raw Materials	372	516	605	679	744	938	1,448	1,715	1,872	2,003	2,143	2,293	2,452	2,623	2,806
Utilities	44	86	124	176	215	250	335	384	416	445	476	509	545	583	625
Water	17	18	29	44	55	66	86	98	106	113	121	130	139	148	158
Power	97	90	109	130	146	168	208	234	252	244	287	306	328	349	373
Catalysts and Chemicals	21	37	47	54	58	70	102	120	131	140	150	160	175	188	200
Bags	37	58	78	98	114	159	284	347	381	408	436	466	499	534	572
Selling Expenses	29	39	40	42	45	56	89	106	116	124	133	142	152	163	174
Total Variable Costs	617	844	1,032	1,223	1,377	1,707	2,552	3,004	3,274	3,477	3,746	4,006	4,290	4,588	4,908
<u>FIXED COSTS</u>															
Labor and Overhead	95	98	114	130	140	164	198	213	227	244	261	281	300	322	346
Depreciation	45	103	138	253	253	466	765	765	765	765	748	694	634	634	634
Others	70	87	104	155	165	284	464	496	531	568	608	650	695	743	795
Total Fixed Costs	210	288	356	538	558	914	1,427	1,474	1,523	1,577	1,617	1,625	1,629	1,699	1,775
Total Production Costs	827	1,132	1,388	1,761	1,935	2,621	3,979	4,478	4,797	5,054	5,363	5,631	5,919	6,287	6,683
Gross Profit	87	248	361	413	516	788	1,430	1,793	1,766	1,735	1,667	1,519	1,515	1,449	1,163
<u>FINANCE CHARGES</u>															
Interest on S.T. Loans	2	13	15	15	15	32	68	46	15	15	15	15	15	15	15
Interest on L.T. Loans	16	41	43	69	64	160	369	361	321	281	240	203	167	132	97
Total Finance Charges	18	54	58	84	79	192	437	407	336	296	255	218	182	147	112
Income/Loss Before Tax	69	194	303	329	437	596	993	1,386	1,430	1,439	1,412	1,301	1,333	1,302	1,051
Income Tax	-	-	-	77	286	321	363	376	382	382	382	376	366	351	330
Net Operating Income	69	194	303	329	360	310	672	1,023	1,054	1,057	1,030	925	967	951	721
Other Income	-	-	-	-	9	19	52	121	169	244	323	403	482	563	647
NET INCOME	69	194	303	329	369	329	724	1,144	1,223	1,301	1,353	1,328	1,449	1,514	1,368
<u>RATIOS</u>															
Net Operating Income/Sales (%)	7.5	14.1	17.3	15.1	14.7	9.1	12.4	16.3	16.1	15.6	14.7	12.9	13.0	12.3	9.2
Net Income/Equity (%)	4.7	10.4	10.9	8.7	7.5	5.7	11.6	15.9	14.6	13.5	12.3	10.8	10.6	10.0	8.2
Net Income/Total Assets (%)	3.1	6.8	7.0	5.5	4.7	3.4	6.7	10.0	10.2	10.1	9.7	8.9	9.1	8.9	7.5

