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IMPLEMENTATION COMPLETION REPORT

CHINA

HUBEI PHOSPHATE PROJECT

(LOAN 3066-CHA)

June 26, 1998

Private Sector Development Unit
East Asia and Pacific Regional Office

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CURRENCY EQUIVALENTS

Currency Name: Renminbi

Currency Unit: Yuan (Y)

Y 1.00 = US\$0.120

Y 8.30 = US\$1.00

FISCAL YEAR

January 1 - December 31

WEIGHTS AND MEASURES

1 cubic meter (m³) = 1.308 cubic yards

1 metric ton (t) = 1,000 kilograms or 2,204.6 pounds

1 kilometer (km) = 0.62 miles

ABBREVIATIONS AND ACRONYMS

CNCC	-	China National Chemical Construction Corporation
DAP	-	Di-Ammonium Phosphate (Fertilizer)
ERR	-	Economic Rate of Return
FRR	-	Financial Rate of Return
GOC	-	Government of China
HAZOP	-	Hazard and Operability
HPCC	-	Huangmailing Phosphate Chemical Company
ICB	-	International Competitive Bidding
ICR	-	Implementation Completion Report
JPCC	-	Jingxiang Phosphate Chemical Company
MAP	-	Mono-Ammonium Phosphate (Fertilizer)
MCI	-	Ministry of Chemical Industries
NPV	-	Net Present Value
tpy	-	Tons per year
SAR	-	Staff Appraisal Report
TSP	-	Triple Superphosphate (Fertilizer)

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IMPLEMENTATION COMPLETION REPORT

CHINA

HUBEI PHOSPHATE PROJECT

(LOAN 3066-CHA)

PREFACE

This is the Implementation Completion Report (ICR) for the Hubei Phosphate Project in China, for which Loan 3066-CHA in the amount of \$137 million was approved on May 23, 1989, and made effective on January 12, 1990.

The loan was closed on March 31, 1997, following one eighteen month and one six month extensions to the original loan closing date of March 31, 1995. Final disbursement took place on July 7, 1997, following provision of a four-month grace period.

The ICR was prepared by Roger Heath, Industry and Mining Division, Industry and Energy Department, Finance and Private Sector Development and reviewed by Zafar Khan, Private Sector Development Unit, East Asia and Pacific Regional Office. The Borrower provided inputs to the ICR that are included as Annexes.

Preparation of this report began during the Bank's ICR mission in April 1997. It is based on material in the project file. The Borrower contributed to the preparation of the ICR by exchanging views on the project preparation, procurement, implementation and initial operations' experience and related issues; by preparing its own set of evaluations on the project's preparation and execution; and by commenting on the draft ICR.

CHINA
HUBEI PHOSPHATE PROJECT
(LOAN 3066-CHA)

EVALUATION SUMMARY

Introduction

1. The Hubei Phosphate Project was one of four fertilizer projects financed by the Bank in China to assist in implementing the three top priorities that the Government had set for the sector, which the Bank agreed with, namely: (a) expansion, rehabilitation and energy saving in nitrogen production; (b) rapid expansion of phosphate fertilizer capacity using locally available phosphate rock; and (c) development of domestic potash resources. The first project—the Fertilizer Rehabilitation and Energy Saving Project (Loan 2541-CHA) dealt with five large- and medium-size ammonia/urea plants. The second project was the Fertilizer Rationalization Project (Loan 2838-CHA), which was to improve efficiencies at five plants, expand phosphate production at one of them, and improve institutional capacities through the introduction of modern financial and operational management. The third and fourth projects were the Phosphate Development Project (Loan 2958-CHA) and the Hubei Phosphate Project (Loan 3066-CHA)—the subject of this ICR—both of which were to expand phosphate fertilizer supplies and serve as demonstration projects for further development of the country's phosphate resources.

Project Objectives

2. The project was to assist China in achieving its priority goals for the fertilizer sector, especially in reducing the nutrient imbalance in fertilizer use by rapidly expanding cost-effective and economic production of high-grade phosphate fertilizers from domestic phosphate resources. Specifically the project was to finance one large- and one medium-scale integrated phosphate mine and phosphate fertilizer production projects, implemented, respectively, by Jingxiang Phosphate Chemical Company (JPCC) located at Dayukou, and Huangmailing Phosphate Chemical Company (HPCC) located at Huangmailing. These projects had been identified as a result of a Phosphate Subsector Study carried out jointly by the Ministry of Chemical Industries (MCI) and the Bank during project preparation, which developed a computer-based model to define an optimal investment program to develop local phosphate deposits. Consultancy services were also included to strengthen the project management capabilities of MCI.

Implementation Experience and Results

3. Project implementation was initially delayed due to counterpart funding problems and then suffered serious implementation delays and local currency cost overruns. Trial

production commenced at Huangmailing in June 1996 and June 1997 at Dayukou—respectively, 26 and 38 months later than appraisal estimates—but neither of the projects attained projected capacity utilization rates in the first year of operation and both are experiencing excessive mechanical problems. Due to the implementation delays, cost overruns and poor initial production performance, the financial and economic prospects for the projects fall far short of appraisal estimates. Financial rates of return are 3.0 percent for Dayukou and 2.5 percent for Huangmailing compared to respective appraisal values of 14.2 and 13.1; the economic rate of return (ERR) is acceptable for Dayukou at 11.4 percent but unacceptable for Huangmailing at 4.2 percent; respective appraisal values were 17.9 and 14.0 percent. The combined economic net present value for the project is negative at -US\$28 million for a discount rate of 10 percent compared with the appraisal estimate of US\$119 million. However, both projects are likely to generate a flow of benefits large enough to exceed the expected marginal costs of operation and be able in time to produce the design quantities of high-grade phosphate fertilizers. On this basis, the project is considered sustainable. Financial restructuring to relieve debt and maintain adequate liquidity levels is required for both projects.

4. The technical assistance component focused mainly on strengthening the project entities as the role of MCI had changed to setting sector policy rather than direct participation at the project level. The training in hazard and operability studies (HAZOP) that MCI was to have carried out did not take place due to lack of bilateral funding. This had no impact on other project components.

5. The project was completed at a cost of US\$649.1 million, compared to the appraisal estimate of US\$510.2 million (Part II, Table 8a). Financing arrangements were essentially as planned (Part II, Table 8b) with central and provincial governments covering the part of the financing not covered by the Bank loan. The project construction was completed at Dayukou in April 1997, Huangmailing was completed one year earlier, and the commissioning of the Dayukou facilities was finished in June 1997. This compares to the planned construction completion date for both Dayukou and Huangmailing of September 1993, a delay of 44 months.

6. Project commencement was delayed due to constraints on funding availability. Throughout the periods of major project construction there was very high local inflation and delays arose as the annual funding allocations would be found to be insufficient due to rising costs. Construction activities would be delayed until additional funds could be allocated. During the initial procurement phases there were delays in finalizing the engineering design arrangements and subsequent delays in finalizing technical specifications for equipment and plant items to be procured by international competitive bidding (ICB). Adequate project monitoring and control systems for cost and schedule were lacking. Efforts midway in the project to remedy the situation were not effective and this lack was a contributing factor to project delays and cost overruns. Procurement was generally handled well, but coordination for ICB was complex and there were instances of delays in Bank approval of procurement actions that contributed to project delays.

Summary of Findings, Future Operations, and Key Lessons Learned

7. The estimated financial and economic benefits for the project are much lower than the appraisal estimates and, with exception of the estimated ERR for Dayukou, are unsatisfactory. Nevertheless, it is likely that with debt relief, Dayukou and Huangmailing can become successful fertilizer producers. Considerable training for all levels was successfully carried out during the project and both companies are well placed to overcome the present teething problems and become viable commercial entities.

8. The technical issues of project preparation were handled well by all parties and no changes in project scope were found to be necessary during implementation. Issues of project organization and management, however, were not adequately dealt with during project preparation and there was no consensus on the scope of specialized project management assistance required. The technical assistance provided was useful and appreciated by the implementing agencies but was insufficient to deal with the problems that arose. Efforts to improve project monitoring and control once implementation is underway are likely to be only effective where there is already a basically sound system in place and the necessary improvements are only incremental.

9. Key lessons learned include:

- The efficient implementation of such fertilizer projects requires special skills and management systems that are quite different from those needed for efficient production operation. At the time of project preparation, arrangements should be agreed for the necessary specialist assistance during the construction period so that the operating company is not burdened with these responsibilities, which then detract from the efforts that the companies should be making to ensure good design and construction quality control, and to prepare for the startup and operating phase. In the case of the project, where the companies had no prior experience of operating such complex facilities, it is even more important that management energies are free to concentrate on the operating phase and that adequate technical assistance resources are provided within the project for these purposes. Measures during implementation to improve project management monitoring and controls are likely to succeed only where these are incremental to an already familiar and well established project management system.
- Project components, such as the HAZOP training, should have a direct relevance to the project and external funding should either be assured at appraisal or provisions made for funding from the loan proceeds.

CHINA

PHOSPHATE DEVELOPMENT PROJECT

(LOAN 3066-CHA)

PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. PROJECT OBJECTIVES AND DESCRIPTION

1. The project, together with the Phosphate Development Project, Loan 2958-CHA (see ICR No. 16244, January 14, 1997), was to assist China in achieving one of the priority goals set for the fertilizer sector under the Seventh and Eighth Five-Year Plans: reduction of the nutrient imbalance in fertilizer use by rapidly expanding the production capacity for high-grade phosphate fertilizer products through cost-effective economic utilization of domestic phosphate resources. An important part of this assistance was the Phosphate Subsector Study carried out jointly by the Ministry of Chemical Industries (MCI) and the Bank during project preparation to define an investment program to the year 2000 to develop local phosphate deposits.

2. Specifically, the objectives of the project were to:

- provide financial and technical assistance in implementing some of the first major projects of the investment program developed from the Phosphate Subsector Study; and
- strengthen the project management capabilities of MCI to reduce the technical risks with the development of large-scale integrated fertilizer complexes.

3. Dayukou and Huangmailing were selected to provide models for the integration of phosphate mines and fertilizer plants using modern mining, beneficiation, and manufacturing technologies for the production of high-nutrient phosphate fertilizers.

4. The project had three major components:

- **Dayukou Phosphate Mine and Fertilizer Production Development**—establishing: (a) a new open-pit mine of 1.5 million tons per year (tpy) phosphate rock capacity, to replace the existing mine; (b) a modern beneficiation plant to produce 0.65 million tpy of concentrate; and (c) fertilizer production facilities and related infrastructure for 560,000 tpy of triple superphosphate (TSP), 200,000 tpy of phosphoric acid, and 12,000 tpy of by-product aluminum fluoride.
- **Huangmailing Phosphate Mine and Fertilizer Production Development**—establishing: (a) a new open-pit mine of 1.0 million tpy phosphate rock capacity, to replace the existing mine; (b) a modern beneficiation plant to produce 0.24 million

tpy of concentrate; (c) fertilizer production facilities and related infrastructure for 180,000 tpy mono-ammonium phosphate (MAP), 93,000 tpy of phosphoric acid; and (d) the rehabilitation of a small coal-based ammonia plant to produce 30,000 tpy of ammonia as feedstock for the MAP production. The then existing small-scale Single Super Phosphate (SSP) and Nitrogen Phosphorous Potassium Complex Fertilizer (NPK) facilities would be shut down after commissioning of the new facilities.

- **Technical Assistance**, carried out by MCI consisting of:
 - consultancy services to MCI's project coordination team for project management, technology selection, production startup, and mine equipment maintenance; and,
 - consultancy services for training in hazard and operability (HAZOP) analysis for chemical plant design and operation.

B. ACHIEVEMENT OF PROJECT OBJECTIVES

5. **Sector Policy Improvements.** During project preparation for both the Phosphate Development Project (Loan 2958-CHA) and the Hubei Phosphate Project, the important sector policy issue of correcting the imbalance in fertilizer nutrient use as regards phosphates was examined in detail by the Bank and MCI in concert. Methodologies for identifying the most cost-effective solutions were developed, and specific investment recommendations were made that have formed the basis for the two projects supported by the Bank and other projects in the sector.

6. **Physical Objectives.** The project was designed to produce 2.5 million tpy of phosphate ore for processing by beneficiation to yield 0.89 million tpy of phosphate concentrates starting in April 1994. The concentrates were to be further processed at the two project sites to give, after reaching stable capacity utilization rates of 90 percent in the third year of operation, 509,000 tpy of TSP (Dayukou), and 164,000 tpy of MAP (Huangmailing); these are high-grade phosphate fertilizers with a total phosphate nutrient content of 320,000 tpy Phosphorous Pentoxide (P_2O_5). Project construction commenced in January 1990 (Dayukou) and March 1992 (Huangmailing), approximately 12 months behind the original plan of January 1989 for Dayukou and 26 months behind the plan of January 1990 for Huangmailing. These initial delays were due to delays in government approval of the project design, technology selection, and mobilization of local funds. Construction was then completed in 89 months in April 1997 for Dayukou, 35 months in excess of the original forecast of 54 months; and, 49 months in April 1996 for Huangmailing, 5 months in excess of the original forecast of 44 months. Construction delays were due to procurement problems, delays in finalizing detailed engineering, delays in allocating local financing, and late delivery of some equipment.

