

ASIAN DEVELOPMENT BANK

PCR: PRC 28241

PROJECT COMPLETION REPORT

ON THE

ANHUI ENVIRONMENTAL IMPROVEMENT PROJECT

FOR INDUSTRIAL POLLUTION ABATEMENT
(Loan 1491-PRC)

IN THE

PEOPLE'S REPUBLIC OF CHINA

October 2004

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

		At Appraisal (15 October 1996)	At Project Completion (1 June 2004)
CNY1.00	=	\$0.1200	\$0.1200
\$1.00	=	CNY8.3364	CNY8.2769

ABBREVIATIONS

ADB	–	Asian Development Bank
AEPB	–	Anhui Environmental Protection Bureau
APG	–	Anhui Provincial Government
AVP	–	Anhui Vinylon Plant
CDCC	–	Chaohu Dongya Cement Company
COD	–	chemical oxygen demand
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
HCFP	–	Hefei Chemical Fertilizer Plant
HCW	–	Hefei Chemical Works
HISC	–	Hefei Iron and Steel Corporation
IEMP	–	integrated environmental management plan
NH ₃ -N	–	ammonia nitrogen
PCR	–	project completion report
PIA	–	project implementing agency
PMO	–	project management office
PRC	–	People's Republic of China
TA	–	technical assistance
WACC	–	weighted average cost of capital

WEIGHTS AND MEASURES

m ³	–	cubic meter
mg/l	–	milligrams/liter
t	–	ton

NOTE

In this report, "\$" refers to US dollars.

CONTENTS

	Page
BASIC DATA	ii
I. PROJECT DESCRIPTION	1
II. EVALUATION OF DESIGN AND IMPLEMENTATION	2
A. Relevance of Design and Formulation	2
B. Project Outputs	2
C. Project Costs	5
D. Disbursements	5
E. Project Schedule	6
F. Implementation Arrangements	6
G. Conditions and Covenants	6
H. Related Technical Assistance	7
I. Consultant Recruitment and Procurement	7
J. Performance of Consultants, Contractors, and Suppliers	8
K. Performance of the Borrower and the Executing Agency	8
L. Performance of the Asian Development Bank	8
III. EVALUATION OF PERFORMANCE	8
A. Relevance	8
B. Efficacy in Achievement of Purpose	9
C. Efficiency in Achievement of Outputs and Purpose	10
D. Preliminary Assessment of Sustainability	11
E. Environmental, Sociocultural, and Other Impacts	11
IV. OVERALL ASSESSMENT AND RECOMMENDATIONS	12
A. Overall Assessment	12
B. Lessons Learned	13
C. Recommendations	13
APPENDIXES	
1. Chronology of Major Events	14
2. Cost Breakdown by Project Components	17
3. Project Cost and Financing Sources	19
4. Projected and Actual Loan Disbursements	20
5. Project Implementation Schedule	21
6. Organization Charts of Project Implementing Agencies	23
7. Compliance with Loan Covenants	27
8. Summary of Contract Packages	33
9. Water Quality and Wastewater Analysis	36
10. Financial Performance of Subproject Enterprises	38
11. Financial Reevaluation	42
12. Economic Reevaluation	48

BASIC DATA

A. Loan Identification

1.	Country	People's Republic of China
2.	Loan Number	1491-PRC
3.	Project Title	Anhui Environmental Improvement for Industrial Pollution Abatement Project
4.	Borrower	People's Republic of China
5.	Executing Agency	Anhui Provincial Government
6.	Amount of Loan	\$112.0 million
7.	PCR Number	PRC 822

B. Loan Data

1.	Appraisal	
	– Date Started	22 Jul 1996
	– Date Completed	16 Aug 1996
2.	Loan Negotiations	
	– Date Started	16 Oct 1996
	– Date Completed	18 Oct 1996
3.	Date of Board Approval	26 Nov 1996
4.	Date of Loan Agreement	16 Jul 1997
5.	Date of Loan Effectiveness	
	– In Loan Agreement	14 Oct 1997
	– Actual	14 Oct 1997
	– Number of Extensions	None
6.	Closing Date	
	– In Loan Agreement	30 Jun 2001
	– Actual	18 Feb 2004
	– Number of Extensions	Two
7.	Terms of Loan	
	– Interest Rate	Pool-based variable lending rate for \$
	– Maturity	20 years
	– Grace Period	4 years
8.	Terms of Relending	
	– Interest Rate	Pool-based variable lending rate for \$
	– Maturity	14 years
	– Grace Period	4 years
	– Second-Step Borrower	Anhui Provincial Government
9.	Terms of Onlending	
	– Interest Rate	Pool-based variable lending rate for \$
	– Maturity	14 years
	– Grace Period	4 years

– Third-Step Borrower	Subproject 1:	Chaohu Dongya Cement Company
	Subproject 2:	Hefei Sifang Chemical Industrial Group Company
	Subproject 3:	Anhui Chlor-Alkali Chemical Group
	Subproject 4:	Hefei Iron and Steel Corporation

10. Disbursement

a.	Dates			
	Initial Disbursement	Final Disbursement	Time Interval	
	15 Apr 1998	13 Feb 2004	68 months	
	Effective Date	Original Closing Date	Time Interval	
	14 Oct 1997	30 Jun 2001	43 months	
b.	Amount (\$ million)			

Category	Original Allocation	Last Revised Allocation	Amount Canceled	Amount Disbursed
Equipment and Materials	84.10	102.90	3.23	99.67
Training	0.60	0.00	0.00	0.00
Consulting Services	0.80	0.00	0.00	0.00
Interest during Construction	11.20	9.10	0.00	9.10
Unallocated	15.30	0.00	0.00	0.00
Total	112.00	112.00	3.23	108.77

Source: Asian Development Bank.

11.	Local Costs (ADB Financed)	
	- Amount (\$)	0

C. Project Data

1. Project Cost (\$ million)

Cost	Appraisal Estimate	Actual
Foreign Exchange Cost	122.40 ^a	108.77
Local Currency Cost	143.60	61.60
Total	266.00	170.37

^a Each project implementing agency provided \$10.4 million for civil works.