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ANNEX 8-7

INDIA-THAL FERTILIZER PROJECT  
PROJECTED CONSOLIDATED BALANCE SHEETS OF RCF

	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
<b>CURRENT ASSETS</b>															
Minimum Cash	2	2	2	2	3	51	77	81	86	92	98	105	112	120	128
Accounts Receivable	236	248	273	313	333	635	788	812	832	863	896	914	952	993	1010
Inventories	321	341	481	501	521	696	789	823	858	895	933	975	1017	1062	1110
Others	70	75	90	100	110	120	120	120	120	120	120	120	120	120	120
Total Current Assets	629	666	846	916	967	1502	1774	1836	1896	1970	2047	2114	2201	2295	2368
Surplus Cash Balance		-		188	388	1038	2426	3375	4883	6458	8062	9639	11259	12943	14513
Railway and Powerline Advance	-	65	65	65	65	53	10	5	3	-	-	-	-	-	-
<b>FIXED ASSETS</b>															
Gross Fixed Assets	2157	3360	5036	6652	8801	9571	9621	9671	9721	9771	9821	9871	9921	9971	10021
Less Accumulated Depreciation	525	628	766	1019	1272	1738	2503	3268	4033	4798	5546	6240	6874	7508	8142
Net Fixed Assets	1632	2732	4270	5633	7529	7833	7118	6403	5688	4973	4275	3631	3047	2463	1879
TOTAL ASSETS	2261	3463	5181	6802	8949	10426	11328	11619	12470	13401	14384	15384	16507	17701	18760
<b>CURRENT LIABILITIES</b>															
Accounts Payable	199	219	230	240	252	332	378	399	421	445	469	495	523	553	584
Short Term Loan	171	207	218	250	250	571	730	250	250	250	250	250	250	250	250
Current Portion of L.T. Loan	40	40	44	55	80	80	394	394	394	394	354	354	350	340	314
Total Current Liabilities	410	466	492	545	582	983	1502	1043	1065	1089	1073	1099	1123	1143	1148
Long-Term Loans	397	710	1405	1980	2803	3550	3209	2815	2421	2027	1673	1319	969	629	315
TOTAL LIABILITIES	807	1176	1897	2525	3385	4533	4711	3858	3486	3116	2746	2418	2092	1772	1463
<b>EQUITY</b>															
Paid in Share Capital	1385	2024	2718	3382	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300
Retained Earnings	69	263	566	895	1264	1593	2317	3461	4684	5985	7338	8666	10115	11629	12997
Total Equity	1454	2287	3284	4277	5564	5893	6617	7761	8984	10285	11638	12966	14415	15929	17297
TOTAL LIABILITIES AND EQUITY	2261	3463	5181	6802	8949	10426	11328	11619	12470	13401	14384	15384	16507	17701	18760
<b>RATIOS</b>															
Current Ratio	1.5	1.4	1.7	1.7	1.7	1.5	1.2	1.8	1.8	1.8	1.9	1.9	2.0	2.0	2.1
Current Ratio (including surplus cash)	1.5	1.4	1.7	2.0	2.3	2.6	2.8	5.0	6.4	7.7	9.4	10.7	12.0	13.3	14.7
Debt/Equity Ratio	21/79	24/76	30/70	32/68	34/66	38/62	33/67	27/73	21/79	16/84	13/87	9/91	6/94	4/96	2/98

Industrial Projects  
June 1979

INDIA - THAL FERTILIZER PROJECT

PROJECTED CONSOLIDATED SOURCES AND USES OF FUNDS OF RCF

	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
<b>SOURCES</b>															
Net Income	69	194	303	329	369	329	724	1,144	1,223	1,301	1,353	1,328	1,449	1,514	1,368
Depreciation	<u>45</u>	<u>103</u>	<u>138</u>	<u>253</u>	<u>253</u>	<u>466</u>	<u>765</u>	<u>765</u>	<u>765</u>	<u>765</u>	<u>748</u>	<u>694</u>	<u>634</u>	<u>634</u>	<u>634</u>
Internal Cash Generation	114	297	441	582	622	795	1,489	1,909	1,988	2,066	2,101	2,022	2,083	2,148	2,002
Interest	18	54	58	84	79	192	437	407	336	296	255	218	182	147	112
*Repayment of Advance	-	-	-	-	-	12	43	5	2	3	-	-	-	-	-
Increase in Accounts Payable	21	20	11	10	12	80	46	21	22	24	24	26	28	30	31
Increase in Short Term Loan	171	36	11	32	-	321	159	480	-	-	-	-	-	-	-
Long Term Loan	40	353	739	630	904	827	53	-	-	-	-	-	-	-	-
Share Capital	260	639	694	664	918	-	-	-	-	-	-	-	-	-	-
<b>TOTAL SOURCES</b>	<u>624</u>	<u>1,399</u>	<u>1,954</u>	<u>2,002</u>	<u>2,535</u>	<u>2,227</u>	<u>2,227</u>	<u>1,862</u>	<u>2,348</u>	<u>2,389</u>	<u>2,380</u>	<u>2,266</u>	<u>2,293</u>	<u>2,325</u>	<u>2,145</u>
<b>USES</b>															
Debt Service	18	94	98	128	135	272	517	801	730	690	649	572	536	497	452
Increase in Current Assets	223	37	180	70	51	535	272	62	60	74	77	67	87	94	73
Increase in Advance	-	65	-	-	-	-	-	-	-	-	-	-	-	-	-
Increase in Gross Fixed Assets	383	1,203	1,676	1,616	2,149	770	50	50	50	50	50	50	50	50	50
Accumulated Cash	-	-	-	188	200	650	1,388	1,949	1,508	1,575	1,604	1,577	1,620	1,684	1,570
<b>TOTAL USES</b>	<u>624</u>	<u>1,399</u>	<u>1,954</u>	<u>2,002</u>	<u>2,535</u>	<u>2,227</u>	<u>2,227</u>	<u>1,862</u>	<u>2,348</u>	<u>2,389</u>	<u>2,380</u>	<u>2,266</u>	<u>2,293</u>	<u>2,325</u>	<u>2,145</u>
<b>RATIOS</b>															
Debt Service Coverage	7.3	3.7	5.1	5.2	5.2	3.6	3.7	2.9	3.2	3.4	3.6	3.9	4.2	4.6	4.7