7. Final performance tests for Dayukou were carried out in May 1997 and commercial operation commenced thereafter. Huangmailing completed final performance tests in December 1996, and commercial operation commenced in January 1997. The

performance tests have been successful, with the exception of the production of concentrate at Dayukou where the ball mills for grinding the phosphate rock can only reach 80 percent of design output. Other sources of concentrate are available to Dayukou so that the production of finished fertilizer will not be affected. Nevertheless, during 1997 production performance for both projects has been much lower than the expected 60 percent, with capacity utilizations of 12 percent for Dayukou, and 21 percent for Huangmailing; rates for the first two months of 1998 were 13 percent for Dayukou and 42 percent for Huangmailing. The annual production plans of fertilizers and their sales in the domestic market are presented in the Operations Plan attached to the ICR mission Aide Memoire (annexed to this report). This indicated that capacity utilization rates of at least 90 percent should be met no later than year 2000, three years after completion of final performance tests. However, on the basis of the 1997 results it is likely that stable capacity utilization rates of at least 90 percent will not be reached until year 2001, and only at that time will all the physical objectives have been met.

8. **Technical Assistance Objectives.** The technical assistance for technology selection was satisfactorily completed early on in project implementation. It included visits by international specialists to China and visits of Chinese managers and engineers to selected sites to view particular technologies in operation. Technical assistance for project management, operation, and maintenance was successful in providing advice on a number of technical issues impacting on operation and maintenance and in ensuring that these areas received early attention. The assistance was less successful in improving project management, and the introduction of computer based scheduling and management information systems for the construction phase was ineffective.

9. The technical assistance for HAZOP training was intended to be financed from bilateral sources and no allocation had been made from the loan funds. MCI was unsuccessful in securing bilateral financing and, in consequence, this component was not implemented. Failure to implement the component had no direct effect on the Dayukou and Huangmailing Projects as the necessary studies were included in the project engineering.

10. **Institutional Development.** The implementing agency for the Dayukou is the Jinxiang Phosphate Chemical Company (JPCC) which, prior to the project, operated three phosphate mines with a total output of 2.5 million tpy, and a large beneficiation plant. JPCC had no prior experience in finished fertilizer production and sales. An agreed program of recruitment, training, and management strengthening was carried out by JPCC to prepare for these new responsibilities. Considerable effort has been put into strengthening JPCC, and much has been achieved. The company is fully aware, however, that the strengthening and training efforts must continue to receive high priority for the next several years until successful sustainable commercial operation is achieved. Implementation of the Huangmailing Project is by the Huangmailing Phosphate Chemical Company (HPCC) formed by the merger, during project preparation, of two fertilizer companies with phosphate mining and fertilizer production and sales operations. An agreed program of recruitment, training, and management strengthening was carried out

by HPCC. Considerable attention was given early on to recruiting and training new operations staff, and retraining existing staff and the company is well placed to successfully operate the facilities. As with Dayukou, it is recognized that training at all levels needs to be continued as a high priority during the early years of operation. Both companies have benefited considerably from staff attending training courses coordinated by MCI at other fertilizer sites, including training carried out under the Phosphate Development Project (Loan 2958-CHA).

11. **Environmental Protection.** The major environmental concerns were the safety of the mine tailings dams, minimization of ground and surface water pollution from the phosphogypsum disposal system, and achievement of international standards for emissions from the sulfuric acid and fluorine recovery plants, and the safety of ammonia transport to the Huangmailing MAP plant. All of these potential problem areas were subject to detailed studies. Measures to ensure safe operation and minimize environmental impact have been carefully designed and implemented. In the case of the phosphogypsum disposal systems, for which there is limited design experience in China, visits to facilities abroad were organized by the management consultant before designs were finalized for the two projects. The mine tailing dams were put into operation early on and are operating satisfactorily: the measures to control surface water drainage into the tailings pond at Huangmailing have been very effective in minimizing solids discharge into the Huanshi River, a minor watercourse that is, nevertheless, important for farming in the area. Effective monitoring systems are in place to record and control effluent discharges at both project sites.

12. **Economic and Financial Objectives.** Moderate economic and financial benefits were estimated at project appraisal. Based on results for 1997 and projections for future performance, these benefits are considerably lower than originally forecast, and while they are still positive (Part II, Tables 8a, 8c and 8d) they are unsatisfactory with the exception of the economic rate of return (ERR) for Dayukou. The estimated ERR for this ICR of 11.4 percent for Dayukou and 4.2 percent for Huangmailing, compared with estimated rates at appraisal of 17.9 and 14.0 percent, respectively, demonstrate the extent to which the project has failed to meet economic objectives. For both combined, the ERR would be 9.1 percent, giving a net present value (NPV) of -US\$28 million for a discount rate of 10 percent. Financial rates of return (FRRs) are now forecast at 3.0 percent for Dayukou and 2.5 percent for Huangmailing compared with the appraisal estimates of 14.2 and 13.1 percent, respectively. The table below shows, as percentages, the increase over Staff Appraisal Report (SAR) estimates in project costs when expressed in terms of US dollars and Yuan, and also the increase in the local financing requirements in Yuan terms:

COST INCREASES (PERCENT) OVER SAR ESTIMATES

Project	Cost	US\$ total	Yuan total	Yuan local financing
Dayukou	Installed Cost	4.4	113.5	127.9
	Total Financing	19.2	136.1	155.7
Huangmailing	Installed Cost	37.3	156.0	194.1
	Total Financing	44.7	168.0	203.7

Both projects experienced much higher local currency costs and attendant local financing increases (156 percent for Dayukou, and 204 percent for Huangmailing) and longer implementation periods than considered at appraisal (including the periods for achieving stable commercial production levels). These have been major factors in depressing the financial and economic rates of returns for the projects. In the case of Huangmailing, the project has experienced, in addition, considerably higher (37.3 percent) installed costs in US dollar terms than at appraisal so that local financing increases have proportionally been much higher than Dayukou. The project cost increases have been partially offset by increased product prices that the enterprises are able to achieve; MAP sales price has increased by 150 percent in yuan terms over prices at appraisal, and TSP prices have similarly increased by 100 percent. The FRRs are very sensitive to sales price decreases: a 10 percent price decrease would give negative FRRs of -0.3 percent for Dayukou, and -0.4 percent for Huangmailing. Such a decrease is, however, unlikely as sales prices remain below import parity prices by around 40 percent for TSP (Dayukou), and 13 percent for MAP (Huangmailing) and China will remain a major importer of phosphate fertilizers for the foreseeable future. The more likely problem facing the enterprises is in reaching stable commercial capacity utilization rates (60 percent in 1998, 75 percent in 1999, and 90 percent in 2000 and onward): a 10 percent reduction in such rates would reduce the FRR for Dayukou to 1.8 percent and that for Huangmailing to 1.1 percent, similarly ERRs would be reduced to 9.0 percent for Dayukou and 4.2 percent for Huangmailing.

13. **Public Sector Management.** The project was the first in a planned series of phosphate fertilizer investments to be implemented by MCI to improve domestic supplies and provide high-grade inputs. MCI has been closely involved in all phases of project preparation, planning and implementation. However, the role of MCI in project implementation has changed appreciably over the period of Bank support for the China fertilizer sector and especially during the project period: MCI now plays a much less active role in direct project management, while still retaining a role as facilitator and coordinator. As a result the consultant services for implementation have focused, almost exclusively, on the needs of the two operating companies, rather than the building of skills within MCI.

C. IMPLEMENTATION RECORD AND MAJOR FACTORS AFFECTING THE PROJECT

14. The project has not yet met its primary development objective—the provision of additional high-grade phosphate fertilizers through the cost-effective economic utilization of domestic raw materials. In the case of Huangmailing it is most unlikely that these goals can be met. Compared with the estimates made at appraisal, project implementation and construction periods have been considerably extended, project costs are much higher, and the buildup of production much slower. The factors that have contributed to this poor performance are: counterpart funds were not available to allow the projects to proceed on the original schedule, the project construction period was one of high local inflation and credit squeezes, engineering arrangements and critical procurement activities were delayed, project management was deficient in establishing effective schedule and cost control, and preparations for the operating phase have not been effective.

15. **Factors not Subject to the Borrower's Control.** China experienced considerable local inflation of domestic construction inputs (steel, cement, equipment, labor, etc.) during the major period of project implementation. Cement, for example, increased in price from Y 105 to Y 338 per ton from 1989 to 1993. This not only increased project costs, but contributed to delays as although the annual allocation of credit to the projects was made on time, the allocation would be found later on to be insufficient to cover price rises and construction activities would be constrained until provision of additional funds would be made. At the project level this situation was exacerbated by the national credit squeezes that the Government was obliged to impose for macroeconomic reasons, resulting in considerable increases to interest rates on project funds.

16. International prices for high-grade phosphate fertilizers have not changed appreciably from projections made at appraisal. However, the international price of sulfur, an important raw material input for the manufacture of such fertilizers, has decreased considerably from a price at appraisal of around US\$110 to US\$35 per ton (all FOB Vancouver). Had such existing sulfur price levels been foreseen, it would have been much more cost-effective to have designed the projects to use imported sulfur instead of local pyrites as not only is the cost of imported sulfur equivalent to that of local pyrites (on a sulfur content basis), but the capital cost of sulfur-based sulfuric acid plants is around 40 percent of a pyrites-based plant, and the cost of operation and maintenance of the sulfur-based plant is considerably less than the pyrites-based plant.

17. **Factors Subject to the Borrower's Control.** The project was part of an ambitious program to develop local phosphate resources, but the full extent of the domestic financing resources required had not been assured so that it was found necessary to stagger projects that had been planned for parallel implementation: both Dayukou and Huangmailing suffered such delays. There was also delay in finalizing engineering arrangements for the process plants. Financing required for the HAZOP training was not secured.

18. **Factors Subject to the Implementing Agencies' Control.** The implementing agencies were the two companies JPCC and HPCC. Both companies were unable to establish effective monitoring and control over project cost and schedule. As a result, there were delays in initial procurement due to excessive time taken to finalize technical specifications for international competitive bidding (ICB); there was poor synchronization of activities so that some components and infrastructure were completed well in advance of need while progress in other critical areas was delayed; and updating project costs to completion was too slow and infrequent to allow timely remedial measures to be considered for controlling costs—this was a particular problem in the case of Huangmailing where civil structure and installation costs were over six times the amount in yuan estimated at appraisal. Quality control during construction and commissioning was not effective and both companies have, as a result, experienced severe delays in reaching reasonable operating levels due to many mechanical problems.

D. PROJECT SUSTAINABILITY

19. It is likely that the project will reach and maintain the physical objective of producing high-grade phosphate fertilizers with a total nutrient content of 320,000 tpy (P_2O_5). However, although both of the projects can cover current costs, provided they attain commercial capacity utilization rates, neither of them is able to service the major part of the debt incurred. It is possible for Dayukou to generate adequate economic benefits, but due to high investment costs the economic benefits from Huangmailing will be unsatisfactory. Nevertheless, each project is likely to generate a flow of benefits large enough to exceed the expected marginal costs of operation, in both financial and economic terms. On this basis, the project is considered sustainable.

E. BANK PERFORMANCE

20. Project preparation and appraisal dealt well with the major technical issues of project design and implementation and, indeed, there were no changes found to be necessary in project scope during implementation. The treatment of institutional development issues was less thorough. No specific measures or action plans were agreed with the two project entities to upgrade management controls, implement specific training programs, and improve the performance of their existing operations. Also, the problems of technology transfer, particularly difficult for JPCC with no prior experience in fertilizer manufacture, were not specifically addressed. The technical assistance component was effective and considered successful by the implementing agencies but was modest in the resources allocated, and focused mainly on technical issues of design and implementation.

21. Supervision missions, especially in the early implementation stage were timely and effective in clarifying the causes of early implementation delays and forming a consensus between the various parties on actions required to move the project forward. Supervision missions also identified deficiencies in monitoring and control of costs and

schedules, but the remedies proposed—adoption of foreign computer-based scheduling systems—were too late in the project cycle and were not effective.

22. Procurement for the two projects was complex as coordination was necessary among the foreign and local engineering design consultants, MCI, the foreign procurement agency China National Chemical Corporation (CNCC), and the implementing agencies JPCC and HPCC. Also, most of the process critical items were procured together for both projects, requiring very close coordination. Although most of the procurement was handled well, there were instances where Bank approval on procurement documentation for time and process critical equipment was delayed and contributed to overall project delays.