2. Financing Plan (\$ million)

Cost	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
Implementation Costs						
Borrower Financed	0.00	67.00	67.00	0.00	50.81	50.81
ADB Financed	111.60	0.00	111.60	99.67	0.00	99.67
Other External Financing	0.00	62.60	62.60	0.00	7.26	7.26
Subtotal	111.60	129.60	241.20	99.67	58.07	157.74
IDC Costs						
Borrower Financed	0.00	14.00	14.00	0.00	3.53	3.53
ADB Financed	10.80	0.00	10.80	9.10	0.00	9.10
Other External Financing	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal	10.80	14.00	24.80	9.10	3.53	12.63
Total	122.40^a	143.60	266.00	108.77	61.60	170.37

ADB = Asian Development Bank, IDC = interest during construction.

^a Each project implementing agency provided \$10.4 million for civil works.

3. Cost Breakdown by Project Component (\$ million)

Component	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
A. Base Cost						
Preliminary Expenses	0.00	0.00	0.00	0.00	2.60	2.60
Land Acquisition	0.00	2.60	2.60	0.00	3.72	3.72
Site Preparation	0.00	1.30	1.30	0.00	0.77	0.77
Engineering and Design	1.50	5.20	6.70	0.00	2.93	2.93
Equipment and Material (major process)	79.00	11.90	90.90	99.67	0.94	100.61
Auxiliary Equipment	3.40	3.60	7.00	0.00	1.06	1.06
Import Duties	0.00	34.20	34.20	0.00	0.00	0.00
Domestic Transport	0.00	2.00	2.00	0.00	0.21	0.21
Construction and Erections	10.40	46.50	56.90	0.00	42.06	42.06
Consulting Services	1.10	0.00	1.10	0.00	0.00	0.00
Training	0.50	0.90	1.40	0.00	0.28	0.28
Commissioning and Start Up	0.10	1.10	1.20	0.00	1.09	1.09
Energy and Environmental Management	0.00	0.50	0.50	0.00	0.67	0.67
Project Management	0.00	1.20	1.20	0.00	1.75	1.75
Subtotal (A)	96.0	111.10	207.10	99.67	58.07	157.74
B. Contingencies						
Physical	8.60	10.20	18.80	0.00	0.00	0.00
Price	7.00	8.30	15.30	0.00	0.00	0.00
Subtotal (B)	15.60	18.50	34.10	0.00	0.00	0.00
C. Interest During Construction						
	10.80	14.00	24.80	9.10	3.53	12.63
Total	122.40^a	143.60	266.0	108.77	61.60	170.37

^a \$10.4 million of civil works were funded by each project implementing agency.

4. Project Schedule

Milestone	Appraisal Estimate	Actual
Preliminary Design		
Subproject 1	Jun 1997	Jul 1997
Subproject 2	Mar 1997	Aug 1997
Subproject 3	Apr 1997	Aug 1997
Subproject 4	Jun 1997	Aug 1997
Preparation of Tender Documents		
Subproject 1	Nov 1997	Jul 1998
Subproject 2	May 1997	Feb 2000
Subproject 3	Dec 1997	Apr 1998
Subproject 4	Dec 1997	Aug 1998
Tender and Bid Evaluation		
Subproject 1	Mar 1998	Jun 1999
Subproject 2	Feb 1998	Jul 1999
Subproject 3	Apr 1998	May 2000
Subproject 4	Jun 1998	Sep 2001
Detail Design		
Subproject 1	Aug 1998	Sep 1998
Subproject 2	May 1998	Aug 1999
Subproject 3	May 1998	Jan 1999
Subproject 4	Jul 1998	Apr 1998
Equipment Delivery		
Subproject 1	Apr 1999	Sep 2000
Subproject 2	Mar 1999	Apr 2000
Subproject 3	Dec 1998	Jul 2001
Subproject 4	Jan 1999	Mar 2003
Civil Works		
Subproject 1	Aug 1999	Oct 2000
Subproject 2	May 1999	Dec 2000
Subproject 3	May 1999	Aug 2001
Subproject 4	Sep 1999	Apr 2002
Equipment Installation		
Subproject 1	Oct 1999	Dec 2000
Subproject 2	Oct 1999	Dec 2000
Subproject 3	Jul 1999	Feb 2002
Subproject 4	Oct 1999	Jul 2003
Commissioning		
Subproject 1	Jul 2000	Mar 2001
Subproject 2	Jul 2000	Sep 2001
Subproject 3	Jul 2000	Jul 2002
Subproject 4	Jul 2000	Nov 2003
Training		
Subproject 1	Aug 2000	Jan 2001
Subproject 2	Aug 2000	Feb 2000
Subproject 3	Aug 2000	Apr 2002
Subproject 4	Aug 2000	Sep 2003

5. Project Performance Report Ratings

Period	Rating	
	Development Objectives	Implementation Progress
From Dec 1998 to Feb 2004	Satisfactory	Satisfactory

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members ^a
Fact-Finding	5–22 May 1996	8	144	a,b,c,d,e,f
Appraisal	22 Jul–16 Aug 1996	10	260	a,b,c,e,f,g,h
Clarification Mission	17–23 Jun 1997	1	7	d
Review 1	29 Jul– 5 Aug 1997	2	16	a,b
Review 2	5–16 Oct 1998	2	24	a, i
Review 3	20–22 Sep 1999	2	6	a,i
Review 4	21–24 Jul 2000	2	8	a,i
Review 5	5–8 Feb 2001	2	8	l,j
Review 6	10–15 Jun 2002	2	12	l,i
Project Completion Review ^b	8–12 Jun 2004	6	30	k,l,m,n

^a a - engineer, b - financial analyst, c - environment specialist, d - senior investment officer, e - economist, f - programs officer, g - manager, h - counsel, i - assistant project analyst, j - senior. economist (environment), k - senior financial specialist; l - energy specialist, m - associate project analyst, n - staff consultant.

^b The Mission comprised S. F. Wong, senior financial specialist and mission leader; A. Bhargava, energy specialist; M. Kawashima, associate project analyst; and staff consultants.