Industrial Projects  
June 1979

INDIA - THAL FERTILIZER PROJECT  
Assumptions for the Economic Analysis

<u>Year</u>	<u>Revenues</u>	<u>Units</u>	<u>Production @ 90% Capacity</u>	<u>Production @ Yearly Capacity</u>	<u>Economic Price 1978/79 US\$/ton</u>	<u>Economic Value Million 1978/79 US\$</u>
1984	Ammonia	ton	26,730	62,000	190	11.8
	Urea	ton	1,336,500	249,000	205	<u>51.0</u> 62.8
1985	Ammonia	ton	26,730	20,000	200	4.0
	Urea	ton	1,336,500	1,014,000	215	<u>218.0</u> 222.0
1986	Ammonia	ton	26,730	23,600	200	4.7
	Urea	ton	1,336,500	1,280,000	215	<u>275.2</u> 279.9
1987	Ammonia	ton	26,730	26,730	200	5.3
	Urea	ton	1,336,500	1,336,500	215	<u>287.3</u> 292.6

Costs

<u>1982</u>	<u>Variable Costs @ 90% Cap.</u>			<u>Unit Cost<sup>a/</sup> 1978/79 US\$</u>		
	Natural Gas	1000Nm <sup>3</sup>	830,000	--	73.4	60.9
	Coal	ton	532,000	--	16.4	8.7
	Water	m <sup>3</sup>	25,000,000	--	0.7	1.8
	Power	MWH	125,000	--	25.0	3.1
	Bags	Bags	26,730,000	--	0.52	13.9
	Consumables			--	various	<u>3.3</u> 91.7

Fixed Costs

Labor and Overhead	2.8
Maintenance Materials	17.9
	<u>20.7</u>

Total Costs

112.4

<u>Capital Costs</u>	<u>Fiscal Year</u>	<u>Disbursement Schedule 1978/79 US\$ Million</u>		
		<u>Fixed Capital</u>	<u>Working Capital</u>	
	1979/80	15%	75.0	
	1980/81	20%	100.0	
	1981/82	25%	125.0	
	1982/83	30%	150.0	
	1983/84	10%	50.1	35.5
	1984/85	-	-	16.4

US\$ Million

Total Project Cost	812.3
<u>Less: Advances paid</u>	7.5
Working Capital	74.4
Price Escalation	96.0
Interest During Construction	61.3
Taxes and Duties	<u>73.0</u>
Base Economic Capital Cost	500.1

a/ Based on 1978/79 financial costs in Annex 8-3 less taxes and duties of 10% for power and bags and 5% for coal.

