Given A.I. D.'s strong interest in Korean agriculture, we believe this interest should be the controlling factor in consideration of development loan assistance for the ammonia-urea project. It is frankly recognized that under present circumstances, the Chungju Fertilizer Corporation activity is likely to remain entirely government-owned, at least in the foreseeable future. However, in view of the strong ROK interest in private enterprise and actions now being taken to spin off some government interests in what heretofore have been completely government-owned enterprises, it is possible that ultimately Chungju will either be sold by the ROK or, at least, private interests will be allowed to invest in it.

10.2 The extent and timing of future industrial demand for ammonia which can be reasonably expected to develop in Korea is difficult to predict with certainty at this time. The projections of the feasibility study, upon which we have largely relied, indicate that 33% of ammonia production will be devoted to industrial uses, largely for the planned petrochemical complex. Should the major petrochemical users--the caprolactum and acrylonitrile plants, which at design capacity will require 160 MT and 55 MT of ammonia per day, respectively--not materialize as now planned, for any reason, additional ammonia would be available for agricultural use. We have concluded that, though industrial demand is somewhat uncertain, agricultural demand is sufficient to support the feasibility of the project. At worst, additional urea capacity would have to be provided at an estimated additional cost of $2-3,000,000, and some ammonia over-capacity might exist at the outset of operations. Any such initial slack would soon disappear given the growing demand for nitrogen fertilizer.

AID-DLC/P-827

ANNEX A

CERTIFICATION PURSUANT TO SECTION 611 (e) OF

THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Henry J. Costanzo, the principal officer of the Agency for International Development in Korea, having taken into account, among other things, the maintenance and utilization of projects in Korea previously financed or assisted by the United States, do hereby certify that in my judgment Korea has both the financial capability and the human resources capability to effectively utilize the capital assistance to be provided by the Chungju Ammonia/Urea Plant Loan.

Henry J. Costanzo

Henry J. Costanzo

May 13, 1969

Date

AID-DLC/P-827
Annex B

STATUTORY CRITERIA CHECKLIST FOR DEVELOPMENT May 29, 1969

ASSISTANCE: Development Loan Fund

The following abbreviations are used in the checklist:

FAA - Foreign Assistance Act of 1961, as amended, incorporating amendments effected by the Foreign Assistance Act of 1967.

App. - Foreign Assistance and Related Agencies Appropriations Act, 1968.

COUNTRY PERFORMANCE

A. Progress Towards Country Goals

1. FAA §§201(b)(5), 201(b)(7), 201(b)(8), 208. Discuss the extent to which the country is:

(a) Making appropriate efforts to increase food production and improve means for food storage and distribution;

(a) The average annual growth rate in Korean agriculture was 6.6% between 1960 and 1966. During 1966, it was 11%. This remarkable performance was due to increases in average yields mainly as a result of increased fertilizer application and to the development of new arable land. There has also been an appreciable expansion of food storage and distribution facilities over the past few years.

(b) Creating a favorable climate for foreign and domestic private enterprise and investment;

(b) Korea has taken a number of effective steps to create a favorable investment climate. A liberal foreign investment law was enacted; the U.S. investment team led by former Under Secretary George Ball was enthusiastically received. An investment center was established. Domestic investment has been assisted by a number of A.I.D. loans such as the loan to the Korea Reconstruction Bank.

(c) Increasing the people's role in the developmental process;

(c) Koreans are a basically homogeneous people whose society is relatively free and politically stable. Korea does not possess deep sectional, religious or social cleavages. Korea's rapid economic development benefits increasingly larger segments of the population.

(d) Allocating expenditures to development rather than to unnecessary military purposes or intervention in other free countries' affairs;	(d) Korea has wisely allocated its resources in such a way as to maximize its economic development while maintaining sufficient military forces to insure a relative freedom from threatened external aggression. Korea is not intervening in other free and independent nations' affairs.
(e) Willing to contribute funds to the project or program;	(e) The Korean Government will be contributing significantly toward total project costs. See Section 6.9.
(f) Making economic, social and political reforms such as tax collection improvements and changes in land tenure arrangement; and making progress toward respect for the rule of law, freedom of expression and of the press, and recognizing the importance of individual freedom, initiative, and private enterprise;	(f) Korean land reform programs have eliminated the large land-holding class and have created a large number of independent farmers who own their own small farms. The ROKG has assisted in the establishment of a number of farm and fishery cooperatives which have been of significant assistance to the independent farm and fishery communities. Our Mission has also assisted the ROKG in its efforts to reform the equity of tax rates and collection procedures. These reforms have greatly increased both the amount of taxes collected and the equity with which the program is administered. The promotion of democratic institutions in Korea is covered in detail in TOAID A-994, 3/6/67 and TOAID A-1220, 2/26/68.
(g) Responding to the vital economic, political and social concerns of its people, and demonstrating a clear determination to take effective self-help measures.	(g) The ROKG has made significant progress in its efforts to provide a better life for the average Korean citizen. The Government has encouraged the rapid expansion of small and medium industry, stimulated the development of farmer credit unions and fishing cooperatives and has helped in many other ways to better the lot of its people. (See TOAID A-994 and TOAID A-1220.)

B. Relations with the United States

1. FAA §620(c). Is the government indebted to any U.S. citizen for goods or services furnished or ordered where such citizen has exhausted available legal remedies, including arbitration, or the debt is not denied or contested by the government, or the indebtedness arises under such government's or a predecessor's unconditional guarantee?	1. No situation of this kind is known to exist.
2. FAA §620(d). If the loan is intended for construction or operation of any productive enterprise that will compete with U.S. enterprise, has the country agreed that it will establish appropriate procedures to prevent export to the U.S. of more than 20% of its enterprises's annual production during the life of the loan?	2. The loan is not intended for such purposes.
3. FAA §620(e)(1). Has the government, or any government agency or subdivision within the country, (A) nationalized or expropriated property owned by U.S. citizens or by any business entity not less than 50% beneficially owned by U.S. citizens, (B) taken steps to repudiate or nullify existing contracts or agreements with such citizen or entity, or (C) imposed or enforced discriminatory taxes or other exactions, or restrictive maintenance or operational conditions? If so, has it failed within a reasonable time to take appropriate steps to discharge its obligations under international law toward such citizen or entity?	3. No situations of the type indicated in this section of the statute are known to exist with respect to Korea.
4. FAA §620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action of U.S. property, and failed to take appropriate measures to prevent a recurrence and to provide adequate compensation for such damage or destruction?	4. No such situation has been known to exist in Korea

5. FAA §620(l). Has the government instituted an investment guaranty program under FAA §221(b)(l) for the specific risks of inconvertibility and expropriation or confiscation?

5. Korea has such an investment guaranty program.

6. FAA §620(o). Has the country seized, or imposed any penalty or sanction against, any U.S. fishing vessel on account of its fishing activities in international waters?

6. No situation of this type known to have occurred.

7. FAA §620(q). Has the country been in default, during a period in excess of 6 months, in payment to the U.S. on any FAA loan?

7. No.

8. FAA §620(t). Have diplomatic relations between the country and the U.S. been severed? If so, have they been renewed?

8. No.

9. App. §106. Describe any attempt made by the country to create distinction because of race or religion in granting personal or commercial access or other rights otherwise available to U.S. citizens generally.

9. Korea has made no known attempts to create such distinctions.

C. Relations with other nations and the U.N.

1. FAA §620(i). Has the country been officially represented at any international conference when that representation included planning activities involving insurrection or subversion directed against the U.S. or countries receiving U.S. assistance?

1. Korea is not known to have been so represented.

2. FAA §§620(a), 620(n); App. §§197(a), 107(b), 116. Has the country sold, furnished, or permitted ships or aircraft under its registry to carry to Cuba or North Vietnam, items of economic, military or other assistance?

2. No such situation known to have occurred.

3. FAA §620(u), App. §114. What is the status of the country's U.N. dues, assessments or other obligations? Does the loan agreement bar any use of funds to pay U.N. assessments, dues or arrearages?

3. The Republic of Korea is not a member of the United Nations. The loan agreement will stipulate that only eligible items of machinery and equipment can be procured with the proceeds of the loan.

D. Military Situation

1. FAA §620(i). Has the country engaged in or prepared for aggressive military efforts directed against the U.S. or countries receiving U.S. assistance?

1. No.

2. FAA §620(s). What is (1) the percentage of the country's budget devoted to military purposes and (2) the amount of the country's foreign exchange resources used to acquire military equipment? Is the country diverting U.S. development assistance or P.L. 480 sales to military expenditures? Is the country diverting its own resources to unnecessary military expenditures? (Findings on these questions shall be made for each country at least once each fiscal year and as often in addition as may be required by a material change in relevant circumstances.)

2. (1) Korean defense budget expenditures as a percent of central government expenditures have declined from 31.9% in 1964 to an estimated 25.4% in 1968.

(2) Annual foreign exchange purchases of military items were less than $1 million over the period 1965 to 1967 and accounted for a negligible portion of the defense budget. Korean requirements for imports of military equipment have been provided under the Military Assistance Program.

State and A.I.D. have reviewed Korean actions under the Symington Amendment and have concluded that Korea is not diverting U.S. development assistance or P.L. 480 sales to military purposes. They also determined that Korea is not diverting its own resources to unnecessary military expenditures to a degree which materially interferes with its development. The Country Team concurs. The following points were among those taken into account in reaching this conclusion.

It is United States policy to assist South Korea in developing the capability to defend itself from Communist attack from

the north and to counter Communist attempts at internal subversion. We also support South Korean contributions to regional mutual security efforts in Southeast Asia. At present, South Korea has 48,000 troops participating in the allied war effort in South Vietnam. Substantial military expenditures are necessary to support these objectives, and we are contributing to the Korean defense budget to help them finance these costs.

Korean defense budget expenditures as a percent of central government expenditures have declined from 31.9% in 1964 to 25.4% in 1968. These expenditures as a percent of central government expenditures were 23.20% for the period 1967-1968, only slightly above the median for the region of 2.95%.

U.S. military budget support derived from P.L. 480 and Supporting Assistance proceeds has been decreasing, and at the same time the Koreans have been increasing their own military expenditures. The self-financed portion of the Korean defense budget has increased from 38.1% in 1965 to 61.4% in 1968. However, these expenditures have remained relatively stable as a percent of total central government expenditures: 11.7% in 1965 as compared to 15.6% in 1968. Korean self-financed defense expenditures as a percent of GNP have risen from 1.4% in 1967 to 3.1% in 1968.

Over the same period of 1965-1967 Korea has made spectacular economic progress. Annual growth in real GNP has averaged about 10%, and reached 13% in 1968.

3. F.A.A. Sec. 620(v); App. §119. Has the country purchased "sophisticated weapons systems," disbursements for which are required during the current A.I.D. fiscal year? If so, identify either (a) the documentation which describes how the withholding of an equivalent amount of A.I.D. assistance has been or will be accomplished, or (b) the requisite Presidential Determination.

3. Korea has made no such purchases, as far as we know, and no such purchases are anticipated during the current fiscal year.

If so, has the withholding of an equivalent amount of A.I.D. assistance been adequately provided for? (Not applicable to Greece, Turkey, Iran, Israel, Republic of China, the Philippines and Korea.)

CONDITION OF THE LOAN

A. General Soundness

Interest and Repayment

1. FAA §§201(d), 201(b)(2). Is the rate of interest excessive or unreasonable for the borrower? What capacity does the borrower have to repay the loan at a reasonable rate of interest? Is the rate of interest less than 2% per annum during the grace period? Less than 2½% per annum following the grace period? Is the rate of interest higher than the country's applicable legal rate of interest?

1. The proposed loan contains a rate of interest which is concessionary. The borrower has the capacity to repay the loan at the rates of interest to be required. The rates in the proposed loan are 2% per annum during the grace period and 3% per annum thereafter for the remaining thirty years of the repayment period. The interest rate is not higher than the country's applicable legal rate of interest.

Financing

1. FAA §201(b)(1). To what extent can financing on reasonable terms be obtained from other free-world sources, including private sources within the U.S.?

1. Export-Import Bank and the IBRD expressed no interest in this project. A majority of total project costs are being financed by free-world sources (other than the United States). The basis for such financing and for U.S. Government participation in financing this project is explained in Section 6.9.

Economic and Technical Soundness

1. FAA §§201(b)(2). 201(e). Describe the activity's economic and technical soundness; did the application, together with information and assurances, indicate that funds will be used in an economically and technically sound manner?

1. The project's economic and technical soundness are described in Section 3.4 and Section 4, respectively. It is believed from all available documentation that the funds will be used in an economically and technically sound matter.

2. FAA §611(a)(1). If substantive technical or financial planning is required, have engineering, financial, and other plans necessary to carry out assistance, and a reasonably firm estimate of the cost of assistance to the U.S., been completed?

2. These plans have been completed and the cost to the U.S. of furnishing this assistance are considered reasonably firm. See the Van der Valk feasibility study (referenced) and Sections 6 and 7 of the loan paper.

3. FAA §611(b);App. §101. Have plans for a water or related land resource construction project or program included a cost-benefit computation; has the project or program met the relevant U.S. construction standards and criteria used in determining feasibility?

3. Not such a project.

4. FAA §611(e). If this is a capital assistance project with U.S. financing in excess of $1 million, has the principal A.I.D. officer in the country certified as to the country's capability effectively to maintain and utilize the project?

4. The A.I.D. Mission Director for Korea has so certified. See Annex A.

B. Relation to Achievement of Country and Regional Goals

Country Goals.

1. FAA §§207, 281(a). Describe this loan's relation to:

1. The project will have as one goal increasing the use of fertilizer, which the Mission believes will benefit the agricultural sector. Other than this relationship to item (b), no direct relationship to these other ideals is anticipated.

(a) institutions needed for a democratic society and to assure maximum participation on the part of the people in the task of economic development;

(b) enabling the country to meet its food needs both from its own resources and through development, with U.S. help, of infra-structure to support increased agricultural productivity;

(c) meeting increasing need for trained manpower;

(d) developing programs to meet public health needs;

(e) assisting other important economic, political and social development activities, including industrial development; growth of free labor unions, cooperatives and voluntary agencies; improvement of transportation and communication systems; capabilities for planning and public administration;

urban development; and modernization of existing laws.

2. FAA §201(b)(4). Describe the activity's consistency with and relationship to other development activities, and its contribution to realizable long-range objectives.

2. See Section 3.1(a),(b) and (c).

3. FAA §201(b)(9). How will the activity to be financed contribute to the achievement of self-sustaining growth?

3. The project aims at supplying the nitrogen which would otherwise have to be imported into Korea for agricultural and industrial needs during the early 1970's.

4. FAA §201(f). If this is a project loan, describe how such project will promote the country's economic development, taking into account the country's human and material resource requirements and the relationship between ultimate objectives of the project and overall economic development.

4. See the discussion in Section 3.1(a),(b) and (c).

5. FAA §201(b)(3). In what ways does the activity give reasonable promise of contributing to development of economic resources, or to increase of productive capacities?

5. These considerations are discussed thoroughly in Sections 3 and 4.

6. FAA §281(b). How does the program under which assistance is provided recognize the particular needs, desires, and capacities of the country's people; utilize the country's intellectual resources to encourage institutional development; and support civic education and training in skills required for effective participation in political processes.

6. One purpose of the project is to benefit agriculture, a traditionally industry in Korea. The AID program in Korea, generally, has worked toward the ideals indicated by, for example assisting Korean self-help efforts in such areas as public safety, family planning and repatriating Korean scientists from abroad (KIST project).

7. FAA §601(a). How will this loan encourage the country's efforts to:

(a) increase the flow of international trade;

(a) The project has as a goal not the increasing of Korean exports, but rather the supplying from Korean sources of items which would otherwise have to be imported.

(b) foster private initiative and competition;

(b) since Chungju is a wholly ROK-owned corporation, no direct connection to this ideal;

(c) encourage development and use of cooperatives, credit unions, and savings and loan associations;

(c) an agricultural cooperative, although a quasi-governmental organization, will be involved in fertilizer distribution under this loan;

(d) discourage monopolistic practices;

(d) no impact anticipated.

(e) improve technical efficiency of industry, agriculture, and commerce; and

(e) no impact anticipated.

(f) strengthen free labor unions.

(f) No impact anticipated.

8. FAA §202(a). Indicate the amount of money under the loan which is: going directly to private enterprise; going to intermediate credit institutions or other borrowers for use by private enterprise; being used to finance imports from private sources; or otherwise being used to finance procurements from private sources.

8. The loan is being made directly to the ROK for relending to Chungju, a wholly-owned ROK corporation. All AID loan funds will be used to finance procurement from private sources.