I. PROJECT DESCRIPTION

1. Impressive and sustained economic growth in the People's Republic of China (PRC) since 1980 has led to rapid industrialization and acute environmental problems. In most urban areas, untreated industrial wastewater is the dominant source of water pollution. Anhui Province is one of the most heavily industrialized provinces in the PRC. Chao Lake located in the center of Anhui Province is the main source of water for about 8 million residents in the area, which includes the industrial cities of Hefei, the provincial capital (about 1.2 million) and Chaohu (about 0.25 million). The lake's water quality has been affected by the discharge of untreated wastewater from urban and industrial development in the basin.¹ Chao Lake was in danger of dying due to excessive eutrophication² with dire consequences for public health and economic development of the basin area. The Government formulated a 5-year action plan to restore the water quality in Chao Lake to make it a suitable source for urban water supply.

2. The main objective of the Project for Industrial Pollution Abatement, formulated together with the Municipal Wastewater Treatment Project,³ is to improve the water quality in Chao Lake and reduce wastewater and air and solid waste pollution in the cities of Hefei and Chaohu. During project processing, extensive discussions were held with the Government to prioritize investments in industrial enterprises that have the highest volume of wastewater generation and highest strength of pollutants. The Project also aimed to demonstrate the benefits of modern technology to reduce emissions, promote environmental awareness among industries, and strengthen the Government's capacity for enforcing stricter environmental compliance.

3. The scope of the Project and the related technical assistance⁴ (TA) includes (i) preparation of an integrated environmental management plan (IEMP) for the Chao Lake basin, (ii) institutional strengthening of concerned agencies, and (iii) technological restructuring of four major industrial polluters⁵ in the basin.

4. Anticipated outputs at appraisal included legal and regulatory reforms for environmental management; policy reform on product/commodity pricing to make it market-based; introduction of energy-efficient clean technology to reduce and/or treat industrial wastes (gaseous, solid, and liquid); training of staff on emission monitoring and reporting systems and maintenance of pollution control equipment; and governance reforms by corporatizing the four state-owned industrial enterprises, namely, Anhui Vinylon Plant (AVP), Hefei Chemical Fertilizer Plant (HCFP), Hefei Chemical Works (HCW), and Hefei Iron and Steel Corporation (HISC).

5. The Project was partly financed by an Asian Development Bank (ADB) loan of \$112.0 million from its ordinary capital resources. The loan carried a term of 20 years including a grace period of 5 years, and a variable interest rate. The loan proceeds were re-lent to the Anhui Provincial Government (APG), the Project's Executing Agency. APG, in turn onlent the proceeds to the four project implementing agencies (PIAs) representing the industrial subprojects.

¹ The water quality deteriorated to class V; class III is the minimum required water quality for urban water supply.

² Depletion of dissolved oxygen caused by growth of algae and other plants resulting from a high level of dissolved nutrients in the water.

³ Asian Development Bank. 1996. *Anhui Environmental Improvement Project for Municipal Wastewater Treatment and for Industrial Pollution Abatement*. Manila. It had two separate loans, one for municipal wastewater treatment and this Project for industrial pollution abatement. The project completion report for the Municipal Wastewater Treatment Project was prepared in March 2003.

⁴ Asian Development Bank. 1996. Technical Assistance to the People's Republic of China for *Formulating of an Integrated Environmental Management Plan for the Chao Lake Basin*. Manila.

⁵ Collectively, these four enterprises accounted for about 65% of wastewater generated by the most polluting industries in the Chao Lake basin

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

6. Economic reforms in the PRC have brought rapid urbanization and industrialization that have contributed to considerable environmental problems in major cities. The Government realizes the seriousness of these problems and is giving high priority to controlling environmental degradation. It has incorporated stricter environmental policies in its economic plans, and APG has followed this through with environmental protection policies of its own. This is consistent with one of ADB's thematic objectives for the PRC, that of enhancing environmental protection and natural resource preservation.

7. The Project addresses environmental issues from different perspectives, including support for regulatory reforms to manage and control pollution, institutional strengthening of concerned agencies, governance reform through privatization, and direct financing of energy-efficient clean technology for pollution abatement. Government reform efforts at appraisal to create a liberalized market-based business environment are still in effect, encouraging many state-owned enterprises to privatize their operations.

8. Project design was generally sound and in keeping with the environmental protection objectives of both ADB and the Government. The project preparatory TA adequately assessed the formulation of the various components. The project scope was established in consultation with the central and local governments, and project enterprises, and was well-defined. Policy dialogue during appraisal included strengthening the environmental legal framework, integrating environmental concerns into the planning process, building capacity for environmental management, and building a system of market-based incentives for enterprises. The major events in project implementation are listed in Appendix 1.

B. Project Outputs

1. Subproject 1: Anhui Vinylon Plant and Chaohu Dongya Cement Company

9. At appraisal, AVP was selected as a subproject to replace an outmoded cement plant by constructing a cement plant with clean technology and pollution control measures to dispose of toxic solid waste products from its vinylon manufacturing activities. AVP's project outputs include (i) construction and installation of a 620,000 ton/year cement plant and pollution control systems; (ii) provision of an environmental monitoring and process control system; (iii) construction of a wastewater collection system; (iv) construction of a 3,500 cubic meter (m³)/day wastewater treatment plant; (v) provision of vehicles for quarrying, sludge disposal, and conveyance; (vi) provision of laboratory equipment and materials; (vii) consulting services; and (viii) staff training.

10. In 1997, at the request of the Government, ADB agreed to a change in scope to subdivide this subproject into two components: Subproject 1a involved environmental modifications at AVP, including closure of the existing wet cement plant, to be executed by AVP; and subproject 1b involved construction of the cement clinker plant using solid wastes from AVP to be executed by Chaohu Dongya Cement Company (CDCC). AVP financed the environmental modifications at its plant with its own resources. AVP renovated five boilers in its power plant to solve the problem of particulate matter generated from its cement plant. Using electric pulse dust removal technology, the dry fly ash is collected and stored in a newly built dry ash storage warehouse, and used in cement production. AVP also renovated and expanded its existing biological treatment plant, increasing its capacity to treat 7,000 tons (t)/day of organic

wastewater. This enabled all the organic wastewater from the production lines of AVP to be fully treated to an average chemical oxygen demand (COD) concentration of less than 40 milligrams (mg)/liter, which meets the class II⁶ standard for wastewater treatment.