F. BORROWER PERFORMANCE

23. Availability of counterpart funds was a problem throughout most of the project implementation period due, in large part, to the necessary introduction of economic reforms. The funding problems were thus not unique to the project and considerable efforts were made to make funds available during a difficult regime of much higher local inflation than expected. While there was strong support for dealing with the technical aspects of project design and implementation, there was a lack of recognition by the borrower on the need for strong technical assistance support for project management.

G. ASSESSMENT OF OUTCOME

24. While the physical objective is considered attainable, the financial benefits are unsatisfactory. Although the ERR of Dayukou is satisfactory the combined economic benefits of the two projects generate a negative NPV of -US\$28 million at a discount rate of 10 percent compared with a value of US\$119 million projected at appraisal. The problems in project implementation and in quickly achieving commercial levels of capacity utilization indicate that the institutional objectives have not been fully met and that there is a risk that financial and economic benefits will be even lower than now estimated. Thus, the project outcome is rated as unsatisfactory.

H. FUTURE OPERATION

25. It is taking longer than expected for both projects to overcome the mechanical problems that have caused the extended commissioning periods. The occurrence of such problems is not unusual in such complex chemical facilities and none of the problems experienced are of a severity that would prevent commercial operation. The major task for both companies is to expeditiously solve the mechanical problems that are preventing full operation and bring the plants to stable commercial operating levels. Once this is achieved, they will then concentrate on improving plant efficiencies and cutting costs. Both companies are pursuing discussions with the central and provincial governments for financial restructuring that will relieve the companies from liquidity problems.

26. Indicators for monitoring and evaluating the future operation of the project were that they should reach stated capacity utilization factors of 60 and 75 percent in the first and second years of operation, respectively, and then maintain a capacity utilization rate of 90 percent from the third year onward. These indicators have not been met.

I. KEY LESSONS LEARNED

27. The efficient implementation of such fertilizer projects requires special skills and management systems that are quite different from those needed for efficient production operation. At the time of project preparation, arrangements should be agreed for the necessary specialist assistance during the construction period so that the operating company is not burdened with these responsibilities, which then detract from the efforts that the companies should be making to ensure good design and construction quality control, and to prepare for the startup and operating phase. In the case of the project, where the companies had no prior experience of operating such complex facilities, it is even more important that management energies are free to concentrate on the operating phase and that adequate technical assistance resources are provided within the project for these purposes. Measures during implementation to improve project management monitoring and controls are likely to succeed only where these are incremental to an already familiar and well established project management system.

28. Project components, such as the HAZOP training, should have a direct relevance to the project and external funding should either be assured at appraisal or provisions made for funding from the loan proceeds.

PART II: STATISTICAL TABLES

TABLE 1: SUMMARY OF ASSESSMENTS

Achievement of Objectives				
	Substantial	Partial	Negligible	Not Applicable
Macroeconomic policies				x
Sector policies		x		
Financial objectives			x	
Institutional development	x			
Physical objectives		x		
Poverty reduction				x
Gender concerns				x
Other social objectives				x
Environmental objectives	x			
Public sector management			x	
Private sector development				x
Project Sustainability				
	Likely	Unlikely		Uncertain
	x			
Bank Performance				
	Highly Satisfactory	Satisfactory		Deficient
Identification		x		
Preparation		x		
Appraisal		x		
Supervision		x		
Borrower Performance				
	Highly Satisfactory	Satisfactory		Deficient
Preparation	x			
Implementation				x
Covenant compliance		x		
Assessment of Outcome				
	Highly Satisfactory	Satisfactory	Unsatisfactory	Highly Unsatisfactory
			x	

TABLE 2: RELATED BANK LOANS

Loan Title	Purpose	Year of Approval	Status
Preceding Operations			
Ln 2541-CHA Fertilizer Rehabilitation & Energy Saving	Improve efficient of nitrogenous fertilizer sector through rehabilitation and energy-saving measures	1985	Completed
Ln 2838-CHA Fertilizer Rationalization	Improve production efficiency of medium plants through renovation/technology, expand phosphate production and improve institutional capacity	1987	Completed
Ln 2958-CHA Phosphate Development	Medium-size integrated phosphate mine	1988	Completed
Following Operations			
Cr 2159-CHA Hebei Agriculture Development	Establish models for small nitrogenous and phosphate plant rehabilitation	1990	Completed

TABLE 3: PROJECT TIMETABLE

Steps in project cycle	Date planned	Date actual
Identification	07/08/84	07/08/84
Project Brief	10/09/84	10/09/84
Preappraisal	05/86	11/29/87
Appraisal	09/86	03/16/88
Negotiations	03/89	03/27/89
Board presentation	04/89	05/23/89
Signing	09/08/89	09/08/89
Effectiveness	01/12/90	01/12/90
Project Completion	09/30/94	06/30/97
Loan closing	03/31/95	03/31/97

Note: The project and the Phosphate Development Project (Loan 2958-CHA) had been planned as a single operation; but at the time of appraisal it was decided to implement them separately.

**TABLE 4: LOAN/CREDIT DISBURSEMENTS: CUMULATIVE ESTIMATED AND ACTUAL
(US\$ million)**

	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97
SAR annual	4.1	23.3	48.0	38.3	20.6	2.7	0.0	0.0
SAR cumulative	4.1	27.4	75.4	113.7	134.3	137.0	137.0	137.0
Actual annual	1.0	0.1	6.4	17.9	27.6	61.2	14.6	8.1
Actual cumulative	1.0	1.1	7.6	25.5	53.1	114.3	128.9	137.0
Actual as % of estimate	24.4	4.1	10.0	22.4	39.6	83.5	94.1	100.0
Date final disbursement	July 17, 1997							

TABLE 5: KEY INDICATORS FOR PROJECT IMPLEMENTATION

Key implementation indicators in SAR	Dayukou			Huangmailing		
	Estimated	Actual	Delay (months)	Estimated	Actual	Delay (months)
Commencement of site preparation	Jan-89	Jan-90	12	Jan-90	Mar-92	26
Process selections and contract awards	Jun-90	Dec-91	18	Feb-90	Sep-91	19
Commencement of local engineering	Jan-90	May-90	4	Jan-90	Aug-91	19
Commencement of foreign engineering	Apr-90	Oct-90	6	Mar-90	Oct-91	19
Completion of local engineering	Mar-92	Oct-94	31	Feb-92	Apr-95	39
Completion of foreign engineering	Sep-91	Mar-95	43	Sep-91	Jul-94	34
Commencement of international procurement	Apr-90	Sep-91	17	Apr-90	Jun-92	26
Completion of international procurement	Sep-92	Jun-95	33	Sep-92	Jan-95	28
Completion of civil work	Sep-92	Dec-96	52	Sep-92	Aug-95	35
Commencement of equipment installation	Apr-92	Dec-91	-4	Apr-92	Oct-94	30
Mechanical completion	Sep-93	Apr-97	44	Sep-93	Apr-96	31
Completion of commissioning	Mar-94	May-97	39	Mar-94	Jun-96	27
Commencement of commercial production	Apr-94	Jun-97	39	Apr-94	Jan-97	34

TABLE 6: KEY INDICATORS FOR PROJECT OPERATION

Capacity utilization rates of 60 percent in the first year of operation, 75 percent in the second year, and 90 percent in the third year and thereafter.

TABLE 7: STUDIES INCLUDED IN PROJECT

No studies were included in the project

TABLE 8A: PROJECT COSTS
(US\$ million)

Dayukou Item	Appraisal estimate			Actual/latest		
	Local	Foreign	Total	Local	Foreign	Total
Licenses and engineering	5.7	8.8	14.5	7.7	12.9	20.6
Equipment, materials and spares	60.4	60.7	121.1	44.5	79.5	124.0
Civil works and erection	70.2	0	70.2	147.1	0	147.1
Project Management	23.4	3.0	26.4	9.6	1.3	10.8
Training and technical assistance	0.5	0.9	1.4	2.4	.5	2.9
Other	0	0	0	3.4	0	3.4
Base Cost	160.2	73.4	233.6	214.8	94.2	309.0
Physical contingencies	16.0	7.3	23.3	0	0	0
Price contingencies	25.5	13.5	39.0	0	0	0
Installed Cost	201.7	94.2	295.9	214.8	94.2	309.0
Incremental working capital	21.8	0	21.8	6.5	0	6.5
Interest during construction	16.5	15.2	31.7	85.4	15.6	101.0
Total Financing Required	240.0	109.4	349.4	306.7	109.8	416.5

Huangmailing Item	Appraisal estimate			Actual/latest		
	Local	Foreign	Total	Local	Foreign	Total
Licenses and engineering	4.1	5.4	9.5	2.6	5.6	8.2
Equipment, materials and spares	29.8	28.0	57.8	25.6	35.7	61.3
Civil works and erection	33.7	0	33.7	96.4	0	96.4
Project Management	7.5	1.2	8.7	4.5	0.9	5.4
Training and technical assistance	0.4	0.5	0.9	0.8	0.7	1.5
Other	0	0	0	19.1	0	19.1
Base Cost	75.5	35.1	110.6	149.0	42.9	191.9
Physical contingencies	7.6	3.6	11.2	0	0	0
Price contingencies	11.9	6.1	18.0	0	0	0
Installed Cost	95	44.8	139.8	149.0	42.9	191.9
Incremental working capital	5.4	0	5.4	3.5	0	3.5
Interest during construction	7.9	7.7	15.6	30.1	7.1	37.2
Total Financing Required	108.3	52.5	160.8	182.6	50.0	232.6

TABLE 8B: PROJECT FINANCING
(US\$ million)

Dayukou Item	Appraisal estimate			Actual/latest		
	Local	Foreign	Total	Local	Foreign	Total
IBRD loan	-	94.2	94.2	-	94.2	94.2
GOC loan	159.6	-	159.6	252.7	-	252.7
HPG loans	58.6	15.4	74.0	47.6	15.6	63.2
ICBC loans	5.8	-	5.8	6.5	-	6.5
Internal funds	16.0	-	16.0	0	-	0
Total	240.0	109.6	349.6	306.8	109.8	416.5

Huangmailing Item	Appraisal estimate			Actual/latest		
	Local	Foreign	Total	Local	Foreign	Total
IBRD loan	-	42.9	42.9	-	42.9	42.9
GOC loan	81.1	-	81.1	149.0	-	149.0
HPG loans	21.8	9.8	31.6	30.1	7.1	37.2
ICBC loans	2.5	-	2.5	3.5	-	3.5
Internal funds	2.9	-	2.9	0	-	0
Total	108.3	52.7	161.0	182.6	50.0	232.5

TABLE 9A: ECONOMIC COSTS AND BENEFITS—DAYUKOU

Yuan (millions)	Actual									Projected					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
<i>Capital Costs</i>															
Total Project Cost	-36.2	-72.2	-242.8	-405.9	-635.6	-954.5	-274.8	-155.5							
Increase in Working Capital								-54.0	-14.3	-12.6	-12.6	0.0	0.0	0.0	
<i>Incremental Revenue</i>															
Domestic Revenue								73.5	734.6	918.3	1,102.0	1,102.0	1,102.0	1,102.0	
<i>Incremental Operating Cost</i>															
Variable Costs								30.2	302.4	378.0	453.6	453.6	453.6	453.6	
Fixed Costs								107.4	107.4	107.4	107.4	107.4	107.4	107.4	
Total Incr. Operating Cost								137.6	409.7	485.3	560.9	560.9	560.9	560.9	
Incremental Operating Benefit								-64.1	324.9	433.0	541.0	541.0	541.0	541.0	
INCREMENTAL BENEFIT	-36.2	-72.2	-242.8	-405.9	-635.6	-954.5	-274.8	-273.5	310.6	420.4	528.4	541.0	541.0	541.0	

Yuan (millions)	Projected													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<i>Capital Costs</i>														
Total Project Cost														0.0
Increase in Working Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.5
<i>Incremental Revenue</i>														
Domestic Revenue	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0	1,102.0
<i>Incremental Operating Cost</i>														
Variable Costs	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6
Fixed Costs	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4
Total Incr. Operating Cost	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9
Incremental Operating Benefit	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0	541.0
INCREMENTAL BENEFIT	541.0	634.5												

ERR.	11.4%
NET PRESENT VALUE:	252.4
(discount rate:)	10%

TABLE 9B: ECONOMIC COSTS AND BENEFITS—HUANGMAILING

Yuan (millions)	Actual									Projected				
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
<i>Capital Costs</i>														
Total Project Cost	-70.6	-106.0	-141.3	-141.3	-247.3	-545.9	-325.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Increase in Working Capital							-29.1	0.0	-2.4	-4.9	-4.9	0.0	0.0	0.0
<i>Incremental Revenue</i>														
Domestic Revenue								90.8	260.9	326.1	391.3	391.3	391.3	391.3
<i>Incremental Operating Cost</i>														
Variable Costs								40.9	117.7	147.1	176.5	176.5	176.5	176.5
Fixed Costs								71.2	71.2	71.2	71.2	71.2	71.2	71.2
Total Incr. Operating Cost								112.1	188.8	218.3	247.7	247.7	247.7	247.7
Incremental Operating Benefit								-21.4	72.0	107.8	143.6	143.6	143.6	143.6
INCREMENTAL BENEFIT	-70.6	-106.0	-141.3	-141.3	-247.3	-545.9	-354.8	-21.4	69.6	102.9	138.7	143.6	143.6	143.6