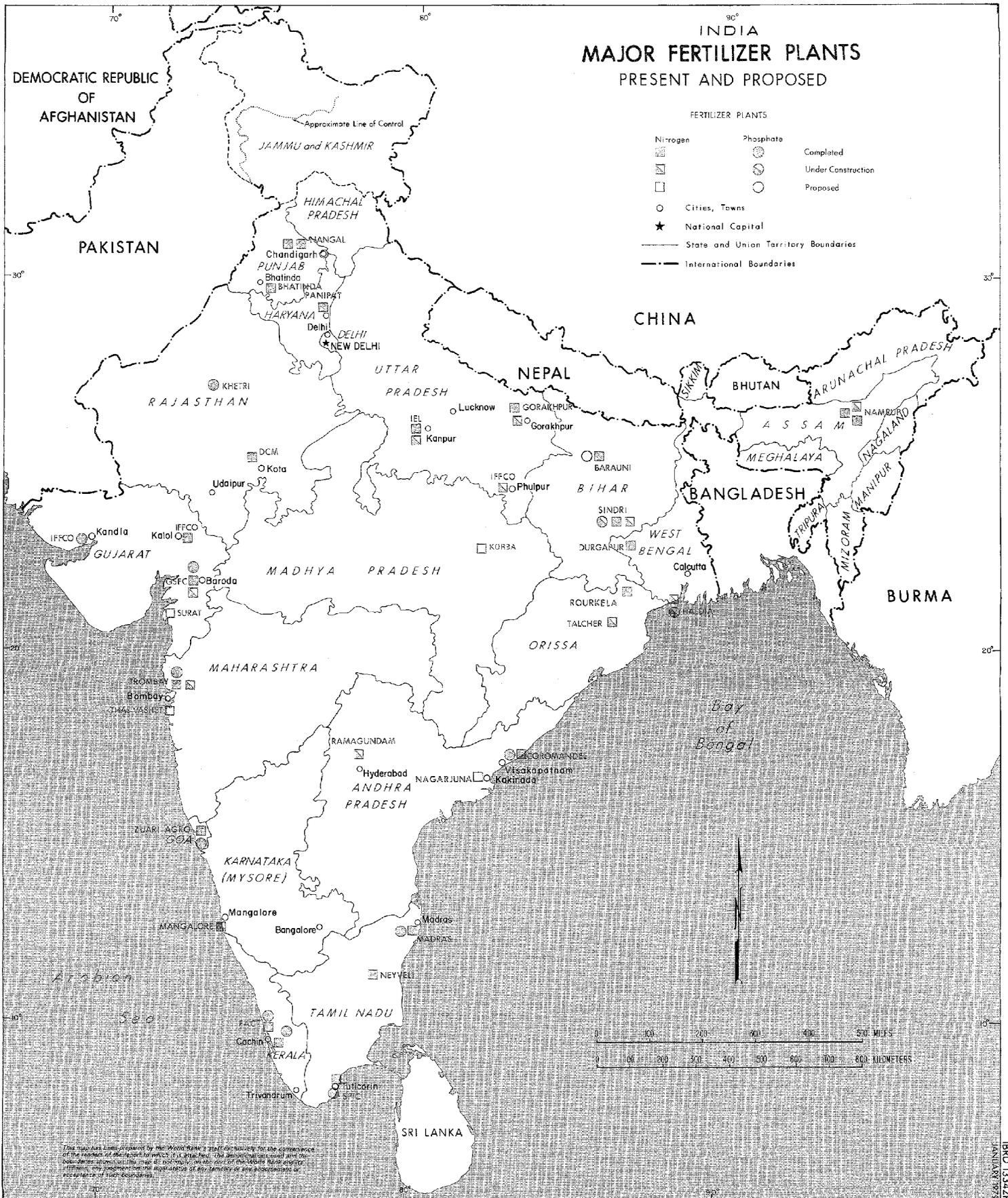
## INDIA - THAL FERTILIZER PROJECT

Cash Flow for the Economic Rate of Return  
(In millions of 1978/79 Dollars)

<u>Years Ending March 31</u>	<u>Fixed Asset Costs</u>	<u>Working Capital</u>	<u>Variable Costs</u>	<u>Fixed Costs</u>	<u>Revenues</u>	<u>Net Benefits</u>
1979/80	75.0	0.0	0.0	0.0	0.0	(75.0)
1980/81	100.0	0.0	0.0	0.0	0.0	(100.0)
1981/82	125.00	0.0	0.0	0.0	0.0	(125.0)
1982/83	150.0	0.0	0.0	0.0	0.0	(150.0)
1983/84	50.1	35.5	21.5	8.6	62.8	(34.9)
1984/85	0.0	16.4	69.5	20.7	222.0	90.7
1985/86	0.0	-	87.8	20.7	279.9	167.5
1986/87	0.0	-	91.7	20.7	292.6	176.3
1987/88	0.0	-	91.7	20.7	292.6	176.3
1988/89	0.0	-	91.7	20.7	292.6	176.3
1989/90	0.0	-	91.7	20.7	292.6	176.3
1990/91	0.0	-	91.7	20.7	292.6	176.3
1991/92	0.0	-	91.7	20.7	292.6	176.3
1992/93	0.0	-	91.7	20.7	292.6	176.3
1993/94	0.0	-	91.7	20.7	292.6	176.3
1994/95 <sup>1/</sup>	(50.0)	(51.9)	91.7	20.7	292.6	276.8

<sup>1/</sup> Assumes a rescue value of 10% of the initial total capital cost plus the 1995 working capital deflated to 1978/79 rupees.