11. CDCC implemented subproject 1b in 2000 with ADB financing. A 2,000 t/day cement clinker production system was installed to use AVP's industrial solid waste, such as, calcium carbide residues, limestone tailings, lime powder, and fly ash. Impressed by the benefits of the new CDCC cement clinker plant, AVP decided to construct its own cement clinker plant to use its industrial waste for clinker production. CDCC was compelled to source solid wastes, mainly fly ash and ferric sulphate, from other industrial plants for its clinker production. In 2003, CDCC actually produced 781,000 tons of cement clinker. The wet cement plant at AVP has been closed down as required in the loan agreement. CDCC has established an environmental management division with four full-time staff, and an environmental monitoring system is in place.

2. Subproject 2: Hefei Chemical Fertilizer Plant

12. HCFP aimed to convert its outdated and polluting ammonium bicarbonate fertilizer process to a modern urea fertilizer plant. Project outputs include (i) a 150,000 t/year urea fertilizer production facility, including provision of a deep hydrolyzer system; (ii) a 200 m³/hour biochemical wastewater treatment facility; (iii) a 700 m³/hour coal gasification, ammonia, and carbon recovery system; (iv) an environmental monitoring and process control system; and (v) an on-site 18 m³/hour chemical wastewater treatment facility for soda ash and demineralized water system. The HCFP subproject was implemented as appraised. Before the Project, a high concentration of ammonia nitrogen (NH₃-N) wastewater was discharged directly, resulting in serious water pollution in the Shiwuli River. But with the wastewater treatment system, all wastewater is treated before discharge, and the NH₃-N content has been reduced to meet class II standard. In 2003, 921,000 t of wastewater was discharged containing 84.8 t of NH₃-N, 122 t COD discharge, and 0.488 t of phosphate. The urea production system with deep hydrolyzes was put into operation in February 2002, replacing the original ammonia bicarbonate production system. The switch from ammonium bicarbonate to urea is beneficial as a higher percentage of NH₃-N in the urea fertilizer can be absorbed by crops, hence contributing to a reduction of NH₃-N wastewater. Average daily urea production is about 440 t. In 2003, urea production was 132,633 t. In 1997 HCFP was privatized, under the name of Hefei Sifang Chemical Industrial Group, to produce diversified chemical products. It established a safety and environmental division with 13 staff to monitor and manage environmental results.

3. Subproject 3: Hefei Chemical Works

13. HCW aimed to replace the existing outdated diaphragm caustic soda process with an environmentally cleaner and more efficient membrane process. It envisaged (i) a 50,000 t/day clean production technology using a membrane process-based caustic soda production plant, (ii) electrical instrumentation and rectification system, (iii) environmental monitoring and process control system, (iv) on-site 100 m³/day wastewater collection and treatment facilities; (v) consulting services, and (vi) staff training. The HCW subproject was completed as planned. The wastewater treatment facility, in operation since October 1999, uses biological and chemical treatment processes. This enables more of the treated wastewater to be reused in caustic soda manufacturing—from 480,000 m³/year in 2000 to 960,000 m³/year in 2003. A new

⁶ Class II standard is one of the five classes. Class I, the highest standard, is for natural reserved and water supply sources with limited treatment. Classes II and III designate water for fishing and recreation, and may be used as water supply sources with full treatment. Class IV is water suitable for industrial uses and noncontact recreational uses. Class V denotes water for agricultural purposes and scenic viewing.

50,000 t/year caustic soda plant using ion membrane cell technology was installed and completed in 2000. This replaced the diaphragm cell plant that produced high concentrations of waste such as asbestos, lead, and asphalt. The new caustic soda plant reached 90% of its capacity in 2003 and is expected to reach full capacity in 2004. Together, the wastewater treatment facility and ion membrane caustic soda plant have helped to improve the wastewater discharged to class II standard. After enterprise reform in 2003 through capital restructuring of a debt to equity swap, HCW is now operating as Anhui Chlor-Alkali Chemical Group. Its Safety and Environmental Protection Division has 10 full-time staff responsible for safety and environmental management and monitoring.

4. Subproject 4: Hefei Iron and Steel Company

14. HISC was to replace the existing coking plant with modern coke ovens with pollution control facilities to capture marketable by-products and reduce dangerous atmospheric emissions. The subproject included (i) a 600,000 t/year coking plant with coal preparation and smoke dust treatment/air pollution control system; (ii) wastewater collection, treatment, and recycling systems; (iii) gas purification plant; (iv) environmental monitoring and process control system; (v) equipment and accessories; (vi) process designs, licenses, and patents; and (vii) consulting services and training. In 1999, HISC completed the installation of the wastewater treatment system consisting of three parts: production wastewater treatment, coal gas scrubbing wastewater treatment, and coking wastewater treatment. The treated coal gas wastewater is re-used, while the rest is discharged after treatment by biological and chemical process. In 2003, 38.89 million tons of wastewater were treated; all the treated water met class I standard for wastewater discharge. But the construction of coke ovens was delayed considerably mainly due to difficulty raising counterpart funds because of the Asian financial crisis. Domestic funding from China Construction Bank did not materialize as planned, and HISC had to divest its noncore activities to finance construction of the coke ovens. As planned at appraisal, the existing coking plant was to be dismantled after the successful installation of the first new coke oven and then the second new coke oven would be built in its place. After mobilization of adequate local funds, HISC proceeded to build the first coke oven and upgrade the coal preparation unit with clean production processes at the number 2 site, while still operating the old coke oven. Work started in December 2000 and the first new coke oven was formally put in production in November 2003. Although performance of the oven has yet to stabilize, results thus far show that the output of coke averages 850 t/day and its quality is grade 1. The second new coke oven is scheduled to be implemented as per the schedule in Table 1.