Yuan (millions)	Projected													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<i>Capital Costs</i>														
Total Project Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Increase in Working Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.3
<i>Incremental Revenue</i>														
Domestic Revenue	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3	391.3
<i>Incremental Operating Cost</i>														
Variable Costs	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5
Fixed Costs	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2
Total Incr. Operating Cost	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7
Incremental Operating Benefit	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6	143.6
INCREMENTAL BENEFIT	143.6	184.9												

ERR:	4.2%
NET PRESENT VALUE:	-483.7
(discount rate:)	10%

TABLE 9C: ECONOMIC COSTS AND BENEFITS—UNDERLYING ASSUMPTIONS

1. Economic capital costs are considered as the same as the financial costs as the project was exempt from duties.
2. The real prices of inputs and outputs in economic terms were assumed to remain unchanged at the end-1997 levels over the life of the project. Actual production levels were used for 1997, projected capacity utilization rates were assumed as follows:

	1998	1999	2000 and Onward
Capacity Utilization %	60.0	75	90

3. The economic prices of TSP and MAP were derived from Bank commodity price data for FOB US Gulf export price, delivered to a Chinese port. Import parity prices were calculated as follows:

	US\$/ton	
	MAP	TSP
FOB US Gulf	221	172
Bagging	20	20
Shipping	25	25
Port and Inland Transport	25	25
Total	291	242

4. The economic price of aluminum fluoride was taken as US\$1,000 per ton based on international prices.

5. The economic price of the major raw material input, pyrites (35 percent sulfur), is very sensitive to the rail tariff as the pyrites is transported from Yunnan, a distance of 1,665 kilometers. The financial rail tariff is Y 0.06 per ton-kilometer comprising Y 100 per ton of the delivered price of Y 265 per ton of pyrites. This gives an equivalent cost per ton of sulfur of US\$90 per ton against a price for imported sulfur of US\$80 per ton. (US\$55 CIF + US\$25 for inland transportation.), so that substitution of pyrites with imported sulfur is already marginally attractive. With the economic rail tariff set at the estimated value of US\$0.03 ton-km, the equivalent sulfur price would be US\$118 per ton, making the use of pyrites totally unattractive compared with imported sulfur. This would, as an example, depress the ERR for Dayukou from 11.4 to 7.4 percent. For these reasons the cost of sulfur (pyrites) has not been increased from the financial value for calculation of the ERR.

6. No shadow wage rates were used for labor, since wages plus nonoperational expenses already reflect the cost to the company of the social services provided to its labor force, including housing, education, hospitals, social security (pensions and unemployment, accident and health insurance), food services and fuel and retail outlets.

TABLE 9D: FINANCIAL COSTS AND BENEFITS—DAYUKOU

Yuan (millions)	Actual								Projected					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
<i>Capital Costs</i>														
Total Project Cost	-36.2	-72.2	-242.8	-405.9	-635.6	-954.5	-274.8	-155.5						
Increase in Working Capital								-54.0	-14.3	-12.6	-12.6	0.0	0.0	0.0
<i>Incremental Revenue</i>														
Domestic Revenue								54.0	540.0	675.0	810.0	810.0	810.0	810.0
<i>Incremental Operating Cost</i>														
Variable Costs								30.2	302.4	378.0	453.6	453.6	453.6	453.6
Fixed Costs								107.4	107.4	107.4	107.4	107.4	107.4	107.4
Total Incr. Operating Cost								137.6	409.7	485.3	560.9	560.9	560.9	560.9
Incremental Gross Operating Income								-83.6	130.3	189.7	249.1	249.1	249.1	249.1
Taxes								1.7	17.5	21.9	26.2	26.2	26.2	26.2
Incremental Net Operating Income								-85.4	112.8	167.8	222.8	222.8	222.8	222.8
INCREMENTAL NET BENEFIT	-36.2	-72.2	-242.8	-405.9	-635.6	-954.5	-274.8	-294.8	98.4	155.2	210.2	222.8	222.8	222.8

Yuan (millions)	Projected													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<i>Capital Costs</i>														
Total Project Cost														0.0
Increase in Working Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.5
<i>Incremental Revenue</i>														
Domestic Revenue	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0	810.0
<i>Incremental Operating Cost</i>														
Variable Costs	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6	453.6
Fixed Costs	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4	107.4
Total Incr. Operating Cost	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9	560.9
Incremental Gross Operating Income	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1	249.1
Taxes	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
Incremental Net Operating Income	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8	222.8
INCREMENTAL NET BENEFIT	222.8	316.3												

FINANCIAL RATE OF RETURN:	3.0%
NET PRESENT VALUE:	-956.0
(discount rate:)	10%

TABLE 9E: FINANCIAL COSTS AND BENEFITS—HUANGMAILING

Yuan (millions)	Actual									Projected					
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
<i>Capital Costs</i>															
Total Project Cost	-70.6	-106.0	-141.3	-141.3	-247.3	-545.9	-325.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Increase in Working Capital							-29.1	0.0	-2.4	-4.9	-4.9	0.0	0.0	0.0	
<i>Incremental Revenue</i>															
Domestic Revenue								84.6	243.0	303.8	364.5	364.5	364.5	364.5	
<i>Incremental Operating Cost</i>															
Variable Costs								40.9	117.7	147.1	176.5	176.5	176.5	176.5	
Fixed Costs								71.2	71.2	71.2	71.2	71.2	71.2	71.2	
Total Incr. Operating Cost								112.1	188.8	218.3	247.7	247.7	247.7	247.7	
Incremental Gross Operating Income								-27.6	54.2	85.5	116.8	116.8	116.8	116.8	
Taxes								0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Incremental Net Operating Income								-27.6	54.2	85.5	116.8	116.8	116.8	116.8	
INCREMENTAL NET BENEFIT	-70.6	-106.0	-141.3	-141.3	-247.3	-545.9	-354.8	-27.6	51.7	80.6	111.9	116.8	116.8	116.8	

Yuan (millions)	Projected													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<i>Capital Costs</i>														
Total Project Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Increase in Working Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2
<i>Incremental Revenue</i>														
Domestic Revenue	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5	364.5
<i>Incremental Operating Cost</i>														
Variable Costs	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5	176.5
Fixed Costs	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2
Total Incr. Operating Cost	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7	247.7
Incremental Gross Operating Income	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8
Taxes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incremental Net Operating Income	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8
INCREMENTAL NET BENEFIT	116.8	129.0												

FINANCIAL RATE OF RETURN:	2.5%
NET PRESENT VALUE:	-587.4
(discount rate:)	10%

TABLE 9F: FINANCIAL COSTS AND BENEFITS—UNDERLYING ASSUMPTIONS

1. Financial prices for products and inputs are based on 1997 data and have been kept at this level for all other years. Product prices are negotiated by the companies outside of the State allocation plan. Value added tax (VAT) has not been deducted from sales as neither of the companies is paying VAT. Dayukou pays municipal taxes, whereas Huangmailing does not.
2. Capacity utilizations are the same as considered in the calculation of the economic rate of return.
3. Operating costs and unit consumptions are based on data provided by the companies.

TABLE 9G: SENSITIVITY TESTS—JPCC AND HPCC

		FRR (%)		ERR (%)	
		Dayukou	Huangmailing	Dayukou	Huangmailing
ICR Estimates:					
Base Case		3.0	2.5	11.4	4.2
Sales Price	-10%	-0.3	-0.4	9.0	1.6
Operating Costs	+10%	0.8	0.6	10.2	2.6
Capacity Utilization	-10%	1.8	1.1	10.1	2.8
	+10%	4.2	3.7	12.6	5.3
SAR					
Base Case		14.2	13.1	17.9	14.0

TABLE 10: STATUS OF LEGAL COVENANTS

Agreement	Section	Covenant type	Present status	Original fulfillment date	Revised fulfillment date	Description of covenant	Comments
Loan	3.03	5	C	N/A	N/A	Borrower to maintain project coordination unit with staff and responsibilities acceptable to the Bank	
	4.02	2	C	N/A	N/A	Borrower to allow each Company to sell entire output outside the state allocation plan at negotiated prices	
	4.03	2	C	N/A	N/A	Borrower to cover any cash flow deficits of each Company during its first three years of operation, provided deficits not due to inefficient management and operation	
Project	2.02	5	C	N/A	N/A	Each Company to maintain its project management team	
	2.07(a)	5	CD	12/90	06/91	Each Company to prepare, by 12/31/90, a comprehensive program to strengthen management and recruit and train staff	
	2.08	11	C	12/91	N/A	JCL to ensure satisfactory supply and transport arrangements for phosphate concentrate	Own concentrate determined to be satisfactory.
	4.01(b) (ii)	2	C	N/A	N/A	Each Company to furnish to the Bank not later than six months after end of each fiscal year certified copies of its audited financial statements	
	4.02(a) (i)	2	CP	N/A	N/A	None of the Companies to incur any debt, unless net revenues are at least 1.2 times the debt service requirements on all debt	} Applicable upon } steady-volume } operation of project—anticipated } at end-1998
	4.02(a) (iii)	2	CP	N/A	N/A	None of the Companies to incur any debt, if after the incurring of such debt the ratio of debt to equity shall be greater than 75 to 25	} }
	4.02(a) (iv)	2	CP	N/A	N/A	Each Company to maintain a ratio of current assets to current liabilities of not less than 1.2	} }
	4.03	2	C	N/A	N/A	Five-year rolling financial plans to be sent to the Bank by each Company no later than 10/31 of each year from 1990 onwards and ending October 1998.	

Covenant types:

- 1 = Accounts/audits
- 2 = Financial performance/revenue generation from beneficiaries
- 3 = Flow and utilization of project funds
- 4 = Counterpart funding
- 5 = Management aspects of the project or executing agency
- 6 = Environmental covenants
- 7 = Involuntary resettlement

- 8 = Indigenous people
- 9 = Monitoring, review, and reporting
- 10 = Project implementation not covered by categories 1-9
- 11 = Sectoral or cross-sectoral budgetary or other resources allocation
- 12 = Sectoral or cross-sectoral policy/regulatory/institutional action
- 13 = Other

Present status:

- C = covenant complied with
- CD = complied with after delay
- CP = complied with partially
- NC = not complied with

TABLE 11: COMPLIANCE WITH OPERATIONAL MANUAL STATEMENTS

There was no significant lack of compliance with an applicable Bank Operational Manual Statement (OD or OP/BP)

TABLE 12: BANK RESOURCES: STAFF INPUTS

Stage of project cycle	Weeks	US\$'000
Through appraisal	155.8	403.6
Appraisal-Board	13.8	36.9
Board-effectiveness	-	-
Supervision	48.6	150.8
Completion	7.6	32.2
Total	225.8	623.5

TABLE 13: BANK RESOURCES: MISSIONS

Stage of project cycle	Month/year	No. of persons	Days in field	Specialized staff skills represented ^{/a}	Performance rating ^{/b}		Type of problems ^{/c}
					Implementation status	Development objectives	
Through appraisal	01/87	4	4	Fe,M,E			
	04/87	4	4	M,Fe,E			
	09/87	4	6	M,Fe,F			
	12/87	5	5	M,Fe,F,E			
Appraisal through Board approval	03/88	1	6	Fe			
	02/89	4	8	F,Fe,M,F			
Board through effectiveness	10/89	1	3	Fe			
Supervision	10/89	1	3	Fe	2	1	Pm,L,P,Ta
	11/90	2	5	Fe,F	2	1	Pm,L,P,T,Ta,F
	05/91	1	2	M	2	1	Pm,L,P,F
	11/91	4	5	Fe,M,F	2	1	Pm,L,C,P,T,Ta,F
	11/92	3	7	Fe,F	2	1	Pm,L,C,P,T,Ta,F
	11/93	4	8	Fe,M,F	2	2	Pm,L,C,P,T,Ta,F
	04/94	1	1	F	2	2	Pm,L,P,T,Ta,F,E
	10/94	1	6	Fe	S	S	Pm,L,P,T,Ta,F,E
02/96	4	12	Fe,M,F,P	S	S	Pm,F	
Completion	03/97	2	7	Fe,En	S	S	-

^{/a} M - Mining Engineer, F - Financial Analyst, Fe - Fertilizer Engineer, E - Economist, E - Environment Specialist, P - Phosphate Beneficiation Specialist.

^{/b} 1: Highly satisfactory; 2: Satisfactory; S: Satisfactory.

^{/c} LE - loan effectiveness, C - construction progress, L - local funding, P - procurement, PM - project management/training, T - TSP plant development, M - market development.