9. FAA §611(a)(2). What legislative action is required within the recipient country? What is the basis for a reasonable anticipation that such action will be completed in time to permit orderly accomplishment of purposes of loan?

9. No new legislation is required.

Regional Goals

1. FAA §619. If this loan is assisting a newly independent country, to what extent do the circumstances permit such assistance to be furnished through multilateral organizations or plans?

1. Korea is not a newly independent nation.

2. FAA §209. If this loan is directed at a problem or an opportunity that is regional in nature, how does assistance under this loan encourage a regional development program? What multilateral assistance is presently being furnished to the country?

2. This loan is not directed at a regional problem.

Korea is a member of the Asian Development Bank (ADB) and is receiving assistance from the World Bank group. Both of these

organizations are expected to become increasingly active in Korea. Moreover, Korea is cooperating with the Republic of China in the establishment of industries which will serve both countries, especially in the petrochemical field.

C. Relation to U.S. Economy

Employment, Balance or Payments, Private Enterprise

1. FAA §§201(b)(6); 102, Fifth. What are the possible effects of this loan on U.S. economy, with special reference to areas of substantial labor surplus; describe the extent to which assistance is constituted of U.S. commodities and services, furnished in a manner consistent with improving the U.S. balance of payments position.

1. Section 9 discusses in detail the expected effect of this loan on the U.S. economy. All AID loan proceeds will be used for the purchase of U.S. source and origin items.

2. FAA §§612(b), 636(h). What steps have been taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. and local currencies contributed by the country are utilized to meet the cost of contractual and other services, and that U.S. foreign owned currencies are utilized in lieu of dollars?

2. The loan proceeds will be used exclusively for foreign exchange costs. U.S. - owned won or ROKG - contributed won - could not be used for this purpose.

3. FAA §601(d); App. §115. If this loan is for a capital project, to what extent has the Agency encouraged utilization of engineering and professional services of U.S. firms and their affiliates? If the loan is to be used to finance direct costs for construction, will any of the contractors be persons other than qualified nationals of the country or qualified citizens of the U.S.? If so, has the required waiver been obtained?

3. A U.S. engineering/construction firm will be retained by Chungju (using other than AID funds) to implement this project. No problem is anticipated with respect to citizenship of that contractor's personnel, but AID policy will be followed if any such problems arise. The same policy will apply with respect to the independent U.S. engineering consulting firm to be retained by Chungju with A.I.D. loan proceeds.

4. FAA §608(a). Provide information on measures to be taken to utilize U.S. Government excess personal property in lieu of the procurement of new items.

4. The Loan Agreement will contain the standard section with respect to excess property.

5. FAA §602. What efforts have been made to assist U.S. small business to participate equitably in the furnishing of commodities and services financed by this loan?

5. American small businesses will have an adequate opportunity to supply the equipment to be procured with the loan proceeds. All procurement will be of U.S. origin. Small Business Notification procedures will be used.

6. FAA §621. If the loan provides technical assistance, how is private enterprise on a contract basis utilized? If the facilities of other Federal agencies will be utilized, in what ways are they particularly suitable; are they competitive with private enterprise (if so, explain); and how can they made available without undue interference with domestic programs?

6. The loan does not provide technical assistance, nor will the services of other Federal agencies be utilized.

7. FAA §611(c). If this loan involves a contract for construction that obligates in excess of $100,000 will it be on a competitive basis to the maximum extent practicable?

7. Such a contract is being financed independently of the AID loan. Therefore it is not considered feasible to insist on competitive procedures in the selection of this contractor.

Procurement

1. FAA §602(a). Will commodity procurement be restricted to U.S. except as otherwise determined by the President?

1. Yes.

2. FAA §604(b). Will any part of this loan be used for bulk commodity procurement at adjusted prices higher than the market price prevailing in the U.S. at time of purchase?

2. No.

3. FAA §604(e). Will any part of this loan be used for procurement of any agricultural commodity or product thereof outside the U.S. when the domestic price of such commodity is less than parity?

3. No.

D. Specific Requirements

1. FAA §201(b). Is the country among the 20 countries in which development loan funds may be used to make loans in this fiscal year?	1. Yes.
2. App. §112. Does the loan agreement provide, with respect to capital projects, for U.S. approval of contract terms and firms?	2. The Loan Agreement will so provide.
3. FAA §620(k). If the loan is for construction of a productive enterprise, with respect to which the aggregate value of assistance to be furnished will exceed $100 million, what preparation has been made to obtain the express approval of Congress?	3. This is not such a loan.
4. FAA §§620(b), 620(f); App. §109(b). Has the President determined that the country is not dominated or controlled by the international Communist movement? If the country is a communist country (including, but not limited to, the countries listed in §620(f)) and the loan is intended for economic assistance, have the findings required by FAA §620(f) and App. §109(b) been made and reported to Congress?	4. Such a determination has been made. The Republic of Korea is not a Communist country.
5. App. §109(a). Will any military assistance, or items of military or strategic significance be furnished to a Communist nation?	5. No.
6. FAA §620(h). What steps have been taken to insure that the loan will not be used in a manner which, contrary to the best interest of the United States, promotes or assists the foreign aid projects of the Communist-bloc countries?	6. The proposed loan will be used for eligible items of equipment of U.S. source and origin and will be utilized only within Korea.

7. App. §118. Will any funds be used to finance procurement of iron and steel products for use in Vietnam other than as contemplated by §118?

7. No.

8. FAA §636(i). Will any part of this loan be used in financing non-U.S. manufactured automobile? If so, has the required waiver been obtained?

8. No.

9. FAA §§620(a)(1) and (2), 620(p); App. §117. Will any assistance be furnished or funds made available to the government of Cuba or the United Arab Republic?

9. No.

10. FAA §620(g). Will any part of this loan be used to compensate owners for expropriated or nationalized property? If any assistance has been used for such purpose in the past, has appropriate reimbursement been made to the U.S. for sums diverted?

10. No part of the loan will be so used. No past assistance is known to have been used for such purpose.

11. FAA §201(f). If this is a project loan, what provision has been made for appropriate participation by the recipient country's private enterprise?

11. It is not believed feasible to require direct participation by private enterprise in this project.

12. App. §104. Does the loan agreement bar any use of funds to pay pensions, etc., for persons who are serving or who have served in the recipient country's armed forces?

12. The Loan Agreement will so provide.

Annex C-1: Consumption of Fertilizer Nutrients (MT)

	Total	Nitrogen (N)	Phosphorus (P_2O_5)	Potash (K_2O)
1960	136,827	87,653	42,784	6,390
1961	303,494	210,667	80,788	16,839
1962	59,855	19,856	39,959	-
1963	307,095	191,729	94,371	20,995
1964	364,145	173,152	153,571	37,422
1965	393,098	217,925	123,439	51,684
1966	423,271	239,693	124,796	58,782
1967	466,491	277,556	132,722	76,213
1968	477,317	285,729	120,572	71,016
Average annual growth rates 1963-4 to 1966-7	10.6%	12.3%	1.3%	32.2

1/ Before 1961, figures are for fertilizer year, Aug. 1 to next July
1962 Aug. 1 to Dec. 31
After 1963 Jan. 1 to Dec. 31

Source: Ministry of Agriculture.

Annex C-2. Index Numbers of Prices Received and Prices Paid by Farmers 1/ (1965=100)

	Average Price Received for Grains	Average Prices Paid for: All Farm Supplies	Fertilizers All	Fertilizers Urea	Price of All Fertilizers Relative to Price of: Grains	All Farm Supplies	Price of Urea Relative to Price of: Grains	All Farm Supplies
1960	40.6	50.6	49.5	56.1	122	98	138	111
1961	50.7	57.1	50.3	55.4	99	88	109	97
1962	53.8	65.1	55.6	58.2	103	85	108	89
1963	86.5	64.7	57.0	57.1	66	88	66	88
1964	110.4	75.6	69.9	70.2	63	92	64	93
1965	100.0	100.0	100.0	100.0	100	100	100	100
1966	105.1	111.7	100.0	100.0	95	90	95	90
1967	117.8	124.8	87.2	85.0	74	70	72	68
1968	133.6	160.1	87.2	85.0	65	54	64	53
1969 (4/16)			2/	99.4			74 3/	62 3/

1/ Research Department, NACF, published in the ROK Monthly Statistical Review, March 1969, page 75.

2/ Although the prices of urea and ammonium sulfate were increased by 17%, the prices of complex fertilizers were reduced by 20%. So it is not expected that this index will rise as near to the 1966 level as in the case of urea.

3/ This is calculated relative to the 1968 prices of grains and all farm supplies.

Annex C-3: Ammonia, Bunker "C" and Naphtha Prices
($/MT)

	International Prices	Domestic Prices
Ammonia		
Van der Valk Study, pages 125, 187		
Import Price	65	
Price from this project		52
Import price used in this Economic Analysis 1/	60	
Bunker "C"		
CIF import price 1968 2/	15.76	
Contract negotiations between KOCO and Gulf and Union Oil companies (early 1969)	15.60	
Van der Valk Study, page 125,	22.60	
Price used in this CAP	15.50	
Naphtha		
Domestic Price		
Van der Valk Study, page 135		22.00
KOCO price (about 3/14/69) 4.43 Won/liter, sp. gr. = .688		23.40
Foreign Exchange Component		
Van der Valk Study, page 125 3/	$22.60	
Used in this CAP 4/	$17.50	

1/ We assume FOB price at Middle East Port would be about 40 $/MT. We assume ocean freight to Korea in a refrigerated tanker would be about 20 $/MT. The transportation price might be less for long-term contracts for larger tonnages. A 20,000 MT pressurized tanker for ammonia is assumed here. As a comparison, oil transportation from the Middle East to Korea in 50,000 MT or larger tankers is over $4/MT, and bulk solids freight in 20,000 MT vessels from U.S. West Coast is $6-7/MT.

2/ Monthly Foreign Trade Statistics 12/68, MOF. SITC 3324.300.

3/ Difference between Van der Valk Study and this CAP is in crude oil price used. Appears that Van der Valk used U.S. price, whereas Korea buys much cheaper from Middle East. The 1968 CIF import price (see footnote 2, SITC 3310.1) is $11.48, about equal to the Middle East FOB price. We believe that import statistics do not include insurance and freight because the oil is carried in Korean ships. Therefore we estimate $17.50 as CIF price.

4/ Foreign exchange component is $17.50/MT, same price as crude oil. Assumption is that crude oil at Middle East port can be spiked with naphtha at that price, and recovered at Korean refinery.

Annex C-4. Comparison of Various Urea Prices ($/MT)

	International Price	Domestic Price
A. Urea		
Prices paid by NACF to domestic producers		
July 1968		73-96
Weighted Average Price, 1968		84.06
including this project 1972		79.08
including this project 1975		77.05
Price from this Project to NACF		
1972 and after		65
Farmer Price to NACF		
Early 1967		101.40
June 20, 1968		84.63
April 16, 1969		96.52
Expected in 1972 with this project		65.00
Average CIF import prices into Korea		
1964	93.60	
1965	96.26	
1966	89.34	
1967	140.58	
1968	61.79	
F.O.B. U.S. Price to:		
Indonesia May 1968	72.23-75.50	
India June 1968	74.37-81.00	

Annex C-5: Supply and Demand for Ammonia (MT)

	1970	1971	1972	1973	1974	1975	1976	1977
I. Demand								
A. 1/ Ammonia produced for industrial and feed grade urea demand.	22,350	43,520	64,340	73,160	84,720	95,170	110,670	119,500
B. 2/ Farm Fertilizer demand.	448,350	484,265	523,025	567,835	610,225	659,120	711,995	769,102
II. Supply								
A. Alternative I								
1. Domestic Capacity								
a. Production	496,600	516,990	523,490	523,490	523,490	523,490	523,490	523,490
(1) All Plants except 1 and 6	436,600	450,000	456,500	456,500	456,500	456,500	456,500	456,500
(2) Plant 1	60,000	66,990	66,990	66,990	66,990	66,990	66,990	66,990
b. Distribution								
(1) Industrial Ammonia	22,350	32,725	465	3/				
(2) Available for Fertilizer	474,250	484,265	523,025	523,490	523,490	523,490	523,490	523,490
2. Imports								
a. Industrial Ammonia	10,	10,795	63,875	73,160	84,720	95,170	110,670	119,500
b. Fertilizer				44,345	86,735	135,630	188,505	245,612
(MT Urea) 5/				(76,457)	(149,543)	(233,845)	(325,008)	(423,469)

	1970	1971	1972	1973	1974	1975	1976	1977
B. Alternative II								
1. Domestic Capacity								
a. Production - Same as Alternative I.								
b. Distribution - Same as Alternative I.								
c. Two New Urea 4/ Plants for Fertilizer				44,345	66,735	130,152	130,152	130,152
2. Imports								
a. Amonia		10,795	63,875	117,525	171,455	225,322	240,822	249,652
(1) Industrial Ammonia - Same as Alternative I.								
(2) For New Urea Plants				44,345	66,735	130,152	130,152	130,152
b. Fertilizer						5,478	56,353	115,460
(MT Urea)						(9,445)	(100,609)	(199,069)
C. Alternative III								
1. Domestic Capacity								
a. Production	496,600	537,500	651,500	711,500	741,500	756,500	756,500	756,500
(1) All Plants except 1 & 6 - Same as Alternative I.								
(2) Plant 1	60,000	30,000						
(3) Plant 6		37,500	195,000	255,000	285,000	300,000	300,000	300,000

	1970	1971	1972	1973	1974	1975	1976	1977
b. Distribution								
(1) Industrial Ammonia	22,350	33,235	64,340	73,160	84,720	99,000 7/	99,000	99,000
(2) Available for Fertilizer	474,250	484,265	587,160	638,320	656,780	657,500 7/	657,500	657,500
2. Imports								
a. Industrial Ammonia		10,235 6/					11,670	20,500
b. Fertilizer						1,620	54,495	111,602
(MT Urea) 5/						(2,793)	(93,957)	(192,417)

1/ Van der Valk Study, page 68-69, sum of lines 6 & 7 from bottom of table I-19.
2/ ibid average of minimum and expected demand by farmer.
3/ After 1971, assume urea production has priority on ammonia use.
4/ op. cit. page 104. Ammonia is .58 of Urea Plant production.
5/ 1,724,137 MT Urea = 1 MT Ammonia.
6/ Imports for Carrolachum and ACH plants.
7/ Assume that only ammonia which cannot be converted to urea in to Plant 6, 99,000 MT/Y.

Annex C-6: Projection of Ammonia Demands to 1981 (MT)

	1977	1978	1979	1980	1981
A. Ammonia produced for industrial and 1/ feed grade urea demand	119,500	123,370	138,680	150,639	164,513
General 2/	55,000	63,800	74,000	85,849	99,585
Petrochemicals 3/ and Melamin	55,675	55,675	55,675	55,675	55,675
Feed Grade Urea 4/	7,700	7,700	7,700	7,700	7,700
B. Farm Fertilizer Demand 5/	769,102	830,809	897,485	969,533	1,047,387
Minimum 6/	733,525	788,534	847,679	911,255	979,599
Expected 7/	804,680	873,078	947,290	1,027,810	1,115,174

1/ The sum of General, Petrochemicals and Feed Grade Urea increased by 1%.
2/ Annual growth rate of 16% from 1977 figure shown in van der Valk report, page 68-69.
3/ Demand shown from ACH, Caprolactam, and Melamine plants in ibid.
4/ Assumed constant from 1977 figure shown in ibid.
5/ Average of Minimum and Expected.
6/ Annual growth rate of 7.5% from 1977 figure shown in ibid.
7/ Annual growth rate of 8.5% from 1977 figure shown in ibid.

Annex C-7. Operation Levels for Each Alternative
(1,000 MT/YR)

	1970	1971	1972	1973	1974	1975	1976	1977
Alternative I								
All plants except #1 and #6		– Capacity at all times –						
Plant #1								
Ammonia	60	66.99	66.99	66.99	66.99	66.99	66.99	66.99
Urea	103	103	115.5	115.5	115.5	115.5	115.5	115.5
Alternative II								
All Plants except #1 and #6		– same as alternative I –						
Plant #1								
Ammonia		– same as alternative I –						
Urea		– same as Alternative I –						
New Urea Plant – Chungju				76.457	82.5	82.5	82.5	82.5
New Urea Plant – Ulsan					67.043	141.9	141.9	141.9
Alternative III								
All plants except #1 and #6		– same as alternative I –						
Plant #1								
Ammonia	60	30						
Urea	103	80	84	106	115.5	115.5	115.5	115.5
Plant #6								
Ammonia		37.5	195	255	285	300	300	300
Urea			160	211	231	231	231	231

1/ op. cit. page 147.