Table 1: Implementation Schedule for the Second Coke Oven at Hefei Iron and Steel Company

Item	Time
Dismantling of the Old Facilities	November 2004
Civil Works	November 2004–February 2005
Construction of the Coking Oven	March–June 2005
Installation of Metal Frames	July–August 2005
Installation of Thermo-Applicants	September–November 2005
Trial Production	December 2005

Source: Hefei Iron and Steel Company.

15. Because of the pollution control system installed, wastewater discharge from the number 2 site has decreased from 4,195 t/hour in 1999 to 3,082 t/hour in 2003, and by 9.74 million t/year. The COD, cyanide, and phenol discharges have also decreased. Since the original coke

plant is still in use, this subproject has not resulted in any significant air quality improvement. HISC has also restructured from a wholly state-owned enterprise to a limited liability company with several equity holders: its debts to Hua Neng Power and Nuclear Industrial Bureau were converted to equity as required in the Loan Agreement.

C. Project Costs

16. At appraisal, the total project cost was estimated at \$266 million equivalent, including a foreign exchange cost of \$122.4 million representing 46% of the total cost. The cost estimates included contingencies, and interest and other charges during construction. At completion, the actual cost of the Project was \$170.37 million equivalent, of which \$108.77 was foreign exchange cost and \$61.60 local currency. The cost savings of \$95.63 million represent 36% of the appraisal estimate. The breakdown and comparison of the appraisal estimates and actual project costs is shown in Appendix 2. Aside from specific reasons for the decline described in para. 17, the reduction was also due to savings resulting from competitive bidding, lower than expected inflation, and lower actual interest rate during construction.

17. The actual project cost of subproject 1 was \$45.04 million, 57% lower than the appraisal estimate of \$105.0 million. The ADB loan was reduced from \$40.0 million to \$29.87 million mainly because AVP used its own financial resources for construction of the wastewater treatment facility. The actual cost of subproject 2 was \$25.62 compared with \$30.0 million at appraisal. The actual cost of subproject 3 dropped from the \$25.90 million appraisal estimate to \$22.75 million because of price reductions in locally made building materials and equipment. Subproject 4 utilized \$48.15 million of ADB funds compared with the appraisal estimate of \$48.30 million. Local currency expenditure was \$28.81 million, which was \$27.99 less than at appraisal. However, an additional \$13.3 million is expected to be incurred for the second coking plant to be built later in 2004. In all cases, savings in project cost were brought about by price declines for domestic goods in the aftermath of the Asian financial crisis, and the Government's waiving of import duties for equipment used for environmental protection purposes.

18. The financing plan envisaged at appraisal included the \$112.0 million ADB loan to finance about 92% of the foreign exchange cost, equivalent to 42% of the total project cost. The remaining \$154.0 million was to be financed from domestic resources: \$62.6 million from domestic loans and \$91.4 million from cash generated internally by the PIAs, and various support mechanisms provided by APG, and Hefei and Chaohu cities, such as, tax rebates and grants. The actual funding came from the \$108.77 million ADB loan representing 64% of the total project cost, \$7.26 million from domestic borrowing, and \$54.34 million from the subprojects' internal resources. A summary of the proposed and actual financing structure is presented in Appendix 3.

D. Disbursements

19. The loan proceeds were disbursed in accordance with ADB's *Loan Disbursement Handbook*. Disbursements were made mainly through letters of credit and direct payment procedures. The first disbursement other than for capitalization of interest was made to subproject 4 in August 1998, 10 months after the loan became effective. The total loan amount disbursed was \$108.77 million; the unused balance of \$3.23 million was canceled. Overall utilization of the loan was about 97%. Contract awards and disbursements lagged projections for the first 2 years, but disbursements picked up significantly in 2000 following major contract awards for civil works and equipment. The imprest account was used effectively for procurement of small expenditures. No problems were encountered in using the statement of expenditure procedures. Actual disbursements by quarter are in Appendix 4.

E. Project Schedule

20. The loan was approved on 26 November 1996 and became effective on 14 October 1997. Although loan effectiveness was delayed by 10.5 months, project activities such as detailed design started in January 1997, as scheduled at appraisal. Lengthy internal Government approval procedures caused some initial delays in implementation. Project procurement⁷ has been slower than estimated at appraisal. The Asian financial crisis resulted in tightening of credit, thus impacting the PIAs' ability to obtain timely funding; this has particularly impacted subproject 4 implementation. In all four subprojects, the wastewater treatment facilities were installed on schedule. Two subprojects, AVP-CDCC and HCFP, completed civil works on schedule. HCW was delayed by about 1 year and HISC by 2 years. The loan closing date was extended up to 31 December 2002 from the original schedule of 30 June 2001. Most of the disbursements were completed by this loan closing date. But, the loan was closed only on 18 February 2004, an extension of almost 32 months from the original schedule, mainly due to delayed liquidation of imprest account. Appendix 5 shows the projected and actual implementation schedules.

F. Implementation Arrangements

21. As envisaged during appraisal, APG through its project management office (PMO), which was established in October 1997, was the Executing Agency providing overall supervision for the four subprojects. A steering committee under the direct supervision of the provincial vice-governor was established to ensure strong coordination of project implementation. The steering committee comprised senior officials of APG, the provincial and local finance bureaus, and senior officials of Hefei and Chaohu cities; and Anhui Environmental Protection Bureau (AEPB) and APG directors. The four enterprises were the PIAs of their respective subprojects. The only change of subproject PIA was for subproject 1. In 1997, at the request of APG, ADB agreed to have the PIA for subproject 1 changed to CDCC. Each PIA was headed by the general manager and was responsible for day-to-day implementation activities. Appendix 6 shows the current individual enterprise structures.

22. This arrangement proved to be effective as the Project was managed well. The PMO held monthly progress meetings with the PIAs and visited sites regularly to ensure problems encountered were resolved promptly. Most PMO staff were permanent employees of APG or AEPB. The PIAs had adequate experienced staff to carry out their respective components. The Project's implementation arrangements were effective in facilitating the transition from project implementation to operation and management of the facilities. However, delayed closure of the imprest account and thereby of the loan suggests that the PMO did not have sufficient financial management skills.