ANNEX 1: ICR MISSION AIDE MEMOIRE

April 23, 1996

1. A World Bank mission consisting of Mr. Roger Heath and Dr. Wang Xiang (Consultant) visited China during the period April 13 to 23, 1997 to carry out the implementation completion review for the above project. Together with representatives of the Ministry of Chemical Industries (MCI) and Hubei Provincial Chemical Bureau the mission visited the project sites of the Jingxiang Phosphorous Chemical Company (JPCC) and the Huangmailing Phosphate Chemical Company (HPCC), and met in Wuhan with officials of the Hubei Provincial Government. The mission discussed, in detail, all aspects of project implementation and related issues, the projects' future operations, and focused on review of the Implementation Completion Report (ICR). The mission wishes to thank all project entities, Hubei Provincial Government (HPG), and MCI for the excellent cooperation extended to the mission. The views expressed in this Aide Memoir are subject to confirmation on the mission's return to Washington.
2. Each of the project entities provided drafts of its contribution to the ICR including comments on the project implementation and performance. Also provided were the five year financial plans and indicators for the Operations Plans for both JPC and HPCC. Specific objectives of the entities that under-pin these plans were reviewed. The mission will further review the operations plans on return to Washington and send its comments to MCI and the project entities. These revised plans will then be included in the ICR.
3. There was no major divergence of opinion between the mission, MCI and the project entities in terms of the project implementation record and related issues or future operation of the project. Project construction and commissioning have been completed successfully for all units at HPCC and the plants are now in the full commercial operation stage. For JPC, commissioning and performance tests of the mining and beneficiation, and sulfuric acid plants have been completed. Commissioning of the phosphoric acid plant is underway, the GTSP plant has been completed and operated extensively on SSP production, and the Aluminum Fluoride Plant is expected to be mechanically completed in May 1997 and commissioned by end June 1997. The goal of commencing commercial production by end June 1997 is realistic.
4. The major problems faced by both projects are the adverse financial impacts of the large local currency cost over-runs and the delays in project completion. Agreement was reached that the two problems were linked and that the very considerable price escalation for local supplies over the project period, and the resulting difficulties and delays in marshaling the extra unplanned investment sources required were the major reasons for completion delays.
5. As a result of the delays and cost over-runs the projects will not be able to service all their debts in the initial years of operation. The mission pointed out that in accordance with Section 4.03 of the Loan Agreement, the Borrower has undertaken to cover any cash flow deficits of the company during its first three years of operation. The mission also expressed concern that JPC and HPCC both show debt/equity positions inferior to the 75:25 debt/equity structure covenanted in the Project Agreement, in the case of JPC the position is very

considerably inferior at around 91:9. HPG assured the mission that this issue is under active review and that State Council has set a 75:25 debt equity positions as the minimum equity holding to be achieved by all fertilizer projects. Conversion of debt to equity has already occurred for JPC to move it closer to the covenanted value further conversions for JPC and similar conversions for HPCC are planned.

6. MCI and HPG confirmed that all project outputs were being marketed outside the state allocation system at freely negotiated prices.

ATTACHMENT: HUBEI PHOSPHATE PROJECT ICR MISSION

List of Key People Met

MCI and Hubei Petrochemical Department

Hu Tian Yi	MCI	Chief Engineer
Xu Kai Rong	Hubei Petrochemical Department	Deputy Division Chief

JPCC

Zeng Chun Gou		General Manager
Ji Song Ling	Dayukou Project Headquarters	Vice Commander
He Qing Ming	Dayukou Project Headquarters	Director
Fang Yun Hua	Financial Division, DPH	Division Chief
Geng Hong Gen	Budgetary Division, DPH	Economist
Zhang Shi An	Dayukou Chemical Complex	Deputy Director
Du Jia Quan	Dayukou Chemical Complex	Chief of Financial Division
Hong Yi	Dayukou Chemical Complex	Chief, Budgetary Division
Han Zhong Qi	Dayukou Chemical Complex	Chief, Spare Parts Division
Du Si Qing	Dayukou Chemical Complex	Deputy Chief, Financial Division
Lu Shi Qiang	Financial Division, Chemical Complex	Accountant

HPCC

Wang Qiu Jia		Vice Manager
Yan Fa Zheng		Chief Engineer
Ling Jun Biao	Project Implementation Office (PIO)	Director
Luo Bao Rui	Chief Engineer Office	Director
Tang Kui	Financial Department	Director
Chen Xiu	Financial Department	Deputy Director
Fu Jin Dong	Chief Engineer Office	Assistant
Gan Li Xing	Chief Engineer Office	Assistant
Jiang Jun Feng	PIO	Deputy Director
Yan Shan Bin	Beneficiation Plant	Deputy Director
Cai Con Sheng	Ammonia Plant	Deputy Director
Liu Da Jin	Guangshui Storage Yard	Director
Tian Jin	PIO	Interpreter
Lu Pin An	Planning and Statistical Department	Accountant
Hao Zhun Ming	Financial Department	Assistant Accountant
Zhong Tao	Environmental Protection Department	Assistant Director

Nanjing Chemical Design Institute

Wang Ming Yuan		Vice Director
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ANNEX 2: OPERATION PLANS FOR THE JPCC AND HPCC

JPCC—Dayukou

1. Mining and beneficiation was completed in September 1996. Performance tests for the sulfuric acid plants are under way, and those for the phosphoric acid, aluminum fluoride and TSP plants are planned for June 1997.
2. The major task for JPCC in the short and medium term is to attain high production rates from the process plants as early as possible. In order to achieve this the problems that have been encountered during commissioning activities need to be solved. These problems include:
 - The capacity of the Ball Mill can only reach 80 percent of design;
 - Incorrect material has been installed in the pyrites roaster section of the sulfuric acid plants leading to mechanical failure and low reliability;
 - Mining equipment bucket excavators have excessive wear and control systems are unreliable; and,
 - The hot gas generator in the TSP Plant for granulation gives problems with coal as fuel.
3. JPCC Has set its goals for capacity utilization as 39 percent in 1997, 71 percent in 1998, 80 percent in 1999, and 100 percent in 2000 and onwards. Sales will initially be through large distribution companies. Later JPCC will develop its own marketing, as is the case for sales of aluminum fluoride.
4. The company is organized under two main cost center units: Dayukou Mining and Beneficiation, and Dayukou Chemical Complex. The later unit is quite new and will need continuing strengthening. With the help of the World Bank the financial management of JPCC is improved; but this will continue to gradually improve.
5. JPCC Practices “three wastes” treatment and has paid much attention to environmental aspects in design and construction. Regular monitoring is carried out for all waste discharges to insure that the required standards are met.
6. We hope to take advantage of the State policy to convert debt to equity so that JPCC equity will be at least 25 percent and thereby improve the financial situation. The rolling five-year financial plans are presented in the following tables.

JPCC—PROJECTED INCOME STATEMENT
(Y million)

	Base	Budget Period				
	Period 1996	1997	1998	1999	2000	2001
Net Sales Revenue		973.7	1,547.8	1,698.7	1,731.0	1,719.46
Less: Cost of Goods Sold		714.6	1,137.6	1,246.8	1,270.6	1,261.76
Selling Expenses		48.7	61.9	67.9	69.2	65.8
Sales Tax		31.5	50.15	55.0	56.1	53.3
Profit on Goods Sold		178.9	298.2	329.0	335.1	338.6
Add: Other Business Profit		3.2	4.5	4.8	5	4.6
Less: General & Administrative Costs		36.6	41.2	50.8	55.0	53.8
Financial Expenses		90.0	160.0	170.0	170.0	160.0
Operating Income		55.5	101.5	113.0	115.1	129.4
Add: Income from Investment Nonoperating Income						
Less: Nonoperating Expenses		9.8	13.4	13.6	15.3	13.5
Gross Profit		45.7	88.1	99.4	99.8	115.9
Income Tax		0	0	0	0	0
Net Profit		45.7	88.1	99.4	99.8	115.9
Less: Dividends paid		11.4	22.0	24.8	24.9	26.2
Retained Earnings		34.3	66.1	74.6	74.9	89.7
RATIOS						
Net Profit/Sales		4.7%	5.7%	5.9%	5.8%	6.7%

JPCC—PROJECTED BALANCE SHEET
(Y million)

	Base	Budget Period				
	Period	1997	1998	1999	2000	2001
	1996					
ASSETS						
Current Assets						
Surplus cash (-deficit)		-100.7	-85.5	-40.2	-55.5	-12.8
Cash & Bank Deposits	124.0	66.0	78.0	102.3	65.7	97.6
Accounts Receivable	442.8	538.7	543.8	531.4	535.5	533.5
Total Inventories	566.8	568.8	623.7	635.3	602.8	633.2
Total Current Assets	1,133.7	1,072.8	1,160.0	1,228.8	1,148.5	1,251.5
Fixed Assets						
Gross Fixed Assets	687.0	4,333.2	4,366.9	4,386.7	4,416.2	4,500.8
Less: Accumulated Depreciation	104.2	378.8	649.8	922.9	1,197.4	1,473.3
Net value of fixed assets	582.8	3,954.5	3,717.1	3,463.8	3,218.8	3,027.5
Work-in-progress under World Bank Project	3,622.4					
Other work-in-progress	49.4	43.5	21.1	32.0	45.0	42.5
Total Fixed Assets	4,254.6	3,998.0	3,738.2	3,495.8	3,263.8	3,070.0
Intangible and Deferred Assets	3.3	3.0	2.6	2.3	2.0	1.8
Total Assets	5,391.5	5,073.8	4,900.7	4,726.9	4,414.3	4,323.3
LIABILITIES AND EQUITY						
Current Liabilities						
Accounts Payable	402.7	262.9	322.9	299.7	235.9	263.8
Other Payable	507.6	488.3	424.7	382.1	303.8	332.2
Short-term Loans	403.8	225.5	101.8	82.5	67.9	68.3
Short-term portion of long-term debt	181.1	184.5	196.1	230.7	288.4	240.8
Total Current Liabilities	1,495.2	1,161.2	1,045.4	995.0	895.9	905.1
Long-term liabilities						
World Bank Loan	781.4	742.4	690.3	638.2	586.1	534.0
Domestic Long-Term Loan	2,886.0	2,740.5	2,596.5	2,417.9	2,181.6	1,992.9
Total Long-term Liabilities	3,667.4	3,482.9	3,286.8	3,056.1	2,767.7	2,526.9
EQUITY						
Paid in Capital	203.3	369.8	442.5	475.2	475.2	526.1
Capital Reserve	7.9	7.9	15.2	15.2	15.2	15.2
Revenue Reserve	17.7	52.0	110.8	185.4	260.3	350.0
Total Equity	228.9	429.7	568.5	675.8	750.7	891.3
Total Liabilities and Equity	5,391.5	5,073.8	4,900.7	4,726.9	4,414.3	4,323.3
RATIOS						
Current assets/current liabilities	0.76	0.92	1.11	1.23	1.28	1.38
Long-term debt/LT Debt + equity	0.94	0.89	0.85	0.82	0.79	0.74
Total debt/equity	0.95	0.90	0.86	0.83	0.81	0.76
Debt Service Coverage Ratio		1.44	1.49	1.47	1.35	1.22

JPCC—PROJECTED CASH FLOW
(Y million)

	Base	Budget Period				
	Period 1996	1997	1998	1999	2000	2001
CASH SOURCES						
Operating Sources						
Net profit		45.7	88.1	99.4	99.8	115.9
Depreciation		255.7	265.7	270.2	272.3	272.3
Adjustments: noncash charges		0.3	0.3	0.3	0.3	0.3
Cash from operation		301.7	354.1	369.9	372.4	388.5
Other cash sources						
New equity		166.5	72.7	32.7	0.0	50.9
Net proceeds on assets disposal						
Extraordinary items		18.8	5.5	2.8	2.2	4.0
Cash from Financial Activities						
Short Term Loans						0.4
Long Term Loans						
TOTAL SOURCES		487.0	432.3	405.4	374.6	443.4
CASH USAGE						
Total Investment						
Expenditure on Fixed Assets		18.0	11.2	30.7	42.5	82.2
Increase in long-term investment						
Loan repayments						
Short Term Loans		178.3	123.8	19.3	14.6	0.0
Long Term Loans		181.1	184.5	196.1	230.7	288.4
Total Loan Repayments						
Dividends paid		11.4	22.0	24.8	24.9	26.2
Changes in Working Capital		199.0	75.6	89.3	77.1	4.0
TOTAL APPLICATIONS		587.8	417.0	360.1	389.9	400.7
Surplus cash (-deficit)		-100.7	15.2	45.3	-15.3	42.7
Cumulated surplus cash		-100.7	-85.5	-40.2	-55.5	-12.8

HPCC—Huangmailing

1. HPCC commissioned the mining and beneficiation in June 1994, the ammonia renovation was completed in April 1995, and qualified product MAP/DAP was produced in December 1996.

2. HPCC is working hard to attain reasonable production rates from the plants as early as possible. Some problems that have been found during commissioning are to be solved:

- Mining excavation equipment has lower productivity than design and operating hours have to be extended to compensate;
- Problems with the rubber lining of the phosphoric acid concentration section need to be solved;
- The double flap valves of the roaster section of the sulfuric acid plant are showing high wear and are not sealing correctly;
- Speed of the MAP elevator is incorrect—design fault; and,
- The storage for slurry is not sufficient (2-3 days) and needs to be increased for operational flexibility.