Annex C-6: Foreign Exchange and Local Operating Cash Costs of Ammonia and Urea Plants ($/MT)

	New Ammonia Plant 907 MT/D	Existing Ammonia Plant 200 MT/D	Two New Urea Plants 250,450 MT/D	New Urea Plant 700 MT/D	Existing Urea Plant 350 MT/D
I. Local Costs at 275 Won/$					
FX	18.68	39.98	38.33	3.53	6.06
Naphtha 1/	16.80	-	-	-	-
Bunker "C" 2/ Process	-	13.46	-	-	-
- Steam & Power	.06	22.70	1.55	1.55	3.90
Cooling Water	.56	-	-	-	-
Chemicals & Catalysts	.89	1.91	-	-	-
Maintenance Materials 6/	1.00	1.94	.52	.52	.72
Pulp for Bags 3/	-	-	1.46	1.46	1.46
Ammonia 4/	-	-	34.80 7/	-	-
Local	11.04	22.92	10.78	45.01	49.06
Labor	.24		.21	.31	.77
Water	.49		.26	.26	.58
Ammonia	-		-	34.80 7/	34.80 7/
Other Supplies	.36		.22	.22	.23
Overhead	2.76		2.67	2.24	2.32
Insurance	.53		.37	.26	.16
Local Costs	-		-	-	-
Naphtha	5.81		-	-	-
Steam & Power	.02		2.17	2.17	4.21
Cooling Water	.23		-	-	-
Maintenance Materials 6/	.50		.26	.26	1.45
Bags	-		4.49	4.49	4.49
TOTAL	29.72	62.90 5/	49.08	48.54	55.11
II. Local Cost at 325 Won/$					
TOTAL	28.02	59.37	47.43	41.62	47.57

1/ Based on Crude Oil price of $17.50/MT.
2/ Based on Bunker "C" price of $15.50/MT.
3/ Based on 2,323 MT/Yr pulp at $145/MT for 2,112 MT/Yr Kraft Paper for 231,000 MT/Yr Urea.
4/ Based on imported Ammonia at $60/MT. .58 MT ammonia to 1 MT Urea.
5/ Chungju statement: Total cost 67.60 less depreciation of 4.70 less interest of 0.
6/ Two-thirds of annual requirement imported.
7/ Based on ammonia cost of $60/MT.

Annex C-9: Cash Flow-Capital Costs of Ammonia-Urea Project
($ 000)

	Ammonia					Urea				
	Foreign Exchange	Local Costs		Total Costs		Foreign Exchange	Local Costs		Total Costs	
		275 W/$	325 W/$	275 W/$	325 W/$		275 W/$	325 W/$	275 W/$	325 W/$
1969	6,136	420	355	6,556	6,491	150	130	110	280	260
1970	10,560	2,585	2,187	13,145	12,747	2,560	2,350	1,988	4,910	4,548
1971	2,214	1,393	1,179	3,607	3,393	2,123	1,189	1,006	3,312	3,129
	(18,910)	(4,398)	(3,721)	(23,308)	(22,631)	(4,833)	(3,669)	(3,104)	(8,502)	(7,937)

Source: Van der Valk-Feasibility Study, 1968, pages 98, 99, 178.

Annex C-10: Cash Flow - Working Capital for Ammonia-Urea Project

	Value (000 Won)		Value (Dollars)	
I. Amount				
A. Foreign Exchange			275 W/$	325 W/$
1. Inventory		177,890	646,873	
Naphtha	110,000			
Bunker C	42,900			
(.245) Bags 2/	24,990			
2. Payables		241,795	879,254	
Naphtha	165,000			
Bunker C	64,300			
(.245) Bags 2/	12,495			
B. Local Costs				
1. Inventory		492,154	1,789,649	1,514,318
(.755) Bags 2/	77,010			
Ammonia & Urea	415,144			
2. Receivables		434,250	1,579,089	1,336,153
Ammonia & Urea	434,250			
3. Cash	20,146	20,146	73,258	61,988
4. Payables		113,605	413,109	349,553
(.755) Bags 2/	38,505			
Payroll & Overhead	75,100			
C. Working Capital (1+2+3-4)			2,796,506	2,330,525
	Ammonia 3/		Urea 3/	
	275 W/$	325 W/$	275 W/$	325 W/$
II. Timing				
1971	1,314,358	1,095,347	1,482,148	1,235,178

1/ Source: Van der Valk Feasibility Study, 1968, page 113, 125, 103, 178.
2/ Page 103 - Bag Cost = 370,120,000 won. Page 125 - Imported Pulp = $337,000 at 275 W/$, Pulp cost/bag cost = .245.
3/ Total split between Ammonia and urea in proportion to production cost, op.cit. page 103. Ammonia = 47% of total.

Annex C-11: Cash Flow - Capital Costs of Two New Urea Plants
(000)

	Foreign Exchange	Local Costs 275 W/$	Local Costs 325 W/$	Total Costs 275 W/$	Total Costs 325 W/$
Total Cost 1/					
250 MT/D at Chungju	2,605	1,978	1,674	4,583	4,279
430 MT/D at Ulsan	3,603	2,739	2,317	6,347	5,925
Time Phasing 2/					
1970	81	70	59	151	140
1971	1,492	1,364	1,154	2,856	2,646
1972	3,056	2,395	2,026	5,451	5,082
1973	1,584	888	752	2,472	2,336

1/ Estimated with the ".6 rule". The capital cost of 250 MT/D plant is: $\left(\frac{250}{700}\right)^{.6}$ x cost of 700 MT/D urea plant given in annex C-9. Note that this is probably an underestimate of cost because it doesn't include extra storage facilities for ammonia nor extra pipe for CO_2.

2/ The foreign exchange and local cost totals are distributed over time in the same proportions as in the case of the new urea plant in annex C-9. The 250 MT/D plant begins operation in 1973 and the 430 MT/D plant begins in 1974, as shown in annex C-7. Hence construction of the 250 MT/D plant begins in 1970, and the 430 MT/D in 1971.

Annex C-12: Calculation of Foreign Exchange (FX) Production Costs for Existing Chungju Ammonia and Urea Plants and Two Additional Urea Plants

	Existing Chungju Ammonia Plant		Existing Chungju Urea Plant		Two Additional Urea Plants	
	(1) Ammonia (MT)	(2) FX Cost ($000) (39.9%xl) 1/	(1) Urea (MT)	(2) FX Cost ($000) (6.0%xl) 1/	(1) Urea (MT)	(2) FX Cost, excluding Ammonia ($000) (3.5%xl) 1/
1969						
1970						
1971	36,990	1,479	23,000	140		
1972	66,990	2,673	31,500	192		
1973	66,990	2,678	9,500	58	76,457	270
1974	"	"			149,543	523
1975	"	"			224,400	792
1976	"	"			224,400	792
1977	"	"			"	"
1978	"	"			"	"
1979	"	"			"	"
1980	"	"			"	"
1981	"	"			"	"

1/ Foreign exchange cost of operating plant, taken from annex C-8.

Annex C-13. Calculation of Foreign Exchange (FX) Production Costs for Ammonia-Urea Project.

	Ammonia Plant (1) Ammonia (MT)	Ammonia Plant (2) FX Cost ($000) (18.68x1) 1/	Urea Plant Urea (MT)	Urea Plant FX Cost ($000) ($3.53x1) 1/	Total FX Cost ($000)
1969					
1970					
1971	37,500				700
1972	195,000		160,000		4,207
1973	255,000		211,000		5,508
1974	285,000		231,000		6,139
1975	300,000		231,000		6,419
1976	300,000		"		6,419
1977	"		"		"
1978	"		"		"
1979	"		"		"
1980	"		"		"
1981	"		"		"

1/ Foreign exchange cost of plant, taken from Annex C-8.

Annex C-14. Import Savings Over Alternative I

(Alternative I imports less Alternative (II, III) imports)

	1970	1971	1972	1973	1974	1975	1976	1977
I. Alternative II								
A. Ammonia (MT)				-44,345	-86,735	-130,152	-130,152	-130,152
B. Urea (MT)				76,457	149,543	224,400	224,400	224,400
C. Value ($000) 1/				2,309	4,516	6,777	6,777	6,777
II. Alternative III								
A. Ammonia (MT)		510	63,875	73,180	84,720	95,170	99,000	99,000
B. Urea (MT)				76,457	149,543	231,052	231,052	231,052
C. Value ($000) 1/		31	3,833	9,361	14,803	20,729	20,958	20,958

1/ Ammonia valued at import price of $60/MT, Urea valued at import price of $65/MT.

Annex C-15

Alternative II: Present Value of Foreign Exchange Savings Over Alternative I
($000)

	Urea and Ammonia Import Savings 1/	Expenditures Two New Urea Plants: Capital 2/	Expenditures Two New Urea Plants: Operating 3/ (less imported ammonia)	Net Savings	Present Value 5%	Present Value 8%
1969						
1970		81		-81		
1971		1,492		1,492		
1972		3,056		3,056		
1973	2,309	1,584	270	455		
1974	4,516		528	3,988		
1975	6,777		792	5,985		
1976	6,777		792	5,985		
1977	"		"	"		
1978	"		"	"		
1979	"		"	"		
1980	"		"	"		
1981	"		"	"		
					29,563	20,476

1/ From annex C-14.
2/ From Annex C-11.
3/ From Annex C-12.

4/ Calculation of Present Values

	(1) Net Savings ($ 000)	(2) 50% Discount Factor	(3) Present Value 5%
1969			
1970	-81	.95238	-77
1971	-1492	.90703	-1353
1972	-3056	.86384	-2640
1973	455	.82270	374
1974	3988	.78353	3125
1975	5985	.74622	4466
1976	5985	.71068	4253
1977	"	.67684	4051
1978	"	.64461	3858
1979	"	.61391	3674
1980	"	.58468	3499
1981	"	.55684	3333
			26,563

Annex C-16

Alternative III: Present Value of Foreign Exchange Savings Over Alternative I ($ 000)

	Savings			Ammonia-Urea Proj. Expenditures		Net	Present Value	
	Urea & Ammonia Imports	Existing Chungju Ammonia Plant Expenses	Existing Chungju Urea Plant Expenses	Capital	Operating	Savings	At 5%	At 8%
1969				6,286		-6,286		
1970				13,120		-13,120		
1971	31	1,479	140	4,337	700	-3,387		
1972	3,833	2,678	192		4,207	2,496		
1973	9,361	2,678	58		5,508	6,589		
1974	14,803	"			6,139	11,342		
1975	20,729	"			6,419	16,988		
1976	20,958	"			6,419	17,217		
1977	20,958	"			"	17,217		
1978	"	"			"	"		
1979	"	"			"	"		
1980	"	"			"	"		
1981	"	"			"	"		
							72,498	54,067

Annex C-17. Cash Flows and Internal-Rate-of-Return

($ 000)

	Gross Profits[1] (Sales less operating cost)	Capital[2] Costs	Working[3] Capital	Taxes[1]	Net Cash Flow	Present Value 15	Present Value 16
1969		6,836			-6,836		
1970		18,055			-18,055		
1971	323	6,919	2,796		-9,392		
1972	6,504				6,504		
1973	9,649			515	9,134		
1974	11,106			1,575	9,531		
1975	11,559			1,766	9,793		
1976	11,559			3,036	8,523		
1977	11,559			3,890	7,669		
1978	"			4,249	7,310		
1979	"			4,649	6,910		
1980	"			4,857	6,702		
1981	"			5,048	6,511		
						986	-362

Thus the internal-rate-of-return is estimated at: 16%

1/ van der Valk Study, page 118.

2/ Taken from annex C-9

3/ Taken from annex C-10

Annex C-18 : Transportation Costs

($/MT)

Freight Rates per ROKG Ministry of Transportation:

	(280 W/$)	(325 W/$)
Distribution of urea to Chungju area		
From Chungju	0.21	0.13
From Pusan	1.68	1.45
From Ulsan	1.26	1.09
Shipment Ammonia		
Chungju to Ulsan	2.65	2.28
Chungju to Seoul	3.55	3.06
Ulsan to Seoul	3.70	3.19
Shipment Bunker "C"		
Inchon to Chungju	1.47	1.27
Shipment Naphtha		
Inchon to Chungju	1.96 1/	1.69

Assumptions:

One fifth of industrial ammonia will be used in Seoul.

Imported urea is all landed at Pusan.

1/ Early 1969 rate on small shipments is $2.20/MT. However, larger shipments should be competitive with Bunker "C" rates. $1.96 figure based on tank car capacity of 40 MT Bunker "C", or 30 MT Naphtha.

Annex C-19: National Benefits and Costs for Urea
(All costs valued at 325 W/$)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Farm Fertilizer Demand Around Chungju (MT) 1/	275,967	298,074	321,931	349,512	375,603	405,700	438,245	473,395	511,377	552,417	596,763	644,604
1. Alternative I												
Production at Chungju 2/ (MT)	103,000	103,000	115,500	115,500	115,500	115,500	115,500	115,500	115,500	115,500	115,500	115,500
Net Benefit ($17.43/MT) 3/ ($000)	1,795	1,795	2,013	2,013	2,013	2,013	2,013	2,013	2,013	2,013	2,013	2,013
Net Deficit Supplied from Outside Chungju	172,967	195,074	206,431	234,012	260,103	290,200	322,745	357,895	395,877	436,917	481,263	529,104
Imported Urea from Pusan	-	-	-	76,457	149,543	233,845	322,745	357,895	395,877	436,917	481,263	529,104
Domestic Urea from Ulsan	172,967	195,074	206,431	157,555	110,560	56,355	-	-	-	-	-	-
Distribution Cost 4/ ($000)	207	231	246	203	353	421	489	540	595	654	719	788
2. Alternative II												
Production at Chungju	103,000	103,000	115,500	191,957	193,000	193,000	193,000	193,000	193,000	193,000	193,000	193,000
Existing Plant - (MT)				---- Same as alternative I - - -								
Net Benefit				---- Same as alternative I - - -								
New 250 MT/D Plant (MT)	-	-	-	76,457	82,500	82,500	82,500	82,500	82,500	82,500	82,500	82,500
Net Benefit ($17.57/MT) 5/($000)	-	-	-	1,343	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450
Net Deficit	172,967	195,074	206,431	157,555	177,603	207,700	240,245	275,395	313,377	354,417	398,763	446,604
Imported Urea from Pusan	-	-	-	-	-	9,445	100,609	199,069	305,460	354,417	398,763	446,604
Domestic Urea from Ulsan	172,967	195,074	206,431	157,555	177,603	198,255	139,636	76,326	7,917	-	-	-
Distribution Cost 4/	207	231	246	206	229	265	334	407	457	550	614	683
New 430 MT/D Plant at Ulsan (MT)	-	-	-	-	67,043	141,900	141,900	141,900	141,900	141,900	141,900	141,900
Net Benefit (17.57/MT) 5/ ($000)	-	-	-	-	1,178	2,493	2,493	2,493	2,493	2,493	2,493	2,493
3. Alternative III												
Production at Chungju	103,000	80,000	244,000	317,000	346,500	346,500	346,500	346,500	346,500	346,500	346,500	346,500
Existing Plant (MT)	103,000	80,000	84,000	106,000	115,500	115,500	115,500	115,500	115,500	115,500	115,500	115,500
Net Benefit ($17.43/MT)3/ ($000)	1,795	1,394	1,464	1,848	2,013	2,013	2,013	2,013	2,013	2,013	2,013	2,013
Plant #6 (MT)	-	-	160,000	211,000	231,000	231,000	231,000	231,000	231,000	231,000	231,000	231,000
Net Benefit ($23.38/MT) 6/($000)	-	-	3,741	4,933	5,401	5,401	5,401	5,401	5,401	5,401	5,401	5,401
Net Deficit	172,967	218,074	77,931	32,512	29,103	59,200	91,745	126,895	164,877	205,917	250,263	298,184
Imported Urea from Pusan	-	-	-	-	-	2,793	91,745	126,895	164,877	205,917	250,263	298,184
Domestic Urea from Ulsan	172,967	218,074	77,931	32,512	29,103	56,407	-	-	-	-	-	-
Distribution Cost 4/	207	252	129	92	94	123	195	246	301	361	425	495

1/ .357 times national Farm Fertilizer Demand shown in Annexes C-5, C-6. Figures in tables converted to MT of Urea with factor 1.724137 MT Urea = 1 MT Ammonia.

2/ From Annex C-7.

3/ Value = $65/MT, Cost of Production = $47.57/MT from Annex C-8.

4/ From Annex C-16, cost from Pusan to Chungju area is $1.45/MT, cost from Ulsan to Chungju area is $1.09/MT, and cost from Chungju to Chungju area is $0.16/MT.

5/ Value = $65/MT, Cost of Production = $47.43/MT from Annex C-8.

6/ Value = $65/MT, Cost of Production = $41.62/MT from Annex C-8.