Industrial Projects Department  
June 1979

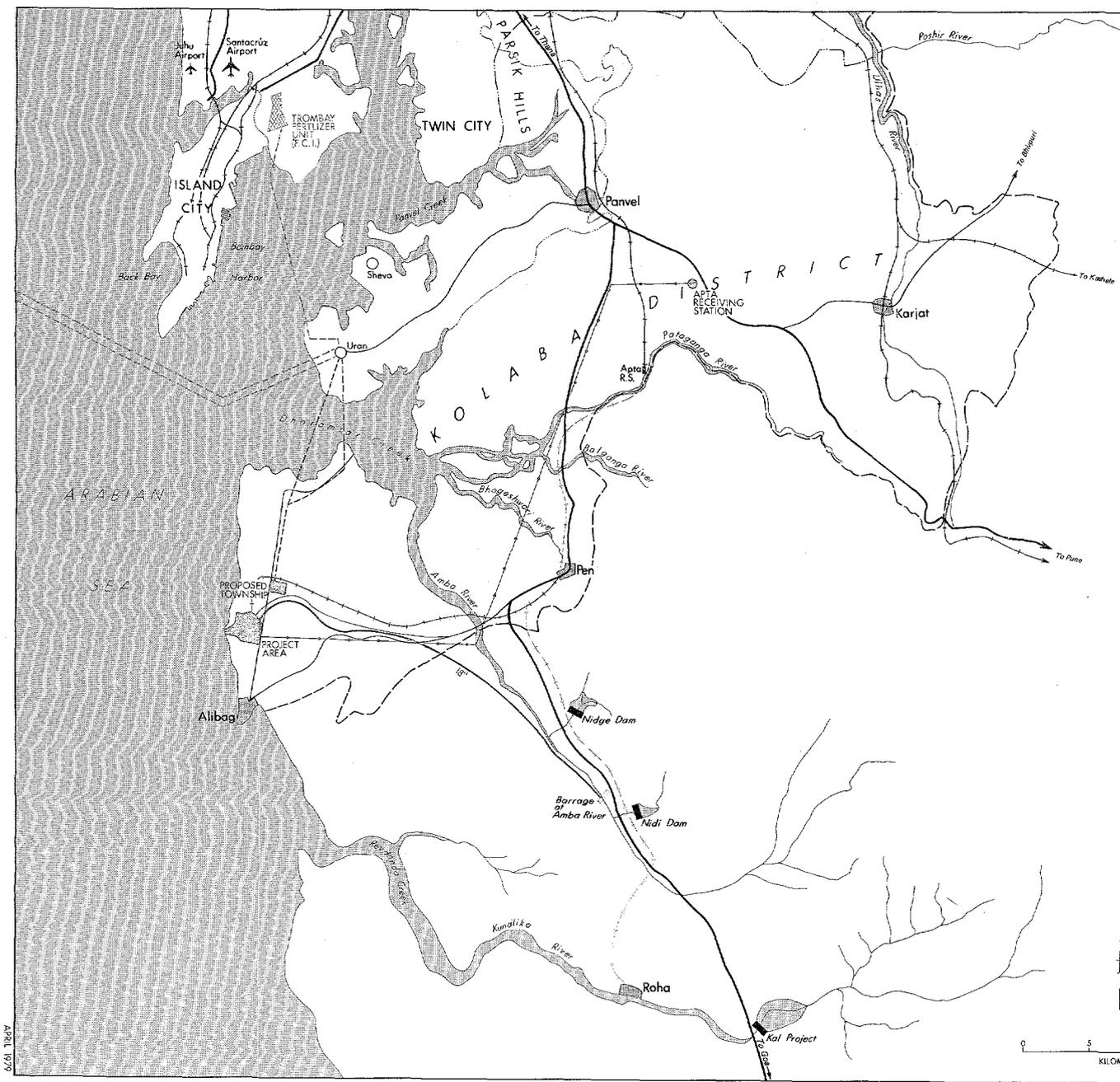
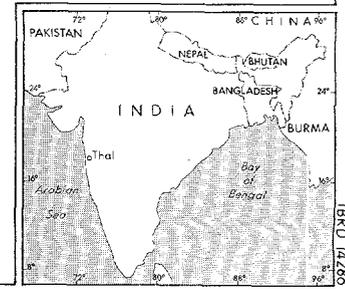