3. HPCC plans for production levels of 70 percent in 1997, 90 percent in 1998, and 100 percent in 2000 and onward. Most of the output will be marketed through negotiated contracts with large distribution companies, about 10 percent will be sold locally.

4. The existing facilities for Single Super Phosphate (SSP), Ammonium Bicarbonate (ABC), and Nitrogen Phosphorous Potassium Complex Fertilizer (NPK) will be kept in operation as sales of these products are good. HPCC will also examine recovery of products from the calcined pyrites and waste gypsum. It has already been successful in recovering carbon dioxide from the ammonia plant for sale to carbonated beverage producers.

5. HPCC is experimenting with substituting some of the pyrites to the sulfuric acid plant with sulfur to improve operation and decrease costs.

6. HPCC has made great efforts to digest and absorb the advanced international process technology and basically master the performance of equipment. These efforts will continue and the training center will continue in operation.

7. Environmental management of the “three wastes” has high priority so that the Huanshui River is not polluted.

8. The Provincial Government has already converted some of HPCC loan into equity, Y 518 million up to end 1996 and further amounts are expected in 1997. The rolling five year financial plans for HPCC are shown in the following tables.

HPCC—PROJECTED INCOME STATEMENT
(Y million)

	Base	Budget Period				
	Period 1996	1997	1998	1999	2000	2001
Net Sales Revenue	125.8	542.5	613.9	667.4	671.9	672.1
Less: Cost of Goods Sold	105.7	422.9	473.6	528.7	528.9	528.7
Selling Expenses	1.9	16.9	16.5	15.8	15.1	15.1
Profit on Goods Sold	18.2	102.7	123.8	122.9	127.9	128.3
Add: Other Business Profit	2.0	2.9	3.1	3.1	3.1	3.1
Less: General & Administrative Costs	11.9	18.3	19.8	19.0	18.9	18.8
Financial Expenses	4.3	78.6	76.2	72.1	66.4	59.7
Operating Income	4.0	8.7	30.9	34.9	45.7	52.9
Add: Income from Investment	0.2	0.3	0.3	0.3	0.4	0.4
Non-operating Income	1.5	1.7	1.8	1.7	1.7	1.8
Less: Non-operating Expenses	0.9	1	1.1	1.2	1.2	1.1
Gross Profit	4.8	9.7	31.9	35.7	46.6	54.0
Income Tax	0	0	0	0	0	0
Net Profit	4.8	9.7	31.9	35.7	46.6	54.0
RATIOS						
Net Profit/Sales	3.8%	1.8%	5.2%	5.3%	6.9%	8.0%

HPCC—PROJECTED BALANCE SHEET
(Y million)

	Base	Budget Period				
	Period	1997	1998	1999	2000	2001
	1996					
ASSETS						
Surplus cash (-deficit)	0.0	0.0	20.0	20.7	57.6	107.7
Cash & Bank Deposits	24.3	26.0	30.9	38.6	41.1	44.1
Accounts Receivable	15.0	50.1	61.9	66.7	67.8	68.6
Total Inventories	68.3	108.5	173.8	210.5	230.8	261.8
Total Current Assets	107.6	184.6	286.6	336.5	397.3	482.2
Fixed Assets						
Gross Fixed Assets	76.1	2,023.4	2,032.9	2,083.6	2,120.1	2,133.9
Less: Accumulated Depreciation	61.2	186.7	312.2	437.2	566.4	694.5
Net value of fixed assets	14.9	1,836.7	1,720.7	1,646.4	1,553.7	1,439.4
Work-in-progress under World Bank Project	1915.8					
Other work-in-progress	1.9	1.2	0.8			
Long-term bonds	1.3	3.4	4.6	14.4	23.7	26.2
Total Fixed Assets	1,933.9	1,841.3	1,726.1	1,660.8	1,577.4	1,465.6
Total Assets	2,041.5	2,025.9	2,012.7	1,997.3	1,974.7	1,947.8
LIABILITIES AND EQUITY						
Current Liabilities						
Accounts Payable	74.1	49.8	48.6	52.2	60.1	50.9
Short-term Loans	4.0	10.0	4.0	8.0	1.0	1.0
Short-term portion of long-term debt	26.2	37.3	48.7	70.2	81.7	83.4
Total Current Liabilities	104.3	97.1	101.3	130.4	142.8	135.3
Long-term liabilities						
World Bank Loan	306.2	307.6	290.3	271.6	251.5	229.8
Capital Construction Loan	1,110.3	672.7	652.7	622.7	572.7	512.7
Less: short-term portion of LT debt	26.2	37.3	48.7	70.2	81.7	83.4
Total Long-term Liabilities	1,390.3	943	894.3	824.1	742.5	659.1
Other Long-term Liabilities	20.4	10.6	10.0	0.0	0.0	10.0
EQUITY						
Paid in Capital	518.8	957.8	957.8	957.8	957.8	957.8
Capital Reserve	7.0	7.0	7.0	7.0	7.0	7.0
Revenue Reserve	0.7	10.4	42.3	78.0	124.6	178.6
Total Equity	526.5	975.2	1,007.1	1,042.8	1,089.4	1,143.4
Total Liabilities and Equity	2,041.5	2,025.9	2,012.7	1,997.3	1,974.7	1,947.8
RATIOS						
Current assets/current liabilities	1.03	1.90	2.83	2.58	2.78	3.56
Long-term debt/LT Debt + equity	0.73	0.49	0.47	0.44	0.41	0.37
Total debt/equity	0.73	0.50	0.48	0.46	0.43	0.39
Debt Service Coverage Ratio	1.39	2.04	2.06	1.94	1.76	1.79

HPCC—PROJECTED CASH FLOW
(Y million)

	Base	Budget Period				
	Period 1996	1997	1998	1999	2000	2001
CASH SOURCES						
Operating Sources						
Net profit	4.8	9.7	31.9	35.7	46.6	54.0
Depreciation	15.3	125.5	125.5	126.7	127.4	128.1
Adjustments: noncash charges	2.2	0.0	0.0	0.0	0.0	11.1
Cash from operation	22.3	135.2	157.4	162.4	174.0	193.2
Other cash sources						
New equity	75.5	439.0				
Net Proceeds on Assets Disposal	1.6	0.5	0.9	1.8	1.3	4.2
Extraordinary items						1.0
Cash from Financial Activities						
Short Term Loans		6.0		4.0		
Long Term Loans	249.6	17.9				
TOTAL SOURCES	349.0	598.6	158.3	168.2	175.3	198.4
CASH USAGE						
Total Investment						
Expenditure on Fixed Assets	345.9	31.5	10.0	49.9	37.8	18.0
Increase in long-term investment	0.5	2.1	1.2	9.8	9.3	2.5
Loan repayments						
Short Term Loans			6.0		7.0	
Long Term Loans	14.9	26.2	37.3	48.7	70.2	81.7
Other items	4.8	-1.5	0.6	13.5	-1.9	2.1
Debt-Equity conversion		439.0				
Net changes in working capital	-17.1	101.3	83.2	45.6	16.0	44.0
TOTAL APPLICATIONS	349.0	598.6	138.3	167.5	138.4	148.3
Surplus cash (-deficit)	0.0	0.0	20.0	0.7	36.9	50.1
Cumulated surplus cash	0.0	0.0	20.0	20.7	57.6	107.7

ANNEX 3: BORROWER'S CONTRIBUTION TO THE ICR

A. REVIEW BY MCI

Background

1. Hubei Phosphate Project (Loan No. 3066-CHA) focused on the development of an efficient domestic phosphate fertilizer industry by using local indigenous phosphate rock resources and was the fourth operation in a series of the World Bank interventions that aimed at assisting GOC's program for improving overall fertilizer sector performances. The GOC was going to establish two high-grade phosphate fertilizer production bases by using local phosphate rock resources in the Jinxiang and Huangmailing mine areas in Hubei province to increase domestic phosphate rock and phosphate fertilizer production and help reduce the imbalanced application of the three nutrients, namely nitrogen, phosphate and potash. The Project consists of the following three components:

(a) The Dayukou Phosphate Mine and Fertilizer Development Component, involving construction of: (i) a new open-pit mine of 1.5 million tpy ROM rock capacity; (ii) a 1.5 Mtpy ore feed beneficiation plant, to produce 0.65 million tpy of phosphate rock concentrate; (iii) a 560,000 tpy pyrites-based sulfuric acid plant; (iv) a 200,000 tpy phosphoric acid plant (100% P_2O_5); (v) a 560,000 tpy TSP plant; (vi) a 10,000 tpy aluminum fluoride plant; (vii) infrastructure.

(b) The Huangmailing Phosphate Mine and Fertilizer Development Component, involving construction of: (i) an open-pit mine of 1.0 Mtpy ROM rock capacity; (ii) a 1.0 Mtpy ore feed beneficiation plant, to produce 0.30 million tpy of phosphate rock concentrate (33% P_2O_5); (iii) a 280,000 tpy pyrites-based sulfuric acid plant; (iv) a 93,000 tpy phosphoric acid plant (100% P_2O_5); (v) a 180,000 tpy DAP/MAP plant; (vi) a 6,000 tpy sodium fluorosilicate plant; (vii) expansion of the existing coal-based ammonia/ABC plant from 15,000 tpy of gaseous to 30,000 tpy of anhydrous liquid NH_3 ; (viii) infrastructure.

(c) The Technical Assistance Component:

(i) Consultant Services for Project Implementation. This technical assistance will provide internationally experienced consultants for MCI's project coordination team, who will help the team and the project companies with: (a) selection and procurement of appropriate technologies and equipment; (b) timely identification and resolution of problems with project implementation; (c) training of project management team staff; (d) preparation of staff recruitment and training programs; (e) implementation of a preventive mine workshop maintenance system; and (f) development

of the Project Implementation Management System for the two project companies.

(ii) Training in Hazard and Operability Analysis. In order to stimulate and improve awareness for safety and operability aspects among related Chinese government agencies, research and design institutes and enterprises involved in the chemical processing industry, and to strengthen the capabilities of Chinese design institutes for identifying and analyzing potential sources of safety hazards and major production losses in chemical plant design and operations, MCI will sponsor a workshop on modern methodologies for hazard and operability analysis, with assistance from internationally experienced consultants.

Implementation Review

2. Overall, the implementation and performance of the Project are considered very satisfactory together with project scope optimization and compliance with project objectives. The completion of the two project components has increased China's high-grade phosphate fertilizer production even further after the operation of the Guizhou (Wengfu) Phosphate Development Project, thus improving the balance of the three nutrients.
3. Final performance tests have verified that the imported technologies and equipment were advanced, reliable and up to the design standards (excluding the hydraulic excavators of the mine and ball mills of Dayukou component, which can not reach full capacity due to technical problems). The professional skills of staff at virtually all levels and enterprise management standards have been significantly enhanced by adoptive of imported technology and equipment and by intensive internal and external training and consulting services. The performances of the production facilities for the two project companies have attained internationally advanced levels not only in terms of efficiency, reliability and product quality but also in human resources development.
4. One component of the technical assistance component-Consultant Services for Project Implementation was completed and achieved the expected objectives.
5. The processes, technologies and equipment were selected with assistance from the Jacobs Engineering Group Inc. of the United States, Mr. F. Sheldrick (a senior fertilizer specialist engaged by the Bank, also the Bank's former employee), the CHEM Systems International LTD and the BETE Inc. of the States. The performance tests verified the international competitiveness of the technology and the equipment in terms of efficiency and reliability.
6. The consultant Services for Project Implementation were provided by Mr. Dahan, a senior consultancy specialist recommended by the Bank. Mr. Dahan visited the project sites for three times, identifying and resolving various issues with project implementation with respect to technical (beneficiation processes; piping and filtration of concentrate

slurry; transportation, storage and disposal of pyrites cinder and phosphogypsum; environmental protection; erosion prevention and the safe transport of anhydrous liquid ammonia) and managerial problems (development of PMIS, MIS and FMIS). Mr. Dahan's suggestions in addressing those problems were basically accepted and implemented and contributed a lot to the smooth implementation of the Project.

7. The other component of the technical assistance-Training on Hazard and Operability Analysis has not been carried out due to lack of funds (During project appraisal, an understanding was reached that the financing for this project component would be covered by the bilateral aid and IDA's technical cooperation credit, but till now the funds has not been available yet.).

MCI's Role in Project Implementation

8. Through its Foreign Funds Utilization Office (FFUO), MCI's role in the execution of the Project was to supervise implementation of all project components, regularly review progress on project implementation and coordinate the efforts of all the related government agencies to remove implementation constraints.