Annex C-20. National Benefits and Costs for Ammonia
(All Cost Values at 325 W/$)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Ammonia Demand in Seoul[1] (MT)	4,470	8,704	12,868	14,636	16,944	19,034	22,134	23,900	25,674	27,736	30,128	32,900
1. Alternative I												
Chungju Supply and Demand												
Ammonia needed for Urea[2] (MT)	60,000	60,000	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990
Production of Ammonia[2] (MT)	60,000	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990	66,990
Net Benefit ($.63/MT)[3] ($000)	38	42	42	42	42	42	42	42	42	42	42	42
Distribution												
Net Chungju surplus shipped to Seoul (MT)	-	6,990	-	-	-	-	-	-	-	-	-	-
Imported Ammonia Shipped to Seoul from Ulsan (MT)	-	1,714	12,868	14,636	16,944	19,034	22,134	23,900	25,674	27,736	30,128	32,900
Distribution Costs[4] ($000)	-	27	41	47	54	61	71	76	82	83	96	105
2. Alternative II												
Chungju Supply and Demand												
Ammonia needed for Urea[2] (MT)	60,000	60,000	66,990	111,535	114,840	114,840	114,840	114,840	114,840	114,840	114,840	114,840
Production of Ammonia[2] (MT)												
Net Benefit												
Distribution												
Net Chungju surplus shipped to Seoul (MT)	-	6,990	-	-	-	-	-	-	-	-	-	-
Imported Ammonia Shipped to Seoul from Ulsan (MT)	-	1,714	12,868	14,636	16,944	19,034	22,134	23,900	25,674	27,736	30,128	32,900
Imported Ammonia Shipped to Chungju from Ulsan (MT)	-	-	-	44,345	47,850	47,850	47,850	47,850	47,850	47,850	47,850	47,850
Distribution Costs[4] ($000)	-	27	41	143	163	170	180	185	191	198	205	214
3. Alternative III												
Chungju supply and demand												
Ammonia needed for Urea[2] MT	60,000	46,430	141,520	183,860	200,970	200,970	200,970	200,970	200,970	200,970	200,970	200,970
Production of Ammonia[2] MT	60,000	67,500	195,000	255,000	285,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Net Benefit[3] ($000)	38	1,218	6,256	8,155	9,114	9,594	9,594	9,594	9,594	9,594	9,594	9,594
Distribution												
Net Chungju surplus shipped to Seoul(MT)	-	8,784	12,868	14,636	16,944	19,034	22,134	23,900	25,674	27,736	30,128	32,900
Net Chungju surplus shipped to Ulsan(MT)	-	12,396	40,682	58,544	67,806	77,996	76,896	75,130	73,356	71,234	68,902	66,127
Distribution Costs[4] ($000)	-	55	132	178	205	241	243	244	246	247	249	251

Annex C-20 (Cont'd)

1/ Assumed to be .20 of Ammonia produced for industrial and feed grade urea demand as shown in Annexes C-5, C-6.

2/ Urea production levels from Annex C-7, Ammonia needed is .58 x Urea production.

3/ Value = $60/MT, cost of production = $59.37/MT from Annex C-8.

4/ From Annex C-18, cost from Chungju to Seoul is $3.06/MT, from Ulsan to Seoul is $3.19/MT, from Chungju to Ulsan $2.28/MT.

5/ Urea production levels from Annex C-7. Ammonia needed is .58 x Urea production.

6/ (1970) $.63/MT - Value = $60/MT, Cost = $59.37/MT. (1971) $.63/MT for 30,000 MT and $31.93/MT for 37,500 MT from New Plant, Value = $60/MT, Cost = $28.02/MT. After 1971, $31.93/MT. See Annex C-8 for unit costs.

Annex C-21: Present Value of Net National Benefits of Alternative II over Alternative I
($000) (325 W/$)

	Net Production Benefits	Costs		Net Benefits	Present Value	
		Distribution 1/	Capital 2/		12%	16%
1969			140	-140		
1970	-	-	2,646	-2,646		
1971	-	-	5,082	-5,082		
1972	-	-	2,336	-2,336		
1973	1,343	4		1,339		
1974	2,683	-20		2,648		
1975	3,943	-47		3,990		
1976	3,943	-46		3,989		
1977	"	-24		3,967		
1978	"	1		3,942		
1979	"	6		3,937		
1980	"	4		3,939		
1981	"	4		3,939		
					4,398	1,927

1/ Taken from Annexes C-19, C-20.

2/ Taken from Annex C-11.

Annex C-22. Present Value of Net National Benefits of Alternative III over Alternative I
(S 000) (325 U/S)

	Net Production Benefits 1/	Costs: Distribution 1/	Costs: Capital 2/	Net Benefits	Present Value 12%	Present Value 16%
1969	-		6,751	-6,751		
1970	-	-	17,295	-17,295		
71	775	49	8,852	-8,126		
72	9,386	-26		9,412		
73	12,881	-80		12,961		
74	14,473	-113		14,586		
75	14,953	-113		15,066		
76	14,953	-122		15,075		
77	14,953	-126		15,079		
78	14,953	-130		15,083		
79	14,953	-134		15,087		
80	14,953	-141		15,094		
81	14,953	-147		15,100		
					33,596	21,430

1/ Taken from annexes C-19, C-20

2/ Taken from annexes C-9, C-10.

Annex C-23. Business Ratios and Estimates of the Return on Manufacturing Capital

	1963	1964	1965	1966	1
A. Business Ratios for Manufacturing (%) 1/					
1. Net profit-to-gross capital	9.77	7.48	7.90	7.78	
2. Payable Interest and net profit-to-gross capital	13.01	11.75	11.85	13.42	
B. Estimate of Corporate Tax Rates					
1. Components of corporate income 2/					
Dividends	2.69	4.48	4.83	8.26	10
Corp. Transfer Payments	1.64	2.15	2.64	2.61	1.6
Corp. Savings	12.62	12.97	20.71	23.60	32
Corp. Direct Taxes	3.30	4.49	6.26	11.92	16
Total	20 45	24.10	34.44	46.46	65
2. Average tax rate	.1614	.1867	.1818	.2581	.2
C. Net Profit and taxes-to-gross capital (%) 3/	11.65	9.20	9.66	10.49	
D. Return-to-Capital (Net Profit + taxes + Payable Interest-to-gross capital) 4/	14.89	13.47	13.61	16.19	

1/ Source: Business Index by Industries, Economic Statistics Yearbook-1968, BOK, page 294-5.

2/ Source: Distribution of National Income (current prices, billion won), Monthly Statistical Review, 8/68, page 35.

3/ (Net profit-to-gross capital)/(1 - tax rate), since payable interest is tax deductible.

4/ C + A2 - A1.

Annex C - 24

Summary Description of the National Agricultural Cooperatives Federation (NACF)

The National Agricultural Cooperatives Federation, (NACF), is an organization of broad scope both geographically and functionally, and is sponsored and promoted by the Korean Government for the benefit of farmers. Although cooperative in name, NACF is not in reality a cooperative association organized and financed by farmers. Rather, it is an instrument of a benevolent government, established, incorporated and administered by government to serve the needs of farmers. NACF is governed from the top down. It is not a cooperative that has been built by farmers from the bottom up.

NACF was organized as a cooperative business enterprise with the objectives of increasing agricultural productivity and improving the economic and social status of farmers through independent cooperative associations. It cannot be said with certainty, however, that a democratically owned and democratically controlled NACF is universally favored. The organization has been functioning between seven and eight years. Its organizational structure is unique in that it includes such a large measure of government control that it is difficult to draw a line between NACF on the one hand and government on the other. As a consequence Korean farmers do not regard NACF or the cooperatives that compose its membership as their organization. Farmers exercise but little control and have only a small investment in its capital structure. They are more inclined to look upon NACF as an arm of government rather than a bona fide farmers' cooperative association.

Economic and political conditions at the time NACF was formed in 1961 made it necessary for the newly formed organization to lean heavily on government for financial support. With the government supplying a major portion of the finances for NACF, it was natural that government should exercise some voice and control over how its money was expended. This supervision and control exercised by government has been over the detailed operation of NACF as well as overall policy.

The principal business activities of NACF include commercial banking, the purchase and merchandising of agricultural production supplies, the marketing of farm products for members, insurance and processing. In the banking department NACF receives deposits from farmers and non-farmers and makes loans to farmers and other business interests. Most of NACF's farm supply business is conducted through cooperatives at Gun and Ri-Dong levels. A major part of the organization's marketing activities is conducted at five strategically located marketing centers owned and operated by NACF. A substantial portion of NACF's overall volume arises from business entrusted to it by the Korean Government. These activities, combined with its own business volume, make NACF the biggest business enterprise in Korea.

With specific respect to its fertilizer operation NACF has the responsibility for all fertilizer distribution to Korean farmers. This responsibility includes purchase of all fertilizer produced by domestic fertilizer plants. These purchases are at prices set by the ROK and over which NACF has no jurisdiction. NACF has two sources of funds to

make payment to the fertilizer plants: (1) payments by farmers; and (2) credit extended to NACF by Bank of Korea at instruction of the Ministry of Finance. NACF has some degree of control over the former but not the latter. And since nearly half of all fertilizer is sold on credit to farmers, NACF likewise must rely on credit to cover payments to domestic fertilizer producers.

The purchasing activities of the NACF on behalf of its affiliated cooperatives cover arrangements for purchase or supply of such productive farm materials as fertilizer, agricultural chemicals, farm equipment, saplings and breeding stock, plus daily necessities.

Ever since the NACF was reinaugurated in 1961, the entire amount of fertilizer required by the nation has been purchased by the Government from either domestic or foreign producers under a nation-wide fertilizer plan and turned over to the NACF each year to be supplied to individual farmers affiliated with agricultural cooperatives.

Fertilizer is supplied to farmers through the agricultural cooperatives under the so-called barter program by means of cash sale, by extension of credit or exchange for grains. Eighty percent of the total value of purchases made through NACF is for fertilizer.

Under the barter program, fertilizer made available in kind is to be financed by funds from the Grain Management Account. For the amount of the advance, NACF reimburses the ROK in rice, other grains, or agricultural products. Rice is by far the main commodity. For its services, NACF receives a commission of five percent of the value of the rice collected.

Under this method of financing, the ROK has the right to demand payment in kind at a ratio determined by relating the price of fertilizers to the government fixed acquisition price of rice. Recently the farmers have had an option of repayment with either cash or rice. The ROK needs rice for the Armed Forces, for relief needs, and to take care of the poor and impoverished.

For fertilizer made available to farmers under the barter system or directly by credit in kind with repayment in cash, NACF does not need funds for loans to farmers. However, it must have funds to pay for fertilizer received from the domestic plants and imports.

The present barter system is not particularly attractive to commercial farmers in that they may be required to pay off a loan in kind, with an unknown future price of rice. This does not encourage private agricultural enterprises, nor does it help to foster farmer incentive to increase agricultural production. If, however, the government acquisition price of rice were announced in the spring, and the price were fair in relation to fertilizer prices, then there would be a price incentive for farmers to increase production. Tying the credit transactions in the fall to an unknown future price of rice would appear to increase delinquencies on production loans and place NACF in an unfavorable position as a credit institution.

ANNEX C-25

(As of June 20, 1968)

Fertilizer Kinds	#1	#2	#3	#4	#5	S.C. 1/	K.K. 2/	P.N. 3/	Import Price Per M/T	Farmer Price to MACF per M/T
	(80.87)	(96.02)	(92.49)*	(85.65)	(73.23)					(84.63
Urea	22,241	26,406	25,435	23,553	20,137					23,27.
			(94.77)	(99.15)						(103.27
18-18-18			26,061	27,265						28,40
			(105.82)	(107.55)						(113.06
22-22-11			29,100	29,579						31,09
			(118.34)	(121.53)						(126.40
14-37-12			32,543	33,421						34,76
							(51.24)	(43.57)		(39.33
Fused Magnesium Phosphate(F.M.P.)							14,091	11,983		10,81
						(106.59)				(82.71)
Calcium Cyanamide						29,313				22,74
									(30.86) 4/	(47.24)
Ammonium Sulphate(A.S.)									8,486	12,990
									(66.41) 5/	(70.15)
Triple Superphosphate(T.S.P.)									18,263	19,290
									(38.58) 6/	(62.25)
Sulphate of Potash(S.P.)									10,610	17,119
									(38.06) 7/	(45.26)
Chloride of Potash(C.P.)									10,467	12,447

$1=₩275. In ( ) dollars ($), others won (₩)

1) Samchok Industrial Co.
2) Kyonggi Chemical Co.
3) Poonguong Fertilizer Co.
4) Bulk material, FOB.
5) Bulk material, CIF.
6) Bulk material, FOB.
7) Bagged, CIF.

* Bagging cost of ₩1556.6/MT is not included

Source: Fertilizer Section, MAF, June 20, 1968.

Source: Feasibility Report, Van der Valk & Associates, Table A-1, page 220.

ANNEX C-26

Imports and Exports of Manufactured Fertilizers 1/
(MT)

	Exports		Imports			
					A'000	
	Total	Urea	Total	Urea	Total	Urea
1964	-	-	756,856	80,817	435,618	15,162
1965	-	-	976,862	171,859	348,725	-
1966	-	-	919,311	37,854	732,834	-
1967	20,000	20,000	626,706	136,160	311,298	-
1968	25,000	25,000	644,003	127,600	184,866	1

1/ Mfg. Fertilizer SITC 561, Urea, SITC 5611.21; Foreign Trade Statistics Ministry of Finance.

Annex C-27: Average Yield and Economic Analysis of NPK Rates on Paddy Rice in the Republic of Korea 2/
(956 Replications)

Fertilizer Formula Kgs/Ha	Average Yield Kgs/Ha	Response Kgs/Ha	Value Response Won	Cost of Fertilizers Won	Gross Profit Won
0-0-0	3,830	--	-	-	-
80-0-0	4,630	800	24,800	4,048	20,752
100-0-0	4,850	1,020	31,620	5,060	26,560
120-0-0	4,930	1,100	34,100	6,072	28,028
80-30-0	4,730	900	27,900	5,308	22,592
100-30-0	4,940	1,110	34,100	6,320	27,780
120-30-0	5,030	1,200	37,200	7,332	29,868
80-60-0	4,780	950	29,450	7,828	21,622
100-60-0	4,940	1,110	34,100	7,580	26,520
120-60-0	5,060	1,230	38,130	8,592	29,538
80-0-40	4,690	860	26,660	4,880	21,780
100-0-40	4,900	1,070	33,170	5,892	27,278
120-0-40	5,040	1,210	37,519	6,904	30,606
80-30-40	4,780	950	29,450	7,247	22,203
100-30-40	4,950	1,120	34,720	8,259	26,461
120-30-40	5,050	1,220	37,820	9,271	28,549
80-60-40	4,800	970	30,070	9,614	20,456
100-60-40	5,000	1,170	36,270	10,626	25,644
120-60-40	5,090	1,260	39,060	11,638	27,422
80-0-80	4,710	880	27,280	5,712	21,568
100-0-80	4,920	1,070	33,170	6,724	26,446
120-0-80	5,010	1,180	36,580	7,736	28,844
80-30-80	4,790	960	29,760	8,079	21,681
100-30-80	4,990	1,160	35,960	9,091	26,869
120-30-80	5,050	1,220	37,820	10,103	27,717
80-60-50	4,800	970	30,070	9,822	20,248
100-60-80	5,040	1,210	37,510	11,964	25,546
120-60-80	5,140	1,310	40,160	12,470	28,140

1/ Based on the following prices: Rice - Won 31 per kgm;
N - Won 50.6 per kgm as urea; P_2O_5 - Won 72.5 per kgm in complex fertilizer 22-22-11; P_2O_5 - Won 42.0 per kgm in triple-super-phosphate; K_2O - Won 32.2 per kgm in complex fertilizer 22-22-11; and K_2O - Won 20.8 per kgm in potassium chloride, 60% K_2O. Complex fertilizer used first as much as possible, balance of application made from additional urea, triple-super-phosphate, and potassium chloride.

2/ Reproduced from page 35 of the van der Volk Study.

Annex D-1

DISCUSSION OF ALTERNATIVE RAW MATERIALS

Though it is agreed that naphtha is the preferred raw material for the proposed new ammonia plant, the following discussion is presented for the sake of completeness.

(a) Coal - As a raw material for ammonia, coal has proved uneconomical everywhere in the world and most coal units have been replaced. The only coal based plant in Korea, Honam at Naju, is converting to a combination naphtha and oil raw material, the choice being based on the special circumstances of Honam. In Korea the use of coal as a raw material has proven to be an especially bad choice because of the very high ash and moisture content of the domestic coal. The large successive price increases in coal the last several years have greatly magnified the economic disadvantages of coal over oil as a chemical raw material.