G. Conditions and Covenants

23. No specific conditions were set for loan effectiveness. No covenants were modified, suspended, or waived during implementation. Major covenants relating to implementation arrangements, environmental protection, and financial and enterprise reforms were complied with except for the dismantling of the existing coking oven at HISC, which will occur by the end of 2004 (Table 1). All the subprojects underwent financial restructuring, converting debt to equity as required in the Loan Agreement. In 2003, debt to equity ratios ranged from 0.08 to 0.49, well below the covenanted ratio of 2.3, but further analysis indicates active short-term borrowing for financial operations.

⁷ Advance procurement action was not included for the Project.

24. The financial covenants for the four subprojects are debt-to-equity ratio of not more than 2.33 and debt service coverage ratio of not less than 1.3. Since CDCC, the subproject component financed by ADB, is a newly built cement plant, the financial statements are available for only 2 years. The subproject has been profitable since the beginning and this is expected to continue given the strong market for cement clinker. The company shows good capital adequacy with a low debt-to-equity ratio of 0.22 in 2003, meeting the loan covenant. It has paid off the subproject loan to APG. Although HCFP has been profitable over the past 6 years, the gross operating profit for 2002–2003 averages 1.1% indicating inefficiencies in its operations. Its debt service coverage ratios since 2000 are below the financial covenant. The gross operating margin at HCW improved from -12% in 1998 to 2.6% in 2003. Debt service coverage ratio also improved from -0.14 in 2000 to 0.65 in 2003, but is still below financial covenant. HISC is one of the largest companies in the province with annual sales averaging CNY1.5 billion. Financial performance of HISC is rather weak, and the company attempted to consolidate its position by divesting its noncore activities. Its debt service coverage ratio in 2003 is at a low 0.21. Even though the financial performance is not satisfactory, demand for coke is strong and sales are expected to continue to improve. All four enterprises have shown improved sales revenue since the Project was implemented. The low debt service coverage ratio for the four companies is because of high short-term borrowings related to operations. AVP-CDCC, HCFP, and HCW are profitable and are expected to be financially viable. Although HISC's earnings are under pressure, current strong demand for iron, steel and coke is expected to bolster sales revenue.

H. Related Technical Assistance

25. At appraisal, the Government requested ADB to provide an advisory TA (footnote 4) to strengthen the capabilities of APG and AEPB in planning and implementing environmental improvement programs in Anhui Province. The TA was approved along with the Project. Its objective was to formulate a least-cost, long-term IEMP to enhance water and air quality, and solid waste management in the Chao Lake basin. The TA was completed in October 1999. Key components of the IEMP include an action plan, which defines specific goals, objectives, and measures to achieve desired water quality in the basin, and a quantified investment program, which identifies specific investment projects to implement the necessary measures to achieve the quantitative water quality goals. As a corollary to the IEMP, the consultants made a comprehensive study of the various sector master plans at the provincial, prefectural, city, and county levels, and proposed modifications to improve them. Recommendations were made for reforming the environmental management system and for capacity building. Training workshops were organized for the industrial enterprises on how to improve wastewater treatment. Training workshops were also conducted for APG and AEPB officials and included an international study tour. These workshops resulted in transfer of knowledge and experience in environmental management and control for persons responsible for developing policy, environmental management, researchers, and industries. The TA was rated⁸ successful.

I. Consultant Recruitment and Procurement

26. Using its own funds, each PIA engaged domestic design institutes to help prepare preliminary and detailed design, engineering, and project supervision. International consultants were not hired. The hiring of domestic consultants using PIA resources resulted in savings under the loan category for consulting services, and part of these savings were reallocated for purchase of equipment.

⁸ The TA completion report was finalized in 2004.

27. Goods and services were procured from loan funds in accordance with ADB's *Guidelines for Procurement*. All civil works contracts were procured through local competitive bidding. Equipment and materials with contract value of more than \$500,000 were procured following international competitive bidding procedures, while those with contract value below \$500,000 were procured using international shopping procedures. Tendering activities were handled by a specialized domestic procurement agency that had previous experience in procurement under ADB-financed projects. No major problems were encountered in the packaging of contracts, preparation of bidding documents, or evaluation of bids. While some PIAs considered ADB guidelines to be cumbersome, all agreed that the guidelines ensured transparent procurement of the suitable equipment at a competitive price. This accounted for substantive savings in foreign exchange costs. The details of the procurement packages financed by ADB and the mode of procurement are given in Appendix 8.

J. Performance of Consultants, Contractors, and Suppliers

28. The performance of contractors and suppliers was satisfactory. All contracts were completed or delivered as scheduled and within budget. The physical facilities completed under the Project are of good quality, reflecting the satisfactory performance of contractors and suppliers. International consultants were not required to supervise project implementation.

K. Performance of the Borrower and the Executing Agency

29. Both the Government and APG met their responsibilities and obligations for project implementation. Project implementation started soon after the loan became effective, although the initial progress was slow. The PMO took some time to set up and perform effectively, but after the initial stages, it effectively coordinated the project activities of four industrial enterprises. The simultaneous privatization and restructuring initiatives of the PIAs had an impact on the implementation schedule. Overall, the performance of the Government and APG was satisfactory and met appraisal expectations. APG's capacity was strengthened through the training provided by two TAs.

L. Performance of the Asian Development Bank

30. ADB fielded six missions to review project progress and to help resolve procurement and implementation issues. At the Government's request, ADB allowed a minor change to the project scope by including CDCC in subproject 1 without changing the subproject terms and output. ADB also facilitated reallocation of funds to accommodate the additional need for equipment. It granted extensions of the loan closing date to allow the Project to be completed. Overall, ADB's performance was satisfactory.

III. EVALUATION OF PERFORMANCE

A. Relevance

31. The Project was highly relevant in meeting the Government's priorities to advance environmental and pollution abatement goals for the Chao Lake basin and to reduce wastewater discharge flowing to the lake. It was also in line with ADB's country strategy and thematic priorities. The project objectives remained unchanged throughout implementation, and the Project supported policy reforms to set environmental standards. The Project is rated highly relevant.