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## INDIA THAL PROJECT LOCATION AND INFRASTRUCTURE

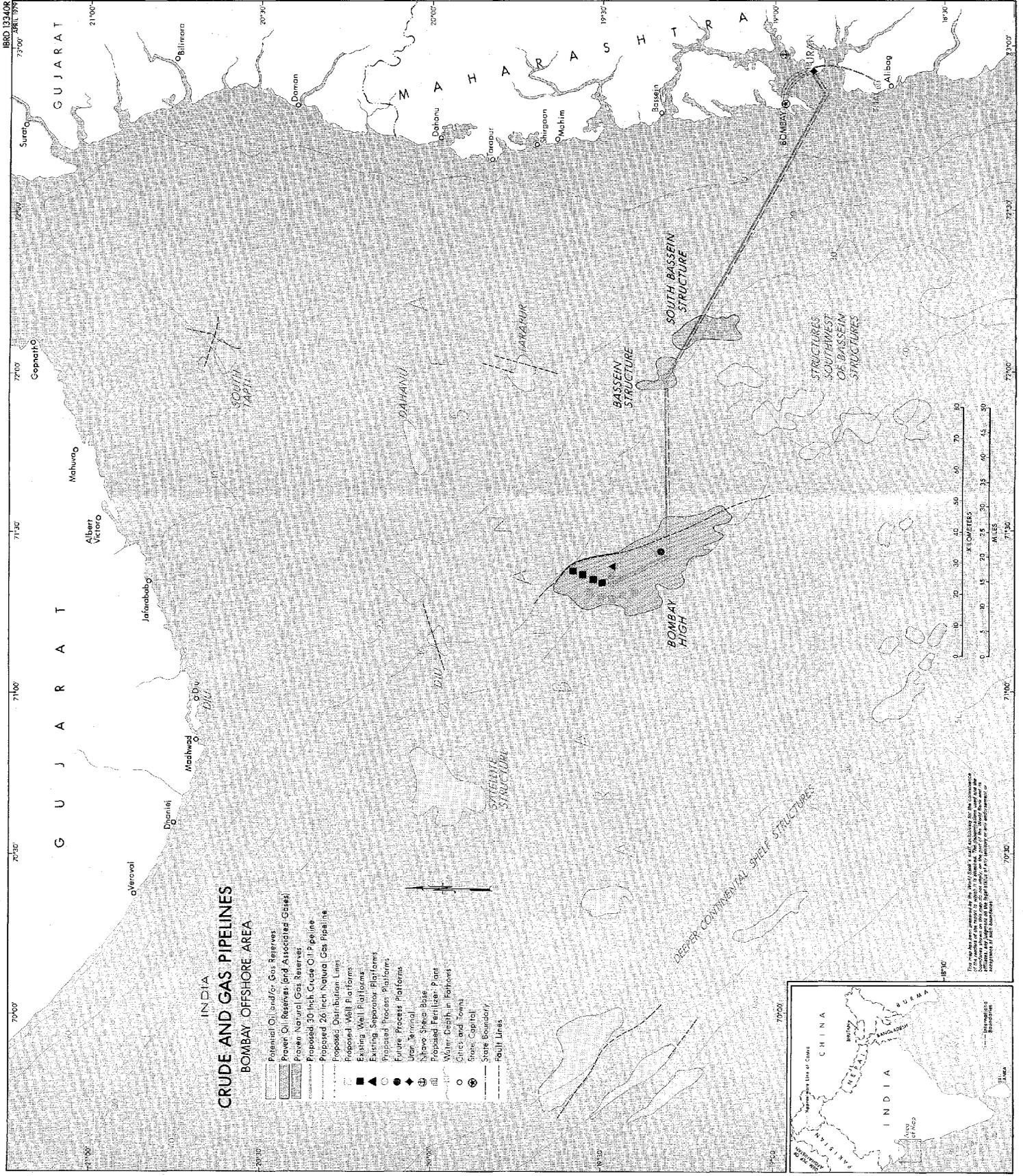
-  THAL Project Area
-  Proposed Natural Gas Pipelines - Alternate Routes
-  Proposed Railroad
-  Proposed Water Pipeline
-  Proposed Road
-  Proposed Power Line
-  Crude Oil Pipelines
-  Natural Gas Pipelines
-  Proposed Railroad (Non Bank Project)
-  Barrage (Part of Thal Project; Non Bank Funded)

-  Villages
-  Towns
-  Bombay - Island City Boundary
-  Twin City Boundary
-  Greater Bombay Municipal Boundary and District Boundary
-  Bombay Metropolitan Region Boundary
-  National Highways
-  State Highways
-  Railroads
-  Dams
-  Rivers
-  Fort Area



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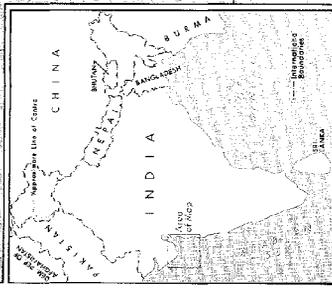
IBRD 14286