(b) Bunker C Fuel Oil - Bunker C is the raw material for the present obsolete Chungju plant and at the time of design of the plant was the preferred raw material for most ammonia plants then being installed. The Texaco partial oxidation process which converts the oil when mixed with tonnage oxygen into free hydrogen (plus carbon monoxide and dioxide) was the most economical process available at that time but has been superseded in recent years by the light hydrocarbon reforming processes. The disadvantage of the Texaco process is the low pressure level of the reaction, which greatly increases the compression horsepower requirement further down stream. The energy requirements of the process

are high because of other factors, also, including the necessary air separation plant. Within the past three years Texaco has announced its new high pressure reforming process in which the oxidation reaction takes place at pressures as high as 1,500 psi. This greatly lowers downstream compression costs and permits design of a total energy concept plant. The development of this process has great potential because of the low cost of heavy fuel oils and the shortage of naphtha in some areas of the world. Dr. Van der Valk did consider this process in his study but determined that, at this time the commercial aspects of the design have not been worked out, even though more than one plant of this design are reported to have been built in Europe. Other reasons for not recommending adoption of this design are:

1. Capital cost of the plant would be larger.

2. Korea will be a net importer of heavy fuel oil for many years whereas a sufficient supply of domestic naphtha will be available (see below).

(c) Imported Liquid Natural Gas (LNG) - Natural gas (methane) is the best raw material for ammonia because of its low carbon to hydrogen ratio. A plant using natural gas has the lowest capital cost and the lowest total energy requirement. Natural gas production in Korea is negligible and consists almost entirely of off-gas from the oil refinery. Shipment of natural gas into Korea by refrigerated tanker is many years away. The first project to ship LNG into Japan from Alaska is now nearing completion and may some time in the future be extended into Korea. The

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cost of preparations for shipping the gas to Japan, over $200 million for 140 million cubic feet per day including the compression station, refrigerated tankers and unloading terminal indicate the magnitude of preparations which must be made to bring in even smaller amounts of LNG to Korea. A 907 MT per day ammonia plant would require 20 million cubic feet (375 MT) per day of LNG for raw material not including fuel. At an estimated price of 50 cents per thousand cubic feet the cost of LNG for ammonia manufacture is closely competitive with naphtha at current prices in Korea. However, the unavailability into the indefinite future and the questionable price level eliminates LNG from consideration until a definite LNG import project is advanced.

(d) Imported LPG - The current domestic price level for propane and butane clearly eliminates locally available LPG from consideration as an ammonia raw material (see ANNEX D-2 Appendix-D). The availability of propane and butane from the Korean refineries is also limited and all propane now being produced can be easily sold at the current prices for fuel. The table in ANNEX D-2 Appendix-D shows that if imported propane were available for $24.30 per MT it would be competitive with naphtha at the current official price of $23.00 per MT for manufacture of ammonia whereas imported butane would be competitive at $23.80 per MT. Prices for these materials are about 3 cents per gallon in large lots in the U.S. Gulf Coast area and may be less from the Persian Gulf area. At 3 cents per gallon propane costs $15.60 per MT and butane 13.60 per MT. At these prices LPG would be an attractive raw material for ammonia in Korea if a large consumer market for imported LPG were developed so that shipping costs could be lowered

to under $10 per MT. This may occur within the next several years but not in time for serious consideration to use LPG feed to the new Chung-ju plant.

(c) Naphtha vs. Light Oil - The current state of technology does not allow use of light oil for reforming. Therefore a discussion of using light oil for raw material for the Chung-ju plant is hypothethetical considering the arguments against using the partial oxidation process given in Section IV (b) above. It is discussed here in the context of naphtha availability and the current concerns of the oil industry regarding a world wide naphtha shortage.

The crude oil now being processed in Korea by the Korea Oil Co. (Honam Oil Refinery starts-up in April) is a 50-50 mixture of Kuwait and Agha Jari (Iron) crude. The various fractions generally run as follows:

	Volume Percent	
	Kuwait	Agha Jari
LPG - Propane and Butane	0.6	0.6
375°F End point - gasoline and naphtha	22.1	26.0
Middle Distillates - Kerosene and Diesel	31.3	33.4
Heavy Ends - Bunker C, asphalt and Refinery fuel	46.0	40.0

Since the trend in Korea will be to use a larger percentage of heavy ends to satisfy the demand for Bunker C fuel oil for power plants the indications are that in the future more Kuwait crude and less Agha Jari crude will be imported. This means a smaller fraction of the petroleum barrel will be available for gasoline and chemical naphtha in the future

than is available now, the predictable percentage being 22.1% vs 24.0% at present. ANNEX D-3 Appendix-E shows the amount of chemical naphtha available for ammonia and ethylene manufacture based on the KIST (Reference 4) estimates of total petroleum and the expected percentage of the 375°F end point fraction less the KIST estimate of gasoline demand. Although the KIST estimates of gasoline demand appear to be far less than the actual percentage (about half), this still leaves sufficient naphtha (375°F end point and less) available for ammonia and ethylene. Note that the crude oil coming to Korea from the Persian Gulf can be spiked with extra naphtha and has been in the past with several percentage points. The availability of this extra naphtha for spiking in the future will be dependent on world wide demand and world prices. If the naphtha is available for spiking in future years it should be assumed at this time that it would be only at higher prices.

Another assumption made for the table in ANNEX D-3 Appendix-E is that all oil is imported as crude oil. In actual practice a large amount will normally be imported as Bunker C fuel oil because of the larger demand for heavy oil than is obtainable by refining of crude oil. As indicated in the KIST report (Reference 4), a large percentage reduction will be required in transportation oil needs during the next decade. This will result partly from electrification of the railroads. The fraction of the oil barrel now going into diesel oil will be reduced accordingly with the difference going into heavy fuel oils which are much lower priced fuels. A conclusion can be reached that light oil will be more available for a chemical raw material during the next decade. The decision to use naptha

rather than light oil as raw material for the present Chung-ju plant is, nevertheless, justified on the basis of the following:

1. Reforming technology is well developed for the 375°F End Point fraction (gasoline and lighter). Use of light oil requires high pressure partial oxidation which is not considered to be developed sufficiently for use in Korea.

2. The next ammonia plant which will be needed after 1974 should be considered as a light oil fed plant based on developments in technology at the time of designing the plant. The decision at that time can be made on the basis of better knowledge of the rapidly changing Korean oil market.

3. The reality of the present market prices is that naphtha is cheaper and will result in a saving of $1.75 per MT of ammonia over using light oil. This amounts to $516,000 per year when the plant is in full operation. Price changes in the future are hypothetical.

4. Use of light oil for ammonia would require a switch of diesel fuel into light oil. With the present price structure the oil refiners would oppose this unless the percentage market for diesel fuel dropped sharply. Kerosene and light oil are now used for household heating and prices are set by the Government on this basis.

5. Sufficient naphtha will probably be available from crude oil refined in Korea for a number of years as shown by the calculations in Appendix-E. ANNEX 5 -

Annex D-2

Costs of Various Raw Materials

	Price before tax per liter			Amount Required MT per MT NH3		Cost per MT $		NH3 $
	¥ (1)	$ (2)	$/MT	Raw Mat. (3)	Fuel (4)	Raw Mat.	Fuel	Total (6)
Kerosene	7.48	.02665	33.70		.461			
Diesel	7.15	.02550	29.65		.471			
Light Oil	5.39	.01925	22.15	.565	.473	12.50	10.50	23.00
Bunker C	3.69	.01316	13.16		.500	(5)	6.58	
Naphtha	4.43	.01580	23.00	.469	.456	10.78	10.50	21.28
Propane	15.60	.05670	111.50	.452	.425	50.40	47.40	98.80
Butane	12.50	.04470	76.60	.459	.436	35.20	33.40	68.60
Imported Methane (LNG)			26.60	.406	.389	10.90	10.38	21.28
Imported Propane			24.30	.452	.425	10.96	10.32	21.28
Imported Butane			23.80	.459	.436	10.93	10.35	21.28

Notes:
1. Prices are official, without tax, ex-plant as of February 11, 1969
2. Prices converted at ¥280:$1.
3. Raw material quantities are theoretical complete conversion to CO2 and hydrogen based on molecular weight of 226 for light oil and 100 for naphtha.
4. Fuel requirement for reforming based on 19 million BTU per MT ammonia.
5. Bunker "C" cannot be used in a reforming process.
6. Some differences in capital requirements would also affect the relative costs of the various raw materials. These differences are not considered here.

ANNEX D-3

ANNEX D-3

Naphtha and Oil Requirements Through 1981

	Nitrogen Indust. Export (1) 1000MT	Total Ammonia (1) 1000MT	Total Ammonia Mfg. 1000MT	Naphtha Petrochem. for Ammonia 1000MT	Ethyl. (1) 1000MT	Nap for Ethyl. 1000MT	Total Chemical Naphtha (2) 1000MT	BPCD (5)	% of Total Oil	Household (light) Gasoline Demand (3) (4) BPCD (5)	% of Total Oil	Gasoline Demand (6) BPCD (5)	% of Total Oil	Total Oil Demand (4) BPCD (5)
1969	210	18	300	485	0	0	485	11,000	10	12,350	12	9,850	10	102,850 (est)
1970	337	18	471	520	0	0	520	13,000	9	14,100	10	13,400	10	138,000
1971	393	41	517	540	0	0	540	13,000	10	6,350	5	5,850	4	132,000
1972	430	81	590	555	75	225	780	19,500	10	10,100	6	9,350	4	160,000
1973	487	69	660	610	90	270	880	22,000	10	11,000	7	7,800	4	195,000
1974	506	80	715	609	103	324	934	24,700	9	19,500	8	10,200	4	231,000
1975	543	89	759	720	130	390	1,110	27,800	9	23,300	8	11,600	4	269,000
1976	598	104	832	769	155	465	1,254	31,500	9	29,500	9	12,000	4	312,000
1977	641	120	907	859	186	558	1,397	35,000	9	33,000	9	13,450	3	360,000
1978	699	133	983	910	224	672	1,582	39,700	9	36,500	9	14,100	3	406,000
1979	743	155	1,068	930	268	804	1,734	45,000	9	39,500	8	15,300	3	459,000
1980	796	183	1,161	1,075	322	966	2,041	51,000	9	43,000	8	16,500	3	515,000
1981	856	209	1,252	1,166	358	1,153	2,324	58,200	9	46,000	8	17,000	3	654,000

Notes:

1. Nitrogen demand based on Van der Valk (Ref. 1) expected figures through 1976 and 7% growth thereafter. Industrial ammonia based on Van der Valk figures through 1976 and 15% growth thereafter. Ethylene based on 20% growth after original use of 75,000 MT in 1972. All figures are considered conservative.

2. Including use at Chung-Ju. Excluding use for gasoline.

3. Including kerosene and light oil. Not including any use for chemical or fertilizer manufacture.

4. Demand figures for total oil, household oil and gasoline for 1970 and after are from EIST study, Reference 4. Demand for 1968 is actual and for 1969 is EPI estimate made in 1969.

5. BPCD is barrels per calender day.

	375°F End Point for Naphtha and Gasoline (6) BPCD	% of Total Oil	Net Available for Chemical Naptha (7) BPCD	% of Total Oil
1969	24,700	24	14,850	14
1970	33,200	24	19,600	14
1971	30,350	23	24,450	18
1972	35,200	22	28,650	18
1973	42,900	22	35,100	18
1974	50,900	22	42,900	18
1975	59,350	21	49,100	18
1976	65,700	22	57,100	18
1977	79,000	22	66,400	18
1978	83,000	22	76,000	18
1979	101,000	22	86,000	19
1980	112,500	22	97,500	19
1981	127,500	22	111,100	19
	143,000	22	125,400	19

Notes:

6. Blends of Kuwait and Agha Jari crude assumed until 1971 and straight Kuwait crude thereafter. All oil demand assumed imported as crude oil.

7. Obtained by subtracting Gasoline Demand from the total 375°F End Point Fraction available for gasoline and naphtha.

Annex D-4

DISCUSSION OF CONTRACTOR OPERATING PERFORMANCE GUARANTEES

The various operating performance guarantees to be required by Chungju of the contractor are detailed below.

Ammonia Plant

(a) Production rate - Ammonia not less than 907 MT/D.

(b) Sulphur content of naphtha feed to the plant after desulphurization not more than 1/2 part per million by weight at any time.

(c) Carbon dioxide content after CO_2 absorption not in excess of 1,000 parts per million by volume.

(d) Carbon dioxide plus carbon monoxide plus oxygen after the carbon oxides removal step shall be not more than ten parts per million by volume.

(e) Commercial liquid ammonia shall meet the following analysis:

	Maximum	Minimum
Ammonia - weight %	-	99.8
Water - weight %	0.2	-
Oil - PPM by weight	5	-

(f) Steam generated in the unit shall have not more than one PPM by weight total dissolved solids and no more than 0.25 PPM silica at 600 PSI.

(g) Naphtha Requirement - Contractor to guarantee maximum for process and for fuel to reformer furnace.

(h) Other fuel - Contractor to guarantee maximum.

(i) Steam generation - Contractor to guarantee minimum.

(j) Methane content after carbon oxide removal - Contractor to guarantee maximum.

(k) Utilities requirement - contractor to guarantee maximums.

The guarantees are to be proven on a 120-hour test run. In case of failure to meet the ammonia guarantees, formulas will be used to determine cash settlements for naphtha use, excessive carbon oxides after CO_2 absorption, and utilities. All or part of a $800,000 holdback will be forfeited by the Contractor for failure to meet the other ammonia guarantees.

Urea Plant

(a) Production rate - Urea not less than 700 MT/D.

(b) Liquid ammonia consumption not more than 0.58 MT per MT urea.

(c) Not more than 1.0 percent biuret content in urea at production rates over 70%.

(d) Urea specifications -

Urea prills	Minimum	Maximum
Nitrogen, wt. %	46.2	-
Moisture, wt %	-	0.3
Biuret, wt %	-	1.0
Iron, PPM	to be specified	
Free ammonia, PPM	to be specified	
PH of 10% solution	7.0	8.0
Particle size, %		
Through 4mm screen	99.0	-
Through 1mm screen	-	30.0
Through 0.595 mm screen	-	1.0

(e) Power requirements - Contractor to guarantee maximum.

(f) Steam requirements - Contractor to guarantee maximum for each pressure used.

(g) Cooling water - Contractor to guarantee maximum.

The guarantees are to be proven on a 120-hour test run. In case of failure to meet urea guarantees, formulas will be used to determine cash settlements for excessive utility and ammonia use. All or part of a $400,000 holdback will be forfeited by the Contractor for failure to meet the other urea guarantees.

Annex D-5

EXPLANATORY DISCUSSION OF NITROGEN FERTILIZERS

Nitrogen is the most important plant food but to be usable to plants it must be chemically combined as part of a complex molecule. In the free gaseous state as in the air it is only very lightly assimilated by plants. The method now used on a large scale to convert gaseous nitrogen to a chemical compound is to first manufacture ammonia, a compound of nitrogen with hydrogen. The method of doing this (the Haber process) was discovered about 60 years ago and all modern ammonia plants are basically improvements to the original process. Ammonia can be converted into a very large number of other compounds containing chemical nitrogen, some of which have suitable physical and chemical properties and a low enough cost to be used as fertilizer. The most common compounds used as straight nitrogen fertilizer are ammonia itself, urea, ammonium sulfate, ammonium nitrate, calcium cyanamide (made from carbide) and sodium nitrate (a mineral).

Urea was selected as the product for Chungju, Korea's first fertilizer plant, because of its superior properties for a chemical nitrogen fertilizer. Urea is a synthetic organic chemical made by reacting ammonia and carbon dioxide at a very high pressure.

$$NH_3 + CO_2 \qquad NH_2CONH_2 + H_2O$$

(Ammonia) (Carbon dioxide) (Urea)

The ammonia used in this step is made by the chemical reaction of gaseous nitrogen, obtained from the air, and hydrogen, which is obtained, usually, by the chemical reaction of a hydrocarbon - oil, naphtha or natural gas - with steam. A byproduct from the manufacture of hydrogen by this method is a large amount of carbon dioxide which is used in the urea step as shown above.

$C_7H_{16} + H_2O$ $H_2 + CO_2$

(Naphtha) (Steam) (Hydrogen) (Carbon dioxide)

N_2 H_2 NH_3

(Nitrogen) (Hydrogen) (Ammonia)

These simplified chemical equations contain many variations in various ammonia plant designs but the basic process is to obtain a mixture of nitrogen and hydrogen which can be reacted to form the ammonia.