Cooperation with the World Bank

9. During the whole course of the project implementation, the cooperation between the Foreign Funds Utilization Office (FFUO) on behalf of MCI and the Bank has been very satisfactory. Whenever difficulties or problems arose, they were promptly identified and resolved through bilateral friendly discussions and consultations. The guidelines and procedures adopted by the Bank in appraising and implementing the project were concise, scientific and efficient. Bank requirements and suggestions to the executing agencies were rational and accepted. Generally, Bank officials in charge of appraisal and implementation supervision as well as the technical specialists engaged for the Project were skillful, competent and responsible. They have played an important role in the implementation of the Project.

Lessons Learned and Prospects

10. As an agriculture-oriented country with a population of over 1.2 billion, China needs to continue to import large quantities of fertilizer to respond to the ever-increasing demand of its agriculture sector. But in the long run, China will have to set up a sound and competitive domestic fertilizer industry to support a sustained agricultural development in an environment that calls for substantial increases in yield and variety. Particularly, priority should be given to the development of its phosphate fertilizer sector due to the imbalanced production of the three nutrients (oversupply of nitrogen, insufficient supply of phosphate and lack of potash). China's relatively rich phosphate rock resources provides good opportunities for the development of its phosphate fertilizer industry. In this context, Bank-financed projects aimed to increasing China's phosphate fertilizer production with local indigenous phosphate rock resources complies with the

GOC's fertilizer industry development strategy. We hope the Bank will continue its assistance in this respect.

11. Out of various reasons, the completion dates for the two project components were delayed for 2-3 years, which affected their respective economic benefits significantly. On the other hand, since demands for high-grade phosphate fertilizer in the domestic market remain high, the social and economic benefits of the two project components will demonstrate after the commercial operation of the production facilities.

12. The Technical Assistance Component stipulated during project negotiations is considered very helpful. The performance of the selected process technologies and equipment with assistance from internationally experienced consultants has attained international level, which ensured the successful implementation of the Project. The other TA component-Training in Hazards and Operability Analysis was not completed due to unavailability of the financing. We sincerely hope the Bank would provide further assistance so that we could complete this work in the near future.

B. THE DAYUKOU AND HUANGMAILING COMPONENTS

Section 1. Project Implementation and Assessment

Project Background

13. As an agriculture-based country that accounts for 22% of the world's population but only 85 of its cultivated area, The Chinese Government's major concern is how to produce maximum foodgrains on its limited cultivated land by means of scientific application of fertilizers so that China can achieve self-sufficiency in its basic food requirements. The soil fertility in a majority of the land is not good, and about 70% of which is lack of phosphate nutrient caused by low-application of phosphate fertilizer. Therefore, the Chinese Government is striving to increase the production of its phosphate fertilizer, especially high-grade phosphate fertilizers such as TSP and MAP/DAP. As one of the provinces in China which are endowed with large size phosphate rock deposits, Hubei province is located in central China and has good access transportation and sufficient power supply. Both Jinxiang and Huangmailing are existing state-owned mine areas, where phosphate rock reserves are large. In each of the two mine areas, there are production facilities for mine, beneficiation plant, some small existing SSP, NPK compound fertilizer, ammonia and ABC plants as well as related infrastructure. Based on the above considerations, the GOC decided to construct a 560,000 TSP plant and a 180,000 tpy MAP/DAP plant in each of the two mine areas.

Project Content

14. The Hubei Phosphate Project comprises the Dayukou Phosphate Mine and Fertilizer Development Component and the Huangmailing Phosphate Mine & Fertilizer Development Component. The Project's financing was jointly met by the World Bank loan, domestic loans arranged by GOC and the Hubei Provincial Government (HPG) and

internal funds of the project companies. The Dayukou component, which would be carried out by JPCC, involves establishment of: (a) a new open-pit mine of 1.5 Mtpy ROM rock capacity; (b) a 1.5 Mtpy beneficiation plant, to produce 0.65 million tpy of phosphate rock concentrate (P_2O_5 33%, $MgO < 1.5\%$); (c) a 560,000 tpy TSP plant, together with a pyrites-based sulfuric acid plant of 560,000 tpy capacity and a phosphoric acid plant of 200,000 tpy P_2O_5 capacity; (d) a 10,000 tpy aluminum fluoride plant; and (e) related infrastructure. The Huangmailing component, which would be carried out by HPCC, involves establishment of: (a) a new open-pit mine of 1.0 Mtpy ROM rock capacity; (b) a 1.0 Mtpy beneficiation plant, to produce 0.30 million tpy of phosphate rock concentrate (P_2O_5 33%, $MgO < 1.5\%$); (c) an MAP/DAP plant of 180,000 tpy capacity, together with a pyrites-based sulfuric acid plant of 280,000 tpy capacity and a phosphoric acid plant of 93,000 tpy P_2O_5 capacity; (d) a 6,000 tpy sodium fluorosilicate plant; (e) rehabilitation of a small coal-based ABC plant to produce 30,000 tpy of ammonia as feedstock for MAP/DAP production; and (f) related infrastructure.

Project Identification and Organization

15. In October 1985, the State Planning Commission (SPC) listed the two projects (the Dayukou and Huangmailing components) as standby World Bank loan projects; In December 1987, the Bank appraised the feasibility studies of the two projects; In September 1989, the Loan Agreement was signed jointly by the Chinese Government and the Bank and became effective in January 1990. The construction of the two project components was officially commenced in July 1990 and in June 1991 respectively. The two project components were rated as State key construction projects and enjoyed prioritized treatment in the provision of capital, electricity, fuels and raw materials.

16. MCI and HPG jointly established a Project Coordination Unit (PCU), under which are MCI's Foreign Funds Utilization Office (FFUO) and the Project Liaison Office of the Hubei Provincial Petrochemical Bureau (HPPB). The PCU will regularly review progress on project implementation and procurement and coordinate efforts to remove any constraints. Each of the two project companies established its own project management team charged with implementing its respective component (including planning of implementation schedule, financial management and expenditure control, procurement of equipment and materials, construction quality supervision, staff recruitment and training, and start-up and production preparation. The engineering contractor for the Huangmailing component was the China Wuhan Chemical Engineering Corporation (CWCEC). The construction quality supervision was done by the Changsha Chemical Design Institute. The procurement agency was the China National Chemical Construction Corporation (CNCCC) and the Hubei Provincial Finance Bureau was responsible for disbursement of the loan proceeds.

Project Implementation

17. In accordance with the stipulations of the Loan Agreement, the two project components would commence construction in September and be completed in September

1994. Actually, construction for the Huangmailing component began in July 1990 and was completed in June 1996, a delay of 1 and 2 years respectively relative to the forecast implementation dates; The Dayukou component construction began in June 1991 and was commissioned in June 1997, with delays of 2 and 3 years respectively compared to the original dates. The delays were caused by the following factors:

(a) As the total investment for Wengfu, Huangmailing and Dayukou projects was huge, the Chinese Government decided to carry out the three projects one by one so as to make full use of the limited construction funds and ensure the smooth implementation of the three projects;

(b) During project implementation, the total costs for the two project components increased by 3.5 times due to higher-than-expected inflation rate, increase of domestic loan interest rates and the fluctuation of foreign exchange rate. The Government had difficulties in raising the additional funds to meet the requirements of the project construction;

(c) The procedures adopted by certain domestic government agencies and the Bank in reviewing and approving the procurement packages were lengthy and troublesome, which affected procurement schedules for imported goods.

KEY MILESTONES FOR PROJECT IMPLEMENTATION

Milestone	Dayukou		Huangmailing	
	Target	Actual	Target	Actual
IPCC:				
TSP production tests	Sep 1989	Dec 1993		
Process selection and contract awards for process plants	Mar 1991	May 1991	Feb 1990	May 1991
Process selection and contract awards for AIF3 Plant	Jun 1990	May 1992		
Commencement of local engineering	Jan 1990	Oct 1991	Jan 1990	Aug 1991
Completion of local engineering	Mar 1992	Dec 1994	Feb 1992	Apr 1995
Commencement of foreign engineering	Apr 1990	Oct 1992	Mar 1990	Oct 1991
Completion of foreign engineering	Sep 1991	Jun 1994	Sep 1991	Jul 1994
Commencement of international procurement	Apr 1990	Oct 1991	Apr 1990	Jun 1992
Completion of international procurement	Sep 1992	Jun 1995	Sep 1992	Jan 1995
Commencement of site preparation	Jan 1989	Oct 1990	Jan 1990	Mar 1992
Completion of civil work	Sep 1992	May-93	Sep 1992	Aug 1995
Railway siding commencement			Sep 1992	Apr 1993
Railway completion			Sep 1993	Apr 1994
Dawu ammonia plant rehabilitation commencement			Apr 1991	Aug 1992
Dawu ammonia plant rehabilitation completion			Mar 1993	Dec 1994
Commencement of equipment installation	Apr 1992	Jun 1992	Apr 1992	Oct 1994
Mechanical completion	Sep 1993	May 1997	Sep 1993	Apr 1996
Completion of commissioning	Mar 1994	Apr 1997	Mar 1994	Jun 1996
Commencement of commercial production	Apr 1994	May 1997	Apr 1994	Jan 1997

The Achievement of Project Objectives

18. Physical Objectives. (a) The mine for the Dayukou component was completed in October 1995, and the 72-hour load run and performance tests were carried out in

December of the year; The sulfuric acid plant was commissioned in June 1996, and the load run and performance tests were carried out in September last year; The phosphoric acid plant was commissioned in February, and load run and performance tests were carried out in April this year; The TSP plant was commissioned in September 1996 and produced up-to-standard granular SSP fertilizer temporarily. The 72-hour load run and performance tests were conducted in May this year. (b) The mine for the Huangmailing component was completed in April 1994, and the 72-hour load run and performance tests were carried out in June of that year; The sulfuric acid plant was commissioned in October 1995, and the load run and performance tests were carried out in December last year; The phosphoric acid and MAP/DAP plant was commissioned in June last year, and load run and performance tests were carried out at the year end; The ammonia plant was commissioned in October 1994 and the 72-hour load run and performance tests were conducted in December of that year.

19. Managerial Objectives The two project components have adopted internationally advanced technologies and management practices imported from abroad. The whole production facilities have achieved automatic control and computerized operational management, thus improving production efficiency significantly. Each of the two project companies, namely JPCC and HPCC, has already established its own project management team charged with implementing its respective component. Each of the two project companies comprises its own mine, beneficiation plant and individual chemical plants, and each plant is divided into production sections or workshops. With assistance from the Bank, the financial management in the two companies has been strengthened. The two project companies regularly submitted to the Bank the audited financial statements and other reports in line with the Bank's requirements.

20. Economic Objectives (a) In terms of 1987 price, the forecast economic benefits for the Dayukou component were as follows: The component would generate 460 million Yuan of annual sales revenue and 190 million Yuan of profits and tax p.a.; The FIRR would be 13.08%, and the investment repayment period 10.94 years. The total cost for the component jumped to 3.67 billion Yuan compared to the forecast of 1.466 billion Yuan in project appraisal, which was caused by higher-than-expected inflation rate, increase in local currency loan interest rate, fluctuation in foreign exchange rate and imposition of a new investment regulatory tax on capital construction projects. Based on the present price levels for raw materials, fuels and electricity, the selling prices of TSP and aluminum fluoride are 1,500 Yuan/ton and 5,000 Yuan/ton respectively. When full capacity is reached, the project component will bring about 900 million Yuan in sales revenue and 126 million Yuan in profits and tax annually, and the investment repayment period will be 13.21 years. (b) In terms of 1987 price, the forecast economic benefits for the Huangmailing component were as follows: The component would generate 150 million Yuan of annual sales revenue and 80 million Yuan of profits and tax p.a.; The investment rate would be 28.5%, and the investment repayment period 13 years. The total cost for the component jumped to 3.67 billion Yuan compared to the forecast of 1.466 billion Yuan in project appraisal, which was caused by higher-than-expected inflation rate, increase in local currency loan interest rate, fluctuation in foreign exchange rate and imposition of a

new investment regulatory tax on capital construction projects. Based on the present price levels for raw materials, fuels and electricity, and the selling price of DAP as 2,250 Yuan/ton, when full capacity is reached, the project component will bring about 430 million Yuan in sales revenue and 81 million Yuan in profits and tax annually, and the investment repayment period will be 19.07 years (including construction period).

Project Outcome

21. Social Benefits of the Project. The two project components were rated as the State's key agriculture-supporting projects that would bring about significant social benefits. When the Project is put into commercial production, it will produce 560,000 tons of TSP and 180,000 tons of MAP/DAP fertilizer annually for China's agricultural sector, accounting for 21.5% of total production of China's high-grade phosphate fertilizer. According to the estimate by agricultural departments, the newly-added fertilizer from the Project will increase foodgrains production by 2.5 million tons annually, or bring about an annual income of 430 million Yuan to Chinese farmers. In addition, the completion of the Project will save more than \$140 million worth of foreign exchange annually, which otherwise would have to be used to import the same amount of fertilizer.