B. Efficacy in Achievement of Purpose

32. The Project was effective in achieving the immediate objective of improving the quality of wastewater discharge from the four industrial enterprises. Together with the parallel loan for the Municipal Wastewater Treatment Project, Chao Lake's water quality did improve considerably. HISC's air emissions will continue to reduce once the second new coke oven is operational. The formulation of the IEMP through the TA has helped APG develop an action plan to meet its goals for pollution abatement in the Chao Lake basin. But, the recent trend of increasing Chao Lake water pollution indexes suggest that the successful example of the four most polluting industrial enterprises was not effectively replicated among other enterprises in the basin. More committed efforts from other industrial polluters as well as a more rigorous implementation of the environmental compliance may provide sustainable improvement in Chao Lake water quality. The Project is rated as efficacious.

1. Strengthening Environmental Protection of Chao Lake

33. Wastewater pollution has decreased in the Chao Lake basin through implementation of the IEMP standards, and improved monitoring and enforcement of environmental policies and regulations. The improvement in the quality of wastewater discharge, solid waste removal, and smoke emission by the four industrial subprojects contribute to the improved environment in the Chao Lake basin. About 144,980 m³ of wastewater from these four factories are treated daily to at least class II standards prior to discharge, thereby reducing the pollution load to Chao Lake by about half. Approximately, 154,016 m³/day of water are recycled for various uses at the subprojects. Although APG has to continue its efforts to improve the environment, the results at the four industrial sites set an example for other industries. From 1999 to 2003, the main pollutants discharged have decreased by 5,703.3 t/year for COD, 1,419.7 t/year for NH₃-N, and 24.01 t/year for phenol. Data for other pollutants may be found in Appendix 9. However, by 2002, most of these reductions had been offset due to continuing growth of major industries in the Chao Lake basin.

2. Technological Reform of Industrial Processes

34. The objective of upgrading the technological processes at the industrial plants to improve the standards for solid, liquid, and gaseous waste disposal has been mostly achieved. The installation of wastewater treatment facilities has enabled a significant reduction in pollutant discharge, and recycling of treated water. Construction of the dry cement plant, use of the new urea production system, and introduction of the ion membrane caustic soda process have mitigated the harmful effects of solid waste discharge. These technological improvements also improved the energy efficiency of these enterprises.

3. Enterprise Reforms

35. In line with the Government's efforts to create a market economy, the PIAs were granted the status of autonomous legal entities responsible for their own profits and losses. The PIAs were restructured into limited-liability companies concentrating on commercializing their core activities and adopting professional management practices. HISC converted its debts to Hua Neng Power and Nuclear Industrial Bureau to equity as required in the Loan Agreement.

36. Under policy reform, the IEMP strengthened the legal framework by adopting and implementing comprehensive standards for water effluent. Regulations for environmental management were also strengthened and are monitored closely. Staff of the four subprojects

were trained in environmental management, monitoring and reporting, and technical training in association with the new process technologies now being used.

C. Efficiency in Achievement of Outputs and Purpose

37. Project implementation has been smooth despite the ongoing enterprise reforms at the PIAs. The project implementation set up with the PMO as the nodal agency to coordinate and oversee the Project was efficient. But delays in availability of counterpart funds, especially for the HISC subproject, slowed project implementation. The project facilities were constructed properly, and within the estimated cost with substantial savings on domestic cost. Subprojects were completed within the 1-year delay of the original schedule except HISC, which was delayed by more than 2 years. New plant and equipment are operating satisfactorily without major problems. The Project is assessed as efficient.

1. Financial Performance

38. The financial performance of the four subprojects from 1998 to 2003 is elaborated and shown in Appendix 10. The financial internal rate of return (FIRR) has been recalculated based on the actual financial performance up to 2003 and financial projections of revenue and expenses in consultation with the enterprises. Capital costs are based on actual expenditures incurred. Except for HISC, incremental revenues were based on sales of products associated with project investments and were assumed to increase as full capacity utilization is achieved in later years of commercial operation. The recalculated FIRR for the four subprojects range from 7.4% to 12.3% as shown in Table 2. Except for HCW, with an FIRR the same as at appraisal, the subprojects FIRRs are lower than appraised. The FIRRs of AVP and HCFP are lower because actual selling prices of their products are lower than at appraisal. The actual selling price of cement clinker is CNY205/t (excluding value-added tax) lower than at appraisal, while the actual selling price of urea is CNY1,200/t lower than appraised. The FIRR of HISC is significantly lower than appraised because the partially completed subproject has just begun operations, and only initial financial data for 5 months are available. As a result, the operating costs do not reflect normal operation. Furthermore, the delay in installing the second coke oven affects the full benefits that can be derived from the subproject. However, the FIRR of all the four subprojects exceed the corresponding weighted average costs of capital. The overall FIRR for the Project is 9.30%, and weighted average cost of capital is 4.64%. Details of the analysis are in Appendix 11.

Table 2: Financial Internal Rate of Return and Weighted Average Cost of Capital at Appraisal and at Project Completion Review
(%)

Subproject	FIRR at Appraisal	FIRR at PCR	WACC at Appraisal	WACC at PCR
AVP/CDCC	14.8	11.35	4.1	4.78
HCFP	10.3	8.33	5.5	4.53
HCW	12.3	12.28	4.8	4.48
HISC	13.4	7.39	4.7	4.77
Whole Project	12.7	9.30	4.8	4.64

AVP = Anhui Vinylon Plant, CDCC = Chaohu Dongya Cement Company, FIRR = financial internal rate of return, HCFP = Hefei Chemical Fertilizer Plant, HCW = Hefei Chemical Works, HISC = Hefei Iron and Steel Corporation, WACC = weighted average cost of capital.

Source: Staff estimates.

2. Economic Performance

39. The Project's economic internal rate of return was recalculated for two scenarios: with and without environmental benefits. At appraisal, the benefits took into account the reduction in both wastewater discharge and air pollution, whereas in this project completion review, only the benefit of wastewater discharge reduction was incorporated. The expected air pollution reduction mainly from the HISC subproject could not be considered because the planned retirement of the existing aged coke oven was deferred. The economic internal rates of return of the subprojects with and without environmental benefit are shown in Table 3. Detailed calculations are in Appendix 12.