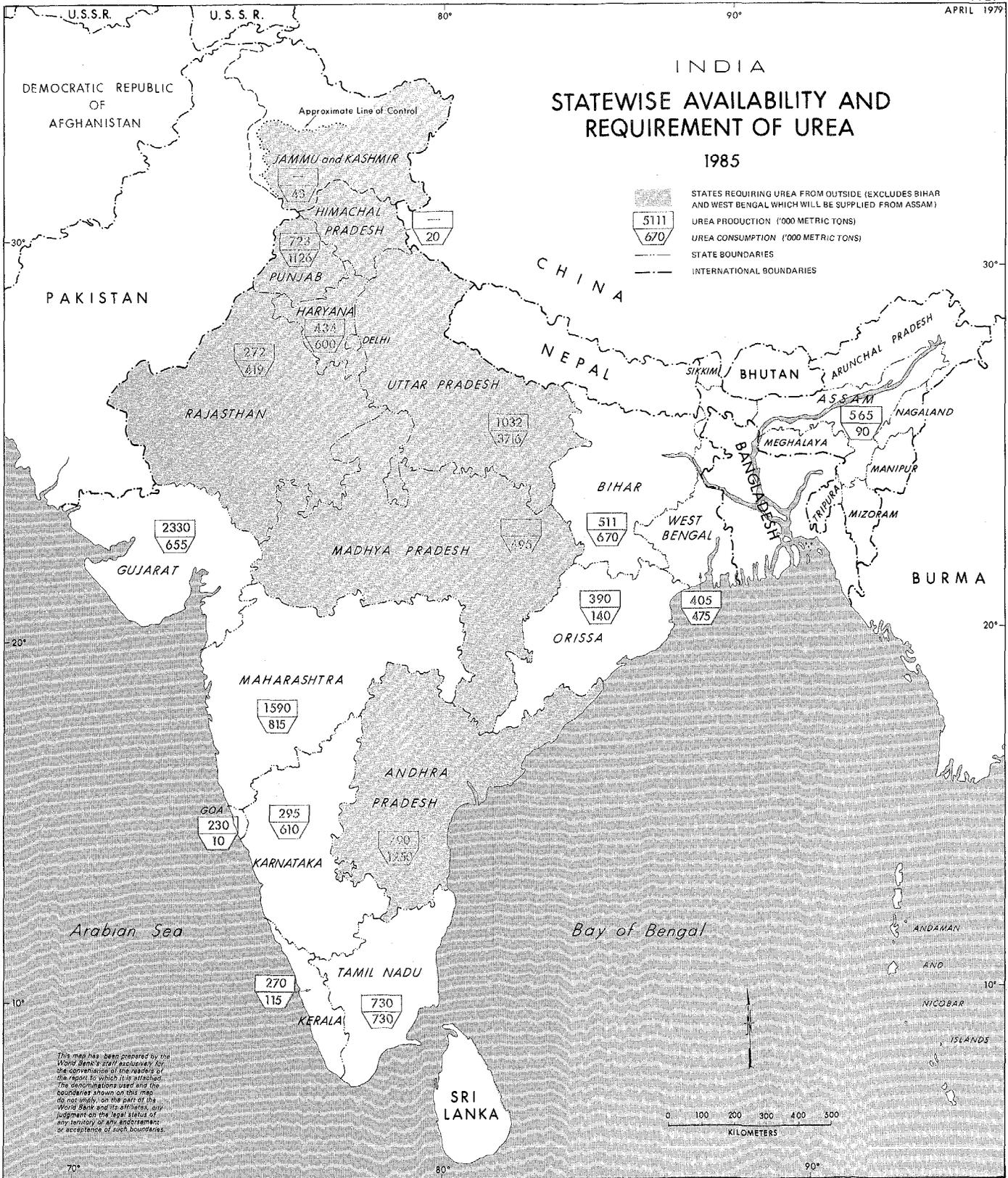
IBRD 1324OR  
APRIL 1974

**INDIA**  
**CRUDE AND GAS PIPELINES**  
**BOMBAY OFFSHORE AREA**

- Potential Oil and/or Gas Reserves
- Proven Oil Reserves (and Associated Gas)
- Proven Natural Gas Reserves
- Proposed 30-inch Crude Oil Pipeline
- Proposed 26-inch Natural Gas Pipeline
- Proposed Distribution Lines
- Proposed Well Platforms
- Existing Well Platforms
- Proposed Separator Platforms
- Existing Separator Platforms
- Future Process Platforms
- Urea Terminal
- Nitro Sludge Base
- Proposed Fertilizer Plant
- Water Desalination Plants
- Cities and Towns
- State Capitals
- State Boundaries
- Fault Lines