Of the three major plant nutrients - nitrogen (N), phosphoric acid or P_2O_5 (P), and potash or K_2O (K) - nitrogen is generally considered the most important. In Korea, to quote the van der Valk report (ref 1 page viii):

(a) Nitrogen is by far the most important nutrient for rice.

(b) Nitrogen is the most important nutrient for barley.

(c) Nitrogen is the most important or predominant nutrient for nearly all other crops.

Chemical nitrogen fertilizer has been used in Korea for many years.

Until 1960 nearly all chemical nitrogen was in the form of imported ammonium sulfate but with the completion of the present Chungju and Honam plants urea was introduced and by 1968 was by far the predominant form of fertilizer used. Some ammonium sulfate is still imported for special crops. In the future a significant amount (over 100,000 MT/Y) of ammonium sulfate will be obtained as a byproduct of the petrochemical industry and all imports can cease.

Ammonium sulfate was the largest synthetic chemical fertilizer used throughout the world for many years. During the 1950s technology was developed for large scale manufacture of urea and this chemical has since replaced a large percentage of the ammonium sulfate market. A large amount of ammonium sulfate will always be used because it is a byproduct of so many industries; however, for a primary manufactured product urea has proven its superiority for the following reasons:

1. Urea requires only ammonia and carbon dioxide as raw materials and the carbon dioxide is available in large quantities as a byproduct of ammonia manufacture. Sulfur, sulfuric acid or a mineral sulfate is required in addition to ammonia to make ammonium sulfate.

2. Urea has a higher nitrogen concentration than ammonium sulfate, being 40 percent N vs. 23 percent. This reduces shipping costs by half.

3. Urea is a nutral compound, strongly preferable for Korea's acidic soils. Ammonium sulfate is acidic.

4. Urea leaves no residual sulfate salts in the soil.

5. Urea is physically and chemically stable but is a fast acting fertilizer.

The other type of solid chemical straight nitrogen fertilizer being produced in large tonnage in other countries is ammonium nitrate. This compound is also used in explosives and a small, 15 MT/D plant has been constructed at the Honam Fertilizer Plant for this use. Ammonium nitrate is made from ammonia, a nitric acid which, in turn, is also made from ammonia. Although some new ammonium nitrate fertilizer plants are still being constructed, urea has in general been a more favorable fertilizer. Reasons are:

1. Nitrogen concentration in urea is higher, being 46 percent N vs. 35 percent N in ammonium nitrate. Transportation costs are therefore lower with urea.

2. Ammonium nitrate is acidic whereas urea is neutral. A neutral fertilizer is much preferable in Korea.

3. Urea is more stable and is a slower acting fertilizer more suitable to rice.

In some countries, notably the U.S. ammonia itself is a widely used chemical fertilizer. It is a stable gas liquified under pressure that can be injected directly into the ground using special equipment. The big attraction is its high nitrogen content, over 82 percent N. It is very effective as a fertilizer for hybrid corn in the U.S. Middle West. It has not been adopted for use in Korea because of the obvious problems of special equipment and techniques required. All ammonia in Korea is converted to solid fertilizers with some small amount sold as a water solution.

Two fertilizer plants in Korea make mixed NPK fertilizers in addition to urea. These are Chinhae Chemical Company and Yongnam Chemical Company, both financed in part by AID loans (DL 026 and DL 027). The mixed fertilizer is based on DAP (diammonium phosphate) which is made by mixing ammonia with phosphoric acid. In the plants a proportion of potash (potassium chloride) is mixed in with the chemical mixture and later urea and a filler are added to make the proper blends of N, P and K. This type of process is not considered for this plant because it was determined by Van der Valk (see reference 1) that no additional P and K are needed at the present time.

Plant Capacity, Participants. and Main Usage of Products

Plant	Capacity (MT/Y)	Sponsor	Investors		Main Usage of Product.
			Foreign	Korean	
Naphtha Cracking Plant	Ethylene 100,000 Propylene 70,000 Butadien 12,000 Benzene 62,300 Cyclohexane 37,300	KOCO	Gulf Oil	KOCO	Raw materials for varios Chemicals and feed stocks of the Petrochemical Plants
Polyethylene Plant	50,000	Chungju	Dow Chem.	Chungju, Korea Chemical	Synthetic Resin, Polyethylene Film, Tablewares, Bottles, Wire-coating, Pipes, etc.
VCM Plant	40,000	Chungju	Dow Chem.	Chungju, Kong Yung Chemical, Dae Han Plastic, Korea Chemical.	PVC, Film, Sheet, Pipes, Electric Isolation, Electric Accessories, etc.
Ethylene Oxide Plant & Ethylene Glycol Plant	10,000 12,000	Chungju	Dow Chem.	Chungju, Sam Yang Sa.	Polyester Synthetic Fibers, Polyester Resin, Anti-freeze, Cellophane, Explosives, Anti-freeze Explosives, Etc.
Polystyrene Plant	6,000	Chungju	Dow Chem.	Chungju, Chun U Sa	Polystyrene Resin, Plastics, Synthetic Rubber, etc.
Acetaldehyde Plant Vinyl Acetate Plant	26,000 [illegible]000	Dong Shin Polymer	UCC	Dong Shin Polymer. Dong Yang Syn. Fiber,	Butanol, Acetic Acid, Paint, Synthetic Resin, Adhesives, Vinyl Products, Vinyl Film, etc.
Acrylonitrile Plant	26,700	Chungju	Skelly Oil	Chungju, Han Il Syn. Fiber, Han Kuk Syn. Fiber, Dong Yang Syn. Fiber.	Acrylic Fiber, Synthetic Resin, etc.
Alkyl Benzene Plant	40,000	I Su Industrial Co.	ARC	I Su Industrial.	Synthetic Detergent.
Polypropylene Plant	20,000	Kuk Tae Industrial Co.	——	Kuk Tae Industrial.	Synthetic Fiber, Synthetic Resin.
SBR Plant	15,000	Sam Yang Tire	ASRC	Sam Yang Tire.	Tire, Tube, Various Rubber Products, etc.
Caprolactam Plant	33,000	Chungju	Allied Chem.	Chungju, Han Il Nylon, Han Kuk Nylon, Dong Yang Nylon.	Nylon Fiber, Various Nylon Products.
Methanol Plant	45,000	Dae Sung Wood.	——	Dae Sung Wood	Chemicals, Solvent, etc.
Utility Center		Chungju	——	Chungju	Utility Supply.
Maintenance Center		Chungju	——	Chungju	Maintenance Service

ANNEX D-7(a)
Chungju Fertilizer Corporation
Key Personnel for Ammonia-Urea Project

Personal History

Name in Full: Chin Suk Pak

Date of Birth: December 24, 1926

Present Address: 109-32 Jungnoung-dong, Sungbuk-ku, Seoul

Educational and Professional Background:

April 1947:	Graduated from Korean Military Academy
June 1954 :	Graduated from the United States Command and General Staff College.
July 1954 :	Director of Instruction, R.O.K. Command and General Staff College.
July 1957 :	Adjutant General, R.O.K. Army Headquarters.
June 1960 :	Graduated from Korean Defense College.
March 1961:	Graduated with a masters degree from the Graduate School of Public Administration Seoul National University.
May 1961 - August 1965:	President, Chungju Fertilizer Corporation
September 1965 - April 1968 :	President, Chinhae Chemical Company, Ltd.
March 1968 :	Returned as President, Chungju Fertilizer Corporation.

ANNEX D-7(b)
Chungju Fertilizer Corporation
Key Personnel for Ammonia-Urea Project

Personal History

Name in Full: Kyung Suk Ma

Date of Birth: April 21, 1921

Present Address: 14-1 Hongpa-dong, Sudaemun-ku, Seoul

Educational and Professional Background:

August 1948:	Graduated from Chemical Engineering course of Seoul National University, received B.S. degree.
May 1950 :	Mastered Seoul National University Graduate course of Chemical Engineering with a M.S. degree.
September 1955 - February 1956:	Attended Michigan State University's Graduate course of Chemical Engineering.
December 1953 - January 1957 :	Chief Engineer of Lucky Chemical Co., Ltd.
January 1957 - March 1965 :	Director of Oriental Chemical Industry, Ltd.
March 1956 :	Joined Chungju Fertilizer Corp. as Technical Advisor.
August 1965 :	Plant Manager (Director), Chungju Fertilizer Corporation.
March 1967 :	Technical Director of the same, Chungju Fertilizer Corporation.

ANNEX D-7(c)
Chungju Fertilizer Corporation
Key Personnel for Ammonia-Urea Project

Personal History

Name in Full: Yong Ki Min

Date of Birth: November 15, 1934

Present Address: 150-3 Pullwang-dong, Sudaemun-ku, Seoul

Educational and Professional Background:

March 1957:	Graduated from Chemical Engineering course of Seoul National University, received B.S. degree.
April 1958:	Joined Chungju Fertilizer Corp. As Chemical Engineer.
February 1959 - May 1959 :	Dispatched to the U.S.A. for technical training.
May 1959 - September 1963:	Operating Engineer, Ammonia Plant
October 1963:	Senior Process Engineer, Research and Development Dept.
August 1965 :	Senior Chemical Engineer in Technical Management Dept.
November 1967 - May 1968:	Dispatched to England for technical training.
May 1968:	Chief of Technical Development Section.
September 1968 - October 1968:	Technical observation tour for Ammonia and Urea plants in U.S.A. and Japan.
February 1969:	Project Manager of Ammonia-Urea Project.

ANNEX D-7(d)
PERSONAL HISTORY

Name in Full: Do Jung Hong

Date of Birth: January 1, 1929

Present Address: 333 Mokhang-dong, Chungju City, Korea

Educational and Professional Background:

April 1953:	Graduated from Chemical Engineering course of Seoul National University, received B.S. degree.
August 1953:	Entered Ministry of Commerce and Industry, R.O.K.
October 1956:	Construction inspector of Chungju Fertilizer Plant and Moonkyung Cement as the representative of M.I.C. R.O.K.
February 1958:	Joined Chungju Fertilizer Corp. as Chemical Engineer.
November 1958 - February 1959:	Dispatched to Switzerland for technical training.
October 1962:	Chief of Urea Section.
November 1964:	Manager of Research Department R & D Laboratory.
September 1965:	Chief Engineer of Chungju Plant.
November 1966 - December 1966:	Jointly performed with VULCAN CINCINNATI, INS., on basic and detail Engineering of existing Urea Plant expansion project in U.S.A.
July 1967:	Superintendent of Production Department.
January 1969:	Plant Manager (Director) of Chungju Plant.

ANNEX D-7(e)
PERSONAL HISTORY

Name in Full: Sun Pyo Hong

Date of Birth: May 15, 1932

Present Address: 333 Mokhang-dong, Chungju City, Korea

Educational and Professional Background:

Sept. 1957:	Graduated from Mechanical Engineering course of Seoul National University, received B.S. degree.
May 1959 - Sept. 1969:	Teacher of Dae Jon Technical High School.
Sept. 1961:	Jointed Chungju Fertilizer Corporation as Mechanical Engineer.
March 1966:	Night Superintendent.
March 1968:	Chief of Design Section.
April 1st - April 30, 1969:	Technical observation tour for Ammonia and Urea plants in U.S.A. and Japan.

Annex D - 7 (f)

Personal History

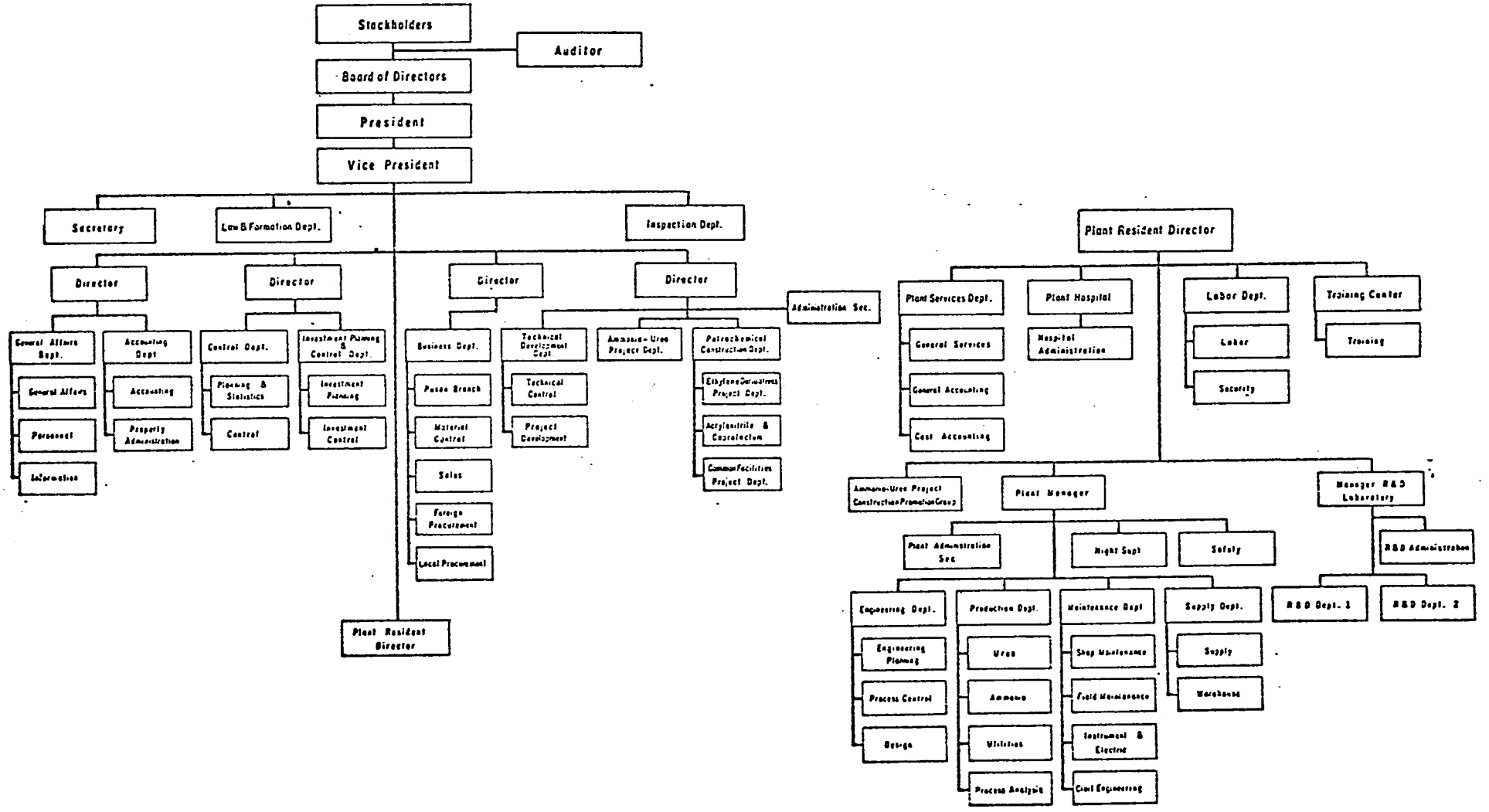
Name in Full:	Cook Chong Song
Date of Birth:	December 10, 1934
Present Address:	36-15 Sangdo-dong, Youngdungpo-ku, Seoul

Educational and Professional Background:

September 1957:	Graduated from Chemistry Dept. College of Teaching Seoul National University, received B.S. degree.
August 1967:	Mastered Graduate College of Industry Process Dept. in Hanyang University, received M.S. degree.
September 1961:	Joined Chungju Fertilizer Corp. as Process Engineer.
December 1964:	Chemical Engineer of Technical Development Dept.
July 1967 - December 1967:	Dispatched to Holland for technical training.
July 1968:	Senior Chemical Engineer in Technical Development Dept.
February 1969:	Senior Project Engineer Ammonia-Urea Project Dept.
April 1st - April 30th, 1969:	Technical observation tour for Ammonia and Urea plants in U.S.A. and Japan.

ANNEX D-8

ORGANIZATION CHART, CHUNGJU FERTILIZER CORPORATION



Annex D-9

List of Foreign Exchange Costs Eligible for AID Financing

Ammonia Plant	
Process Equipment	$ 7,700,000
Royalties (U.S.)	75,000
Piping and Valves	1,900,000
Instruments	300,000
Electricals	150,000
Control House Equipment	30,000
Insulation and Paint	150,000
Ocean Freight	2,000,000
Insurance	250,000
	$12,055,000
Urea Plant	
Process Equipment	$ 2,150,000
Piping and Valves	430,000
Instruments	110,000
Electricals	100,000
Insulation and Paint	50,000
Freight	560,000
Insurance	100,000
	$ 3,505,000
Offsite Equipment	
Ammonia	$ 1,100,000
Urea	1,000,000
	$ 2,100,000
Spare Parts	
Ammonia	$ 300,000
Urea	200,000
	$ 500,000
Consultant	
Salary, overhead and travel	150,000
Grand Total	$18,310,000

Source: Chungju Fertilizer Corporation, Unevaluated Construction Bids, received March 17, 1969.