Performance of the Bank

22. Throughout the implementation period of the two project components, the Bank sent several supervision missions to the project sites, which assisted MCI and the two project companies to review project implementation statues and address project implementation difficulties in an orderly manner. The Bank's assistance proved very helpful in project identification, process and product line selection and procurement of equipment and materials, as well as in project management, implementation schedule supervision, expenditure control, financial management and staff training. The Bank officials in charge of the Project specialists and consultants engaged have given many valuable recommendations and contributed a lot to the completion and commissioning of the project facilities. On the other hand, the procedures adopted by the Bank in reviewing and approving procurement packages of technology and equipment were lengthy, sometimes the officials in charge were not available at all, thus affecting procurement efficiency. We hope the Bank will make some changes in this respect.

Performance of the Borrower

23. MCI and HPG jointly established a Project Coordination Unit (PCU), under which are MCI's Foreign Funds Utilization Office (FFUO) and the Project Liaison Office of the Hubei Provincial Petrochemical Bureau (HPPB) to consolidate the project implementation work. The PCU will regularly review progress on project implementation and procurement and coordinate efforts to remove any constraints. Each of the two project companies established its own project management team comprising experienced technical and managerial personnel (They have been given intensive external and internal training.) that was charged with implementing its respective component. The major tasks

for the team included planning of implementation schedule, financial management and expenditure control, procurement of equipment and materials, construction quality supervision, staff recruitment and training, working-out work schemes and various regulations, and start-up and production preparation. With assistance from Bank's specialists and international consultants, a computerized management system was adopted in planning and accounting management. The capabilities of domestic research and design institutes in chemical plant design and construction project management have been strengthened by implementing the Project. The knowledge on the imported processes and technologies with internationally advanced levels was digested, and the operational features of the imported equipment mastered. The completion of the Project marks the establishment of China's first large-scale phosphate mine and fertilizer development projects. In addition, a large number of technical and managerial professionals emerged and a management mechanism in line with modern corporate system was established within the two project companies. Now that the two project components are completed and put into commercial production, they will give full play to their economic and social benefits continuously.

24. The Start-up of the project construction was delayed due to sharp increase in the total cost. The implementation period was further delayed in part caused by delays in mobilization of the local currency funds needed for construction and in reviewing and approving procurement packages, thus reducing its financial and economic benefits.

Consultant Services Assessment

25. With assistance from the Jacobs Engineering Group Inc. of the United States, the two local design institutes, namely CMRDI and CMPDI, prepared the feasibility studies for the mines and beneficiation plants of the Dayukou and Huangmailing components respectively.

26. With assistance from the CHEM Systems International LTD and the BETE Inc. of the United States, the two local design institutes (NCEDI & WCEDI) prepared the feasibility studies for the chemical plants of the two project components.

27. Mr. F. Sheldrick (a senior fertilizer specialist engaged by the Bank, also the Bank's former employee) was engaged to help the project companies with: (a) selection and procurement of appropriate technologies and equipment; (b) engagement of engineering contractors; and (c) preparation of bidding documents.

28. The consultant Services for Project Implementation were provided by Mr. Dahan, a senior consultancy specialist recommended by the Bank. Mr. Dahan put forward many useful recommendations in project construction management, production and accounting management, commissioning preparation, staff training, equipment maintenance and institutional capacity building. Mr. Dahan also helped identify and resolve various technical problems with the chemical plants facilities (piping and filtration of concentrate slurry; transportation, storage and disposal of phosphogypsum; environmental protection; and safe transport of anhydrous liquid ammonia).

29. A few experienced domestic consultants were also engaged to provide needed consultancy services in technical and managerial aspects of the project implementation. For example, Mr. Han Qingchun, former chief engineer of the Design Institute under the Nanjing Chemical Industry Corporation, was engaged for the Dayukou component; Professor Wang Cunxin, a senior specialist on sulfuric acid production from the Wuhan University was employed for the Huangmailing component.

30. A commissioning assistance team composed of experts and technicians from the Yunnan Yunfeng Chemical Industry Company and the Nanjing Chemical Industry Company provided all-round services for the commissioning of the two project components.

Operation Status

31. The facilities for the mines, beneficiation plants and related infrastructure of the two project components have been commissioned and put into commercial operation. Due to quality problems of the hydraulic excavators (manufactured with technology imported from Germany), the mines did not reach full production capacities. The ball mills procured from the MPSI Company of the United States for the Dayukou component achieved only 80% of its nominal capacity. At present, the two project companies are asking the suppliers to take effective measures to improve the performances of the equipment, at the same time, the two companies are making their own efforts so that the equipment can achieve full capacities as soon as possible. The Huangmailing component will reach a production capacity of 1.0 Mtpy of ore and 300,000 tpy of phosphate rock concentrates by 1997; And the Dayukou component will produce 1.1 Mtpy of phosphate ore and 340,000 tpy of phosphate rock concentrate.

32. All the chemical plants of the two project components have been commissioned and put into commercial production. The projected production for the Dayukou component in 1997 is as follows: 400,000 tpy of sulfuric acid, 170,000 tpy of phosphoric acid (100% P_2O_5), 220,000 tpy of TSP and 4,000 tpy of aluminum fluoride. The estimated production for the Huangmailing component in 1997 is as follows: 230,000 tpy of sulfuric acid, 76,000 tpy of phosphoric acid (100% P_2O_5), 148,000 tpy of DAP fluoride. It is expected each of the two project components will reach its respective production capacity in 2-3 years.

Project Sustainability

33. As an agriculture-based country with a population of over 1.2 billion, the agriculture sector has always been the foundation and development priority of China's national economy. The demand for fertilizer from agricultural sector has been increasing steadily. China has always held that the supply of fertilizer relies mainly on its domestic production and fertilizer imports should only be used as a supplement to domestic production in variety and quantity. In the long run, there will be no difficulties in the selling of the fertilizer products from the two project components. Significant economic and financial benefits were estimated at project appraisal. However, these benefits are

lower than originally forecast that were caused by a few certain factors: First the Project's total cost was 3.5 times larger than appraisal estimate; Secondly, the two project component were commissioned only a few month ago; Thirdly, the reform on the pricing policy is only at an early stage and the priority policies in provision of funds for fertilizer project construction have not been in place. With the deepening of China's economic reform, adopting of various priority policies for state-owned fertilizer enterprises and effective control over fertilizer imports quantity, the pricing policy for domestic fertilizer products will gradually become rationalized. In addition, with the commercial operation of the production facilities and strengthening of management levels of the project companies, the Project is considered likely to be financially and economically viable and fully sustainable.

Project Financial Cost

34. The total financing required for the Dayukou component was estimated at 1.06 billion Yuan in the feasibility study, of which US\$ 94.15 million was from the IBRD loan; The cost estimate was adjusted to 1.46 billion Yuan when the component commenced construction; The total cost jumped to 3.67 billion Yuan as a result of higher-than-expected inflation, increase in local currency loan interest rate and fluctuation in foreign exchange rate, 3.5 times larger than appraisal forecast.

35. The total financing required for the Dayukou component was estimated at 516 million Yuan in the feasibility study, of which US\$ 42.85 million was from the IBRD loan; The cost estimate was adjusted to 680 million Yuan when the component commenced construction; The total cost jumped to 1.92 billion Yuan as a result of higher-than-expected inflation, increase in local currency loan interest rate and fluctuation in foreign exchange rate, 3.7 times larger than appraisal forecast.

Conclusions

36. Generally, the identification of the project components and achievement in project objectives is satisfactory. As the first-batch mine and fertilizer development projects in China, both the Dayukou and Huangmailing component focused on the development of high-grade phosphate fertilizer (TSP and DAP/MAP) with domestic indigenous phosphate rock resources. The geographic locations of the two project components were considered ideal in terms of transport of inputs and outputs. The load run tests for the two project components were successful. At present the trial production is well underway in the project companies, with product quality up to design standard and emission levels within the national permission standards.

37. The imported technologies and equipment are advanced and meet the requirements of the production processes and local real situations. With the implementation of the project, introduction of internationally advanced technologies and high-performance equipment and intensive internal and external training for the staff, the technical and equipment levels in the two project components have been improved

significantly. The successful experiences in the implementation of the Project can be copied to similar projects in the future.

38. The economic and social benefits of the Project are considered satisfactory.

39. Throughout the course of the project implementation, the World Bank assigned several supervision missions to the project sites to help resolve various implementation issues and provide all-round assistance in project components identification, selection of processes and equipment and construction supervision; The Chinese government agencies at all levels and related domestic financial institutions also made efforts in supervising project implementation and providing various assistance; The China National Chemical Construction Corporation (CNCCC) did a very good job in the procurement of technologies and equipment with the Bank loan proceeds. The efforts of all these parties contributed to the smooth implementation of the Project.

BORROWER'S COMMENTS ON DRAFT
IMPLEMENTATION COMPLETION REPORT

To: Mr. Roger Heath:
Principal Chemical Engineer

From: FFUO MCI
Beijing .China.

Fax: 001-202-5220396

Fax: 0086-10-64915441

Date: 05/06/1998

Page: 3

Re: Hubei Phosphate Project (Loan 3066-CHA)

Dear Mr. Roger Heath:

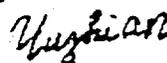
We acknowledge the receipt of the draft Implementation Completion Report on Hubei Phosphate Project (Loan 3066-CHA) which you asked Mr. George Plant to pass on to us for our comments. After consulting the two project companies, we give the following comments on the ICR for your consideration.

- I. In paragraph 1 in the Evaluation Summary of the ICR, the Fertilizer Rehabilitation and Energy Saving Project (Loan 2541-CHA) should contain five large- and medium-sized ammonia/urea plants, rather than four plants;
- II. In paragraph 3 in the Evaluation Summary of the ICR, based on the relevant data in the revised Table 9B (enclosed), the economic rate of return (ERR) for Huangmailing should be 7%. Accordingly, the financial rate of return (FRR) and economic net present value for Huangmailing should also be renewed;
- III. In paragraph 9 in Part I of the ICR, it should be noticed that the Bank promised to secure the financial requirements needed for HAZOP training at the early stage, but failed to do so. Therefore, failure to secure bilateral financing and implement the component should not be MCI's fault;
- IV. In paragraph 12, the ERR value for Huangmailing should be renewed. Accordingly, the relevant statements should also be revised;
- V. As mentioned above, failure to secure the financing needed for HAZOP training (paragraph 17, page 7) should not be included in the "Factors Subject to the Borrower's Control";

- VI. About the Project Sustainability (paragraph 19, page 7), the ICR gives the following expression: "Due to high investment costs the economic benefits from Huangmailing will be unsatisfactory. The project is thus considered to be not sustainable". We suggest that this expression be adjusted as follows: "Due to delays in project implementation, excessive overrun of the project costs and short of equity investment, the economic rate of return for the project will be unsatisfactory. Provided that the necessary equity investment is secured, the operation conditions improved and operation supervision strengthened, the project will be marginally sustainable."
- VII. In "STATISTICS TABLES" in Part II, Table 9B should be replaced by the revised one (attached), the data for "domestic revenue" and "variable costs" should be revised. Accordingly, the ERR will be 7% and NPV -279.22.

Best regards

Yours sincerely



Yu Zhi-an

CC: Mr. Hoon Mok Chung Sector Manager
Mr. George Plant Chief of Operations Unit,
World Bank Department MOF.

TABLE 9B: ECONOMIC COSTS AND BENEFITS - HUANGMAILING

Yuan (millions)	Actual							Projection						
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Capital Costs														
Total Project Cost	-70.6	-106	-141.3	-141.3	-247.3	-545.9	-325.7	0	0	0	0	0	0	0
Increase in Working Capital							-29.1	0	-2.4	-4.9	-4.9	0	0	0
Incremental Revenue														
Domestic Revenue								107.3	279	343.44	429.3	429.3	429.3	429.3
Incremental Operating Cost														
Variable Costs								40.9	117.7	147.1	156.8	156.8	156.8	156.8
Fixed Costs								71.2	71.2	71.2	71.2	71.2	71.2	71.2
Total Incn Operating Cost								112.1	188.9	218.3	228	228	228	228
Incremental Operating Benefit								-4.77	90.15	125.14	201.3	201.3	201.3	201.3
INCREMENTAL BENEFIT	-70.6	-106	-141.3	-141.3	-247.3	-545.9	-354.8	-4.77	87.75	120.24	196.4	201.3	201.3	201.3

Yuan (millions)	Projection													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Capital Costs														
Total Project Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Increase in Working Capital	0	0	0	0	0	0	0	0	0	0	0	0	0	41.3
Incremental Revenue														
Domestic Revenue	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3	429.3
Incremental Operating Cost														
Variable Costs	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8	156.8
Fixed Costs	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2	71.2
Total Incn Operating Cost	228	228	228	228	228	228	228	228	228	228	228	228	228	228
Incremental Operating Benefit	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3
INCREMENTAL BENEFIT	201.3	242.6												

ERR	7.00%
NET PRESENT VALUE	-279.22
(DISCOUNT RATE)	10%