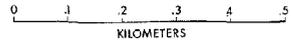


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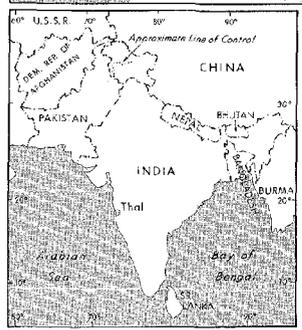
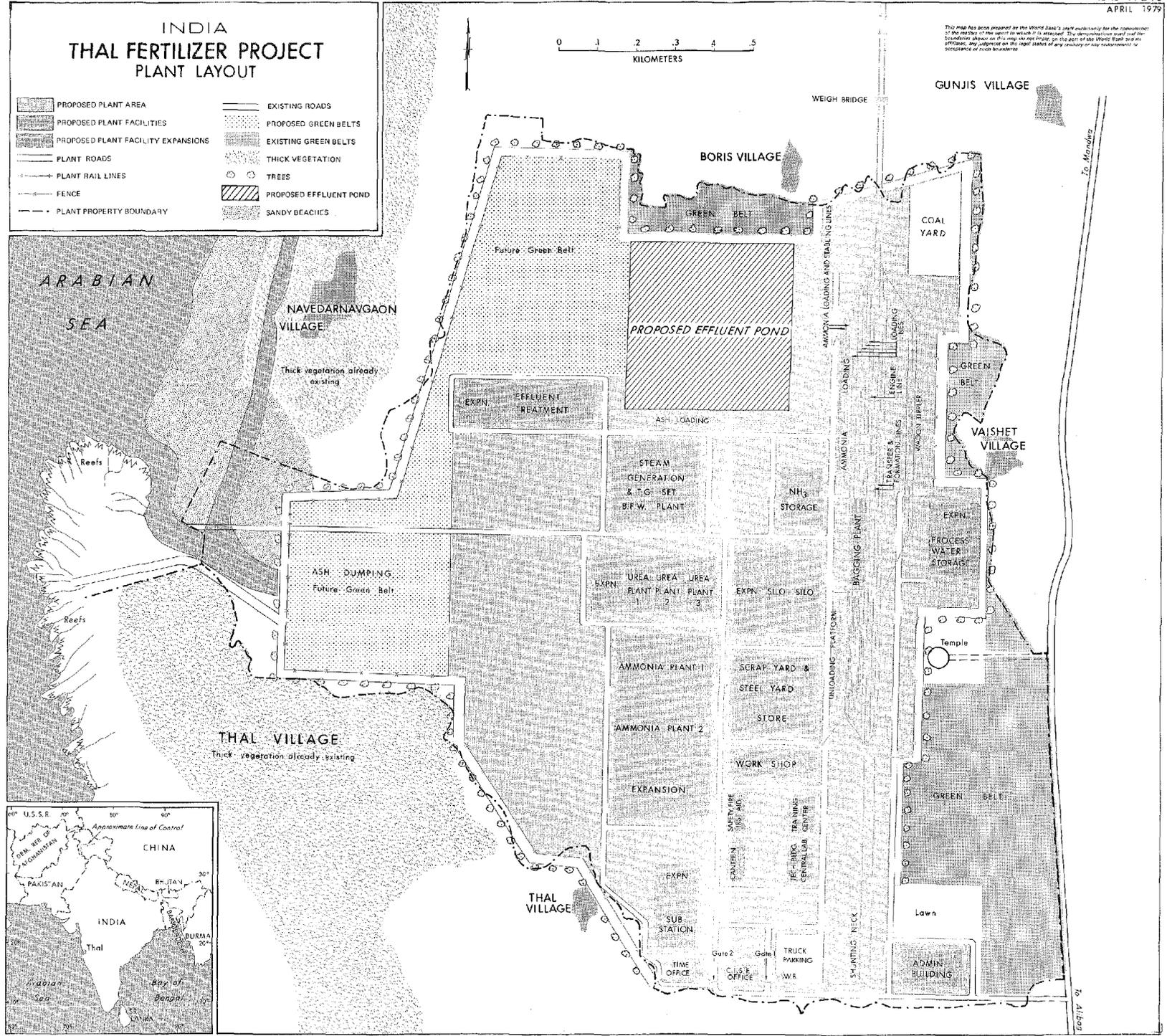


# INDIA THAL FERTILIZER PROJECT PLANT LAYOUT

- |  |                                    |  |                        |
|--|------------------------------------|--|------------------------|
|  | PROPOSED PLANT AREA                |  | EXISTING ROADS         |
|  | PROPOSED PLANT FACILITIES          |  | PROPOSED GREEN BELTS   |
|  | PROPOSED PLANT FACILITY EXPANSIONS |  | EXISTING GREEN BELTS   |
|  | PLANT ROADS                        |  | THICK VEGETATION       |
|  | PLANT RAIL LINES                   |  | TREES                  |
|  | FENCE                              |  | PROPOSED EFFLUENT POND |
|  | PLANT PROPERTY BOUNDARY            |  | SANDY BEACHES          |



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To Madhav  
To Alibet