Annex D-10

Equipment List
907 MT/D Ammonia Plant

The following is a list of all major equipment based upon the unevaluated bids received by Chungju Fertilizer Corporation on March 17, 1969:

C - Columns and Vessels

C-102	Secondary Reformer
C-103	900# Steam Wash Column
C-105	900# Steam Drum
C-108	1st Interstage Separator (For K-101)
C-109	2nd Interstage Separator (For K-101)
C-110	3rd Interstage Separator (For K-101)
C-111	Hydrodesulfurizer Reactor
C-112	Desulfurizer Separator
C-113	Stripper
C-114	Cobalt Moly Drum
C-115 A&B	Zinc-Oxide Drums
C-201	Primary Shift Converter
C-202	Secondary Shift Converter
C-203	Carbonate Regenerator
C-204	600# Steam Wash Column
C-205	No. 1 Condensate Separator
C-206	No. 2 Condensate Separator
C-207	Catacarb Solution Filter
C-208	CO_2 Absorber
C-209	Absorber K.O. Drum
C-210	Methanator
C-211	Methanator Gas K.O. Drum
C-212	Process Cond. Stripper
C-213	No. 1 Regenerator O.H. Accum.
C-214	600# Steam Drum
C-215	No. 2 Regenerator O.H. Accum.
C-301	Ammonia Converter
C-303	Primary Ammonia Separator
C-304	Secondary Ammonia Separator
C-305	Ammonia Let Down Drum
C-311	Ammonia Flash Drum
C-312	2nd Case Syngas K.O. Drum
C-313	1st Case Syngas K.O. Drum
C-314	Blowdown Drum
C-402	Continuous Blowdown Drum
C-403	Intermittent Blowdown Drum
C-404	Instrument Air Receiver
C-407	Refrigerant Ammonia Receiver

C - Columns & Vessels (Continued)

C-414	Low Pressure Condensate K.O. Drum
C-415	Ammonia Refrig. Compr. 2nd. Sec. Suction K.O. Drum
C-416	Ammonia Refrig. Compr. 3rd. Sec. Suction K.O. Drum
C-417	Ammonia Refrig. Compr. 4th Sec. Suction K.O. Drum
C-418	Ammonia Relief K.O. Drum

D-Tanks

D-201	Catacarb Solution Storage Tank
D-402	BFW Chemical Mix Tank
D-406	Treated Water Storage
D-407	H_2SO_4 Storage
D-408	Inhibitor Mix Tank
D-413	Condensate Storage Tank
D-414	Corrosion Control Tank

E - Exchangers

E-101	Secondary Reformer Steam Generator
E-104	Intercooler (K-101) (1st Stg.)
E-105	Intercooler (K-101) (2nd Stg.)
E-106	Intercooler (K-101) (3rd Stg.)
E-109 A&B	Lube Oil Cooler (K-101)
E-113	Gland Steam Cooler
E-114	Desulfurizer Reactor Feed/Effluent Exchanger
E-115	Reactor Effluent/Separator Bottoms Exchange
E-116	Reactor Effluent Condenser
E-201	Shift Converter Steam Generator
E-202 A&B	Regenerator Reboilers
E-203	Sec. Shift Eff./BFW Exchange
E-204	Product CO_2 Cond.
E-205	Hi-Temp. Feedwater Heater
E-206	Shifted Gas/Feedwater Heater
E-209 A&B	Meth. Feed/Effluent Exchangers
E-210	Meth. Effluent Cooler
E-212	Meth. Feed Trim Heater
E-215	Lean Solution Cooler
E-220	Meth. Eff./Cond. Exchanger
E-303	1st Ammonia Chiller Condenser
E-309	600 PSIA Stm Generator
E-310 A&B	Converter Feed Preheater
E-311	2nd Case Syngas Chiller

E - Exchangers (Continued)

E-312		3rd Case Syngas Aftercooler (K-301)
E-313		Refrig. Compressors Turbines Surface Condensers
E-314		Inter - Aftercondenser For (E-313)
E-317		Converter Feed/Effluent Exch.
E-318		Ammonia Flash Gas Condenser
E-320		2nd Case Syngas Intercooler (K-301)
E-321	A&B	Lube Oil Coolers IIKGT-301)
E-326		Converter Effluent Cooler
E-327		Purge Gas Cooler
E-328		Refrig. Flash Gas Condenser
E-330		Surface Condenser for (KT-301)
E-331		Inter - Aftercondenser for (E-330)
E-333		2nd Ammonia Chiller Condenser
E-334		1st Case Syngas Intercooler
E-335		Gland Stm. Cooling
E-336	A&B	Turbine Lube Oil Coolings
E-337		Turbine Gland Stm. Cooler
E-338	A&B	Lube Seal Oil Coolers for IK-301
E-339		Recycle ByPassCooler
E-402	A1, A 2, B1, B2 C1, C2, D1, D2	Refrigerant Ammonia Condenser
E-405		Refrig. Comp. Intercooler
E-406	A&B	Seal Oil Coolers (K-401)
E-415		Treated Water Cooler
E-416		BFW Turbine Surface Condenser

F - Furnaces

F-101	Primary Reformer Furnace
F-102	Aux. Fired Heater
F-103	Desulfurizer Reactor Charge Heater
F-104	Naphtha Stripper Reboiler
F-301	Start Up Heater

G - Pumps

G-101		Naphtha Stripper Revoiler Feed
G-102	A&B	Water Circ. Pumps
G-104	A&B	Lube Oil for (K-101)
G-106		Naphtha Stripper Bottoms
G-106		Naphtha Stripper Bottoms
G-201	A,B&C	Semi-Lean Catacarb Sol'n Circ. Pumps

G - Pumps

G-202 A&B	Regen. Overhead Cond. Pumps
G-203	Catacarb Sol'n Sump Pumps
G-206 A&B	Lean Catacarb Sol'n Pumps
G-210	Vac. Condensate Pump
G-303 A&B	Ammonia Product Pumps
G-304 A&B	Condenser Condensate Pumps (E-313)
G-307 A&B	Lube Oil Pumps (IKGT-301)
G-308 A&B	Seal Oil Pumps (K-301)
G-310 A&B	Condenser Condensate Pump for (E-330)
G-311	Lube Oil Pump (IK-301)
G-402 A&B	Water Treating Charge Pumps
G-403 A&B	BFW Pumps
G-404	Spare for G-403
G-417 A&B	Lube & Seal Oil Pumps (K-401)
G-419	H_2SO_4 Pump
G-420	Inhibitor Pump
G-422	BFW Chemical Injection Pump for IC-103
G-423	BFW Chemical Injection Pump for IF-401
G-424	BFW Chemical Injection Pump for IF-402
G-425	Common Spare for 422, 423, & 424
G-426	BFW Chemical Injection Pump for IE-214
G-427	BFW Chemical Injection Pump for IE-309
G-428	Common Spare for 426 & 427
G-430	Desuper Heater Quench Pump
G-431	Fuel Oil Pump
G-432	BFW Condenser Condensate Pump

K - Compressors and Drivers

K-101	Process Air Compressor
K-102 A&B	Draft Fan (Primary Reformer)
K-103	Desulfurizer Recycle Compressor
DM-103	Desulfurizer Recycle Compressor Motor
K-301	Syngas & Recycle Compressor
K-401	Refrigeration Compressor
K-404	Seal Air Blower
KT-101	Turbine for K-101
KT-102 A&B	Turbines for K-102 A&B
KT-301	Steam Turbine for K-301
KT-401	Turbine for K-401

L - Piping Specialty Items

L-101	Intake Filter for K-101
L-102	Intake Silencer for K-101
L-103	Vent Silencer for K-101
L-302	Steam Separator
L-401	Emergency Shower
L-402	Emergency Shower
L-403	Emergency Shower
L-404	Main Blowdown Vent Silencer
L-405	Emergency Shower

T - Special Equipment

T-301	Converter Basket Lifting Frame

V - Packaged Units

V-401	Instrument Air Dryer
V-402	Inert Gas Generator

DEMINERALIZING EQUIPMENT

D - Tanks

D-36261	Dechlorination Tank
D-36253	Sulfuric Acid Storage
D-36254	Caustic Storage
D-36255	Neutralizing Sump
D-36201 A&B	Cation Exchange
D-36203 A&B	Anion Exchange

G - Pumps

P-36214	Dechlorination Pump
P-36209 & A	Regenerating Acid Pump & Spare
P-36211 & A	Neutralizing Pump & Spare
P-36210 & A	Caustic Pump & Spare
P-36213 & A	Demineralized Water Pump & Spare

EQUIPMENT LIST

700 MT/D UREA PLANT

Section B - Prilling Section

B 502A	Dosing Device
B 502B	Dosing Device
B 503	Drying Tube
B 601	Prilling Tower
B 602	Prilling Equipment
B 603	Scraper
B 604	Belt Conveyor

Section C - Columns

C 303	Rectifying Column plus Separator Recirculation
C 701	Desorption Column
C 702	Absorption Column

Section E - Heat Exchangers

E 201	HP Heat Exchanger
E 202	HP Condenser
E 203	HP Scrubber
E 508	After Heater
E 302	Heater Recirculation
E 303	LP Carbamate Condenser
E 501	Evaporator
E 502	Evaporator/Flashtank Condenser
E 504	1st Crystallizer
E 505	2nd Crystallizer
E 506	Air Heater
E 507	Melt Heater
E 701	Desorber Heat Exchanger
E 702	Absorber Heat Exchanger
E 704	Absorber Cooler
E 902	Circulation Water Cooler for LP Condenser
E 904	Circulation Water Cooler for HP Scrubber

Section P - Pumps, Etc.

P 101	Process Air Blower
P 102	CO_2 - Compressor
P 104	HP NH_3 - Pump
P 301A	Carbamate Pump
P 301B	Carbamate Pump - Spare
P 303A	Urea Solution Pump
P 303B	Urea Solution Pump - Spare
P 501A	Mother Liquor Pump
P 501B	Mother Liquor Pump - Spare
P 502	Slurry Pump
P 503	Biuret Extraction Pump
P 504	Air Blower
P 505	Melt Pump
P 506	Suction Fan for Crystallization
P 601A	Fan on Prilling Tower
P 601B	Fan on Prilling Tower
P 601C	Fan on Prilling Tower
P 601D	Fan on Prilling Tower
P 701A	Desorber Feedpump
P 701B	Desorber Feedpump - Spare
P 703A	Absorber Feedpump - Spare
P 703B	Absorber Feedpump
P 704	Absorber Condenser Feed Pump
P 901A	Steam Condensate Pump
P 901B	Steam Condensate Pump - Spare
P 902	HP Flush Water Pump
P 903A	Circulation Water Pump for LP Condenser
P 903B	Circulation Water Pump for LP Condenser - Spare
P 904A	Injection Pump
P 904B	Injection Pump - Spare
P 905	Boiler Feed Water Pump
P 905A	Boiler Feed Water Pump - Spare
P 905B	Boiler Feed Water Pump
P 906A	Circulation Water Pump for HP Scrubber
P 906B	Circulation Water Pump for HP Scrubber - Spare
P 907	Seal Water Pump

Section R - Reaction

R 202	Reactor

Section S - Separators

S 101	CO_2 Knock-out Drum
S 102A	NH_3 Filter
S 102B	NH_3 Filter
S 304	Flash Tank
S 501	Separator Evaporation
S 502	Crystallizer
S 503A	Sieve Bend
S 503B	Sieve Bend
S 503C	Sieve Bend
S 503D	Sieve Bend
S 504A	Centrifuge
S 504B	Centrifuge
S 505	Air Filter
S 506	Cyclone
S 601	Urea Melt Filer
S 701	Vent Stack
S 901	M.P. Steam Condensate Flashtank

Section V - Vessels & Tanks

V 201	Steam Drum
V 301	Leveltank LP Carbamate Condenser
V 302	Urea Storage Tank
V 501	Mother Liquor Tank
V 502	Splitter Box under Sieve Bend
V 504	Melt Vessel
V 505	Splitter Box under Afterheater
V 701	NH_3 Watertank
V 901	Steam Condensate Tank
V 906	Steam Saturator
V 907	Expansion Drum for LP Carbamate Condenser
V 908	Expansion Drum for HP Scrubber

Section J - Ejectors

J 501	Ejector Flashtank/Evaporator Condenser
J 502	1st Ejector Crystallization
J 503	2nd Ejector Crystallization

EQUIPMENT LIST
OFFSITES

20 D-1	Ammonia Storage Tank
20 D-2	Naphtha Storage Tank
20 D-3	Naphtha Storage Tank
20 D-4	Desulfurized Naphtha Storage Tank
20 E-1	Ammonia Heater
20 V-1	Holding Refrigeration
21 G-1	Ammonia Loading Pump
21 G-2	Naphtha Feed Pump
21 G-3	Desulfurized Naphtha Feed Pump
21 G-4	Spare for 21 G-2 and 21 G-3
23 M-1	Ammonia Rail Car Loading Rack
23 V-1	Rail Scale
30 P-1	Transformer (Furnished by others)
40 D-1	Reclaim Hopper
40 D-2	Reclaim Hopper
40 D-3	Reclaim Hopper
40 E-1	Urea Bulk Storage Building
40 E-2	Urea Bagging and Bag Storage Building
40 T-1	Elevator
40 T-2	Conveyor
40 T-3	Transfer Tower
40 T-4	Tripper Conveyor
40 T-5	Feeder for Bagging
40 T-6	Feeder for Bagging
40 T-7	Feeder for Bagging
40 T-8	Elevator for Bagging
40 T-9	Elevator for Bagging
40 T-10	Elevator for Bagging
40 T-11	By-Pass Conveyor
40 T-12	Transfer Tower
40 T-13	Bagging Machine
40 T-14	Bagging Machine
40 T-15	Bagging Machine
40 T-16	Bag Conveyor
40 T-17	Bag Conveyor
40 T-18	Bag Conveyor
40 T-19	Weigh Scale
40 T-20	Weigh Scale
40 T-21	Weigh Scale

Annex E-1 (In $000)

Chungju Fertilizer Corporation
Balance Sheets
Five Years Ended 1968

	1968	1967	1966	1965	1964
Assets					
Current Assets:					
Cash	$ 11	$ 651	$ 124	$ 293	$ 702
Other	5217	5611	6056	6836	5557
Total Current Assets	5228	6262	6180	7129	6259
Fixed Assets:					
Tangible fixed assets	12979	9646	8232	8086	7829
Less: Reserve for depreciation	5886	5380	4734	3885	2906
Net tangible fixed assets	7093	4266	3498	4201	4923
Intangible fixed assets	35	36	35	-	-
Investments	20261	20261	16836	3727	-
Total fixed assets	27389	24563	20369	10928	4923
Deferred accounts	113	175	233	147	594
Total Assets	$32730	$31000	$26782	$18204	$11776
Liabilities:					
Current liabilities	$ 1079	$ 701	$ 2212	$ 855	$ 1372
Fixed liabilities	6964	7369	7871	8075	8071
Total liabilities	8043	8070	10083	8930	9443
Stockholder's equity:					
Common Stock	19407	17589	12734	6189	371
Capital Surplus	46	46	46	46	46
Earned surplus	5234	5295	3919	3039	1916
Total stockholders' equity	24687	22930	16699	9274	2333
Total of liabilities and stockholders' equity	$32730	$31000	$26782	$18204	$11776
Current Ratio	4.8:1	8.9:1	2.8:1	8.3:1	4.6:1
Debt/equity ratio	0.3:1	0.3:1	0.6:1	1.0:1	4.0:1

Exchange rate: ₩275 = $1

Source: Chungju Fertilizer Corporation

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Annex E-2

(In $000)

ngju Fertilizer Corporation
Income Statements
Five Years Ended 1968

	1968	1967	1966	1965	1964
Urea Produced (MT)	96,300	99,424	90,640	76,647	86,011
Sales	$7,847	$10,211	$7,519	$7,325	$5,826
Operating Expenses:					
Production	6,553	7,454	5,718	5,597	5,109
Selling and Administrative	810	646	491	297	219
Interest	461	511	518	392	470
Total	7,824	8,611	6,727	6,286	5,798
Operating Income	23	1,600	792	1,039	28
Other Income	504	111	178	137	302
Net Income Before Income Taxes	527	1,711	970	1,176	330
Income Taxes	261	846	480	582	163
Net Income	$266	$865	$490	$594	$167

Exchange Rate: W275 = $1

Source: Chungju Fertilizer Corporation

Annex E-3 (In $000)

Chungju Fertilizer Corporation
Statements of Source and Application of Funds
Four Years Ended 1968

	1968	1967	1966	1965
Source of Funds:				
Net Income before Interest	$988	$2,222	$1,488	$1,568
Add: Depreciation and Amortization Allowance	577	726	907	1,520
Increase in Paid-In Capital	1,818	4,855	6,545	5,818
Borrowings:				
Short-term Loans	-	-	-	-
Long-term Loans	-	116	1,418	-
Total Receipts	3,383	7,919	10,358	8,906
Use of Funds:				
Construction	1,932	1,416	142	259
Investments	1,401	3,425	10,109	6,727
Increase (Decrease) in Working Capital	(770)	1,062	(717)	1,796
Intangible & Other Fixed Assets	8	23	181	92
Retirement Allowance	(33)	180	(231)	(51)
Debt Service:				
Amortization of Principal	437	439	434	47
Interest	461	511	518	392
Total Expenditures	3,436	7,056	10,436	9,262
Cash Flow				
Annual Cash Increase (Decrease)	(53)	863	(78)	(356)
Surplus Appropriation (1)	587	336	91	53
Cash Balance - Ending	$11	$651	$124	$293

Exchange Rate: W275 = $1

(1) Primarily payments of current and prior years' income taxes.

Source: Chungju Fertilizer Corporation.

Annex E-4
Estimated Production Cost
New Ammonia and Urea Plants

In U.S. $(000)

Ammonia	1971	1972	1973	1974	1975
Production (MT)	37,500	195,000	255,000	285,000	300,000
Production Costs:					
Labor	$ 37	$ 74	$ 74	$ 74	$ 74
Direct Material	965	4,831	6,082	6,707	7,016
Indirect Material	124	573	745	808	826
Expenses:					
Depreciation	-	5,179	4,123	3,285	2,619
Interest	420	1,681	1,681	1,681	1,513
Plant Overhead	291	582	582	582	582
Insurance	87	173	173	173	173
Administrative Overhead	123	246	246	246	246
Total Costs	$1,947	$13,339	$13,706	$13,556	$13,049
Cost per Metric Ton	$52	$68.2	$53.9	$47.7	$43.5

Urea					
Production (MT)		160,000	211,000	231,000	231,000
Production Costs:					
Labor		$ 74	$ 74	$ 74	$ 74
Direct Material		6,715	8,556	9,261	9,261
Indirect Material		194	220	230	230
Expenses:					
Depreciation		2,418	1,754	1,275	931
Interest		420	420	420	378
Plant Overhead		268	268	268	268
Insurance		60	60	60	60
Administrative Overhead		246	246	246	246
Total Costs		$10,395	$11,598	$11,834	$11,448
Cost per Metric Ton		$65	$55	$51.3	$49.5

Source: Feasibility Report, van der Valk & Associates, Tables 2-9 and 2-10, pp. 180-181.

Annex E-5
Estimated Net Income -
New Ammonia and Urea Plants

In U.S. $(000)

	1971	1972	1973	1974	1975
Production:					
Ammonia, MT	37,500	195,000	255,000	285,000	300,000
Urea, MT	-	160,000	211,000	231,000	231,000
Net Income:					
Sales					
Ammonia @ $52	$1,950	$10,140	$13,260	$14,820	$15,600
Urea @ $65	-	10,400	13,715	15,015	15,015
Sub Total	1,950	20,540	26,975	29,835	30,615
Production Cost					
Ammonia	1,947	13,339	13,706	13,556	13,049
Urea	-	10,395	11,598	11,834	11,448
Sub Total	1,947	23,734	25,304	25,390	24,497
Profit Before Tax					
Ammonia	3	(3,199)	(446)	1,264	2,551
Urea	-	5	2,117	3,181	3,567
Sub Total	3	(3,194)	1,671	4,445	6,118
Income Tax					
Ammonia	-	-	-	-	-
Urea	-	-	515	1,575	1,766
Sub Total	-	-	515	1.575	1.766
Profit After Tax					
Ammonia	3	(3,199)	(446)	1,264	2,551
Urea	-	5	1,602	1,606	1,801
Total Net Income	3	(3,194)	1,156	2,870	4,352
Cash Flow:					
Ammonia Project					
Profit After Tax	3	(3,199)	(446)	1,264	2,551
Depreciation	-	5,179)	4,123	3,285	2,619
Total	3	1,980	3,677	4.549	5.170
Urea Project					
Profit After Tax	-	5	1,602	1,606	1,801
Depreciation	-	2,418	1,754	1,275	931
Total	-	2,423	3,356	2,881	2,732
Total Cash Flow	3	4,403	7,033	7,430	7,902

Source: Feasibility Report, van der Valk & Associates, Table 2-12, pp. 188-189.

Annex E-6 (In $000)

Chungju Fertilizer Corporation
Pro Forma Balance Sheets
Years 1968 through 1972

	1968 (Actual)	1969	1970	1971	1972
Assets:					
Current Assets:					
Cash	$ 11	$2,884	$2,833	$412	$2,480
Others	5,217	5,035	5,035	5,035	6,789
Total Current Assets	5,228	7,919	7,868	5,447	9,269
Fixed Assets:					
Tangible Fixed Assets	12,979	14,055	38,918	47,645	48,778
Less: Reserve for Depreciation	5,886	2,577	4,077	5,205	13,720
Net Tangible Fixed Assets	7,093	11,478	34,841	42,440	35,058
Intangible Fixed Assets	35	32	31	29	28
Investments	20,261	28,322	41,827	41,827	41,827
Total Fixed Assets	27,389	39,832	76,699	84,296	76,913
Deferred Accounts	133	91	64	30	22
Total Assets	$32,730	$47,842	$84,631	$89,773	$86,204
Liabilities:					
Current Liabilities	$1,079	$739	$739	$739	$739
Fixed Liabilities	6,964	10,535	32,811	35,172	29,722
Total Liabilities	8,043	11,274	33,550	35,911	30,461
Stockholder's Equity:					
Common Stock	19,407	23,989	37,495	37,495	37,495
Capital Surplus	46	4,882(a)	4,882	4,882	4,882
Earned Surplus	5,234	7,697	8,704	11,485	13,366
Total Stockholder's Equity	24,687	36,568	51,081	53,862	55,743
Total of Liabilities and Stockholder's Equity	$32,730	$47,842	$84,631	$89,773	$86,204
Current Ratio	4.8:1	10.7:1	10.6:1	7.4:1	12.5:1
Debt/Equity Ratio	0.3:1	0.3:1	0.6:1	0.7:1	0.5:1

Exchange Rate: W275 = $1 (1968)
W285 = $1 (1969 and later)

(a) Increase from revaluation of assets.

Source: Chungju Fertilizer Corporation.

Annex E-7 (IN $000)

Chungju Fertilizer Corporation
Pro Forma Income Statements
Years 1968 through 1972

	1968 (Actual)	1969	1970	1971	1972
Urea Production (MT)	96,300	104,000	103,000	80,000	244,000
Sales	$7,847	$8,715	$8,543	$7,836	$18,631
Operating Expenses:					
Production	6,553	8,746	8,091	6,178	17,898
Selling and Administration	810	777	777	777	777
Interest	461	385	801	777	2,430
Total	7,824	9,908	9,669	7,732	21,105
Operating Income	23	(1,193)	(1,126)	104	(2,474)
Other Income	504	5,116	4,101	4,066	6,450
Net Income before Income Taxes	527	3,923	2,975	4,170	3,976
Income Taxes	261	1,942	1,365	2,064	1,968
Net Income	$266	$1,981	$1,610	$2,106	$2,008

Exchange Rate: W275 = $1 (1968)
W285 = $1 (1969 and later)

Source: Chungju Fertilizer Corporation

Annex E-8 (In $000)

Chungju Fertilizer Corporation
Pro Forma Statements of Source and Application of Funds
Years 1968 through 1972

	1968 (Actual)	1969	1970	1971	1972
Source of Funds					
Net Income before Interest	$988	$4,308	$3,777	$4,947	$6,406
Add: Depreciation and Amortization Allowance	577	2,070	1,528	1,163	8,524
Increase in Paid-in Capital	1,818	5,263	13,505	-	-
Borrowings:					
Short-term Loans					
Long-term Loans		4,250	22,711	2,795	193
Total Receipts	3,383	15,891	41,521	8,905	15,123
Use of Funds					
Construction	1,932	3,162	24,864	8,725	1,133
Investments	1,401	7,420	13,505	-	-
Increase (Decrease) in Working Capital	(770)	301	-	-	1,754
Intangible & Other Fixed Assets	8	37	-	-	-
Retirement Allowance	(33)	-	-	-	-
Debt Service:					
Amortization of Principal	437	434	435	434	5,644
Interest	461	385	801	777	2,430
Total Expenditures	3,436	11,739	39,605	9,936	10,961
Cash Flow					
Annual Cash Increase (Decrease)	(53)	4,152	1,916	(1,031)	4,162
Surplus Appropriation (1)	587	1,279	1,967	1,390	2,096
Cash Balance - Ending	$ 11	$2,884	$2,833	$412	$2,480

Exchange Rate: W275 = $1 (1968)
W285 = $1 (1969 and later)

(1) Primarily payments of current and prior years' income taxes.

Source: Chungju Fertilizer Corporation.

Annex F-9

Estimated Capital Cost of Ammonia Plant
(U.S. $ - 000 omitted)

	Foreign Exchange	Won	Total
Equipment and materials	$ 11,000	$ 400	$11,400
Catalyst and chemicals(including spares)	1,400	-	1,400
Spare parts	750	-	750
Engineering cost	3,016	-	3,016
Inland freight	-	213	213
Construction cost at site(including piping, erection, instrumentation, insulation and painting)	-	3,240	3,240
Expatriate services, construction and start-up	350	-	350
Escalation	619	145	764
Contingency	1,250	400	1,650
Royalty	525	-	525
Total cost - ammonia plant	$18,910	$4,398	$23,308

Estimated Capital Cost of Urea Plant
(U.S. $ - 000 omitted)

	Foreign Exchange	Won	Total
Equipment and materials	$ 2,990	-	$ 2,990
Spare parts	240	-	240
Freight	145	-	145
Engineering cost	340	-	340
Construction cost at site (prilling tower and other civil work)	-	342	342
Bagged urea storage, other buildings and structures	-	2,560	2,560
Erection	-	125	125
Piping, electrical, instrumentation, insulation and painting	-	190	190
Temporary work	-	54	54
Erection supervision	212	-	212
Escalation	118	98	216
Contingency	350	300	650
Royalty5	438	-	438
Total cost - urea plant	$4,833	$3,669	$8,502

Source: Feasibility Report, Van der Valk & Associates, Tables 1 - 22 and 1 - 23, pp. 98 - 99.

Implementation Plan

Chungju will sign an engineering-construction contract with one of the three bidders (Kellogg, Bechtel or Chemico) for a complete job including all engineering, purchasing and construction of both ammonia and urea plants. Engineering and purchasing will be performed in the contractor's offices outside Korea. The contractor will send expatriate personnel to Korea to manage and supervise field construction.

Chungju will retain a U.S. consulting engineering firm to assist in monitoring all phases of the project. In order to maintain the present project schedule, Chungju has requested that the usual A.I.D. advertising requirement be waived.

Chungju will have its own personnel present at the contractor's office during the important phases of engineering and procurement in order to expedite the necessary approvals. The consulting engineer will attend approval conferences as necessary and assist Chungju with major decisions. Construction monitoring at the plant site will be by Chungju plant and engineering personnel. There will be no day-to-day at the site monitoring by the U.S. engineer though he will act in an advisory capacity to Chungju throughout the construction period.

Equipment specifications and Invitations for Bids for U.S. equipmen to be funded by A.I.D. will be prepared by the contractor in accordance with A.I.D. requirements. The General Terms and Conditions to be included in the IFB will be subject to A.I.D. approval, which will normally be given by USAID/Korea. Since it is anticipated that A.I.D.-financed items will be procured under Section 3 of the new A.I.D. Capital Project Guidelines dated

January 1969, technical specifications, bid analyses and awards will not normally require A.I.D. approval.

A.I.D. monitoring of the field construction will be by USAID/Korea.

Disbursement of A.I.D. funds will begin shortly after opening of the Letter of Commitment for such items as the services of engineering consultant to Chungju, but heaviest disbursement will be toward the completion of construction when the long delivery items are shipped. Final disbursements will be made by payment of any holdbacks upon successful completion of performance tests.

ROK implementation responsibilities (re utilities) will be minimal for this project because the plants will be constructed on a developed site. Some special tasks that will be required are:

Issuance of import licenses - by the Ministry of Commerce and Industry.

Granting of permits for transporting large equipment items - Ministry of Construction if by highway, and KNR if by rail.

Arrangement for purchase of fertilizer - NACF.

Arrangements for shipment of ammonia - KNR.

Implementation Schedule

1. Signing of A.I.D. Loan Authorization - June, 1969
2. Execution of A.I.D. Loan Agreement - First month
3. Advertisement for bids for equipment items to be financed by A.I.D. - third month
4. Issuance of IFB's for equipment items to be financed by A.I.D. - fourth month
5. Terminal date for meeting Conditions Precedent to Loan Agreement - third month
6. Receipt of bids for equipment to be financed by A.I.D. - sixth month
7. Start construction - sixth month
8. Purchase of A.I.D. financed equipment - seventh month
9. Purchase of commercially financed equipment - seventh month
10. Complete engineering - thirteenth month
11. Complete construction - twenty-fourth month
12. Start-up of plant - twenty-fourth month
13. Terminal date for disbursement of A.I.D. funds - thirtieth month.

AID-DLC/P-827/A DRAFT

Annex G

CAPITAL ASSISTANCE

LOAN AUTHORIZATION

Provided from: Development Loan Funds

(Korea: Chungju Ammonia/Urea Project)

Pursuant to the authority vested in the Assistant Administrator, Bureau for East Asia, Agency for International Development (A.I.D.) by the Foreign Assistance Act of 1961, as amended, and Delegations of Authority issued thereunder, I hereby authorize the establishment of a loan pursuant to Part 1, Chapter 2, Title 1, the Development Loan Fund, to the Republic of Korea (ROK) of not to exceed Five Million Dollars ($5,000,000) to finance the foreign exchange costs of the procurement of certain materials, equipment and services for the construction by the Chungju Fertilizer Corporation (Chungju) of a modern, total energy recovery, centrifugal compressor ammonia plant with design capacity of 907 metric tons per day and a new urea plant with a production capacity of 700 metric tons per day.

This loan will be subject to the following terms and conditions:

1. Interest and Terms of Repayment

The loan will be to the ROK, acting through its Economic Planning Board, which will then relend the proceeds to Chungju. The loan will be repayable by the ROK in U.S. dollars within forty (40) years after the date of the first disbursement thereunder, including a grace period on principal repayments of ten (10) years, on the basis of level semi-annual

installments of principal and interest during the repayment period. Interest shall be at the rate of two percent (2%) during the grace period and three percent (3%) during the remainder of the loan. The ROK shall relend the loan proceeds to Chungju for the purposes provided herein, on terms of eight and three quarters percent (8-3/4%) interest for a period of eighteen years including a three (3) year grace period on principal repayment, with repayment in local currency (Korean won) in level semi-annual installments with maintenance of value.

2. Other Terms and Conditions

(a) Equipment, materials and services financed with the proceeds of this loan shall be of U.S. source and origin.

(b) Except as A.I.D. shall otherwise agree in writing and in addition to the usual conditions precedent, as a condition precedent to any disbursement under this loan, there shall be presented, in form and substance satisfactory to A.I.D., evidence of:

(1) Firm commitments from U.S. and foreign lending institutions and/or suppliers for all foreign exchange funds required for the project, aside from those funds provided by the A.I.D. loan, on acceptable terms, within sixty (60) days of signing of this loan agreement.

(c) In addition to the covenants normally contained in A.I.D. loan agreements, this loan will be made on the basis of the following special covenants:

(1) Commitment by the ROK that, if Chungju for any reason is unable to provide all funding required for the project, whether foreign exchange or local currency, necessary funds will be made available by the ROK.

(2) Additional long-term indebtedness by Chungju will require prior A.I.D. approval.

(3) Commitment by the ROK that adequate railway rolling stock, pipelines, or other means of transport for naphtha and ammonia will be assured.

(4) Agreement that the ROK shall not approve nor undertake the construction of additional production facilities or expansion of existing facilities for ammonia or urea production during a three year period following the date of the loan agreement, until and unless such actions are justified and supported by economic, technical and financial feasibility studies acceptable to the ROK and A.I.D.

(d) The loan will be subject to such other terms and conditions as A.I.D. may deem advisable.

Date_____

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Acting Assistant Administrator
Bureau for East Asia