Table 3: Summary Economic Internal Rate of Return
(%)

Item	EIRR Without Environmental Benefit	EIRR With Environmental Benefit
AVP/CDCC	16.3	18.1
HCFP	19.7	19.5
HCW	15.8	16.8
HISC	11.6	13.2
The Whole Project	14.8	16.0

AVP = Anhui Vinylon Plant, CDCC = Chaohu Dongya Cement Company, EIRR = economic internal rate of return, HCFP = Hefei Chemical Fertilizer Plant, HCW = Hefei Chemical Works, HISC = Hefei Iron and Steel Corporation.
Source: Staff estimates.

D. Preliminary Assessment of Sustainability

40. The technologies adopted for wastewater treatment and solid waste improvement are technically and commercially sound. Trained personnel are in place to handle operational and technical problems. The demand for the Project's products is strong reflecting strong economic growth in the PRC. The state, provincial, and local governments are committed to the Project, and have given considerable importance to improving the environment. The PIAs have established policies and procedures for maintaining the project facilities. All four PIAs have instituted adequate environmental management systems, although resources at HISC could be strengthened. Financial management systems are also in place, but more training is needed to improve the skills in preparing financial statements. The Project is rated sustainable.

E. Environmental, Sociocultural, and Other Impacts

1. Environmental Impact

41. As anticipated at appraisal, the Project's environmental impact is significant and positive in the Chao Lake basin. The Project supported the Government's initiatives for environmental protection, and provided the resources needed for investment in environmental improvement in the area. The main benefits are the strengthening of environmental management programs and the reduction of pollution discharges into Chao Lake. The wastewater discharge in Chao Lake has improved from four major polluters, but this has been offset by the incremental wastewater discharge from new industries in Chao Lake basin. Wastewater discharge into the river courses in Hefei and Chaohu has also reduced. During project implementation, mitigating measures identified in the summary environmental impact assessment were undertaken, and vigorous construction quality control measures were enforced to prevent adverse impacts on the environment. The Government also introduced a new pollution charge system whereby water and air pollution is charged based on certain pollution equivalents.

2. Social Impact

42. The four industrial subprojects were carried out within existing factory sites owned by the PIAs as envisaged at appraisal. About 150,000 square meters of land was acquired before the Project was approved. Most of the land was wasteland with no resettlement requirements. Compensation was paid according to Government guidelines wherever families were resettled. There were no indigenous people affected by the Project. The Project supported the Government's "3 Rivers and 3 Lakes Pollution Control" initiative to clean up the environment. Huai River and Chao Lake in Anhui Province are both part of this program, which elevated the importance of this Project to APG. Pollution of Chao Lake directly affects the drinking water source for Hefei, Chaohu, and the surrounding areas, therefore the Project's ability to reduce harmful discharge (para. 33) is beneficial to area residents. The Project also sustained employment opportunities, particularly for HCW, which was in danger of closing down due to its obsolete technology and inefficient operations.

3. Institutional Development and Other Impacts

43. The Project has further strengthened AEPB's institutional skills and capacities in environmental management. Before the Project, ADB provided TA to train staff involved in environmental management, and to assist in drafting and revising the PRC's environmental laws, such as the Water Pollution Law, which provides the legal basis for improving the water quality of Chao Lake.⁹ Training workshops and international study tours were conducted for APG and AEPB officials in an associated TA (para. 25).

44. All the subprojects have improved their organizational arrangements for the effective maintenance and operational of the project facilities. They have established separate safety and environmental divisions within the organizations. All the subprojects have significantly achieved the environmental objectives of the Project although financial management can further be improved.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

45. The Project was implemented as envisaged at appraisal. The objectives of the Project and associated TA to improve water quality of Chao Lake by reducing wastewater discharge, and to reduce waste pollution in the cities of Hefei and Chaohu were achieved. The quality of Chao Lake has improved from class V in 1996 to between classes IV and V in 2004. The overall emissions of the subprojects have been reduced, except at HISC, which has not yet decommissioned the old coke oven. The institutional capacities of APG and the PIAs have been strengthened. Delays in implementation were mainly due to delays in availability of counterpart funds.

46. Based on the criteria of relevance, efficacy, efficiency, sustainability, and institutional development and other impacts, the Project is rated successful.

⁹ ADB. 1994 *Legislative Planning and Procedures for the Protection of the Environment*. Manila.

B. Lessons Learned

47. The suitability of a full-time and adequately resourced PMO in project implementation for a multicomponent project was proven through efficient implementation and coordination of the project activities. The PMO approach continued to keep APG's focus on the Project. ADB should continue to encourage APG to set up a similar PMO for all multicomponent projects.

48. Timely availability of required funds is essential for smooth project implementation. In this Project, availability of counterpart funds was a key issue, because they could not be secured in a timely manner. ADB staff must carefully scrutinize counterpart fund arrangements and availability during project appraisal.

49. TA that is suitably designed, properly targeted, and appropriately timed can provide synergies to a loan project and enhance its overall impact. The advisory TA associated with the Project was directly relevant and well timed, which enabled formulation of an IEMP and enhanced APG's institutional capacity for enforcing stricter environmental compliance.

50. The phased implementation of the coke oven plants construction was not fully assessed during project design, resulting in an unrealistic implementation schedule for the HISC component of the Project. ADB staff should fully assess and anticipate environmental versus economic/financial objectives of the industrial enterprises in future projects.

C. Recommendations

51. The four enterprises should continue to monitor and manage their operation and maintenance expenditures and debt service requirements annually, and ensure long-term viability by keeping the debt to equity ratio within reasonable limits. The enterprises also need to pay attention to operational efficiencies.

52. The four entities should improve their financial management systems and training of staff to improve their accounting capabilities and foreign exchange risk management.

53. HISC should dismantle the present coke oven and build the second new one as planned. ADB should continue to follow up to make sure this is implemented.

54. The project performance audit report for the Project could be prepared in 2006 or later, only after HISC has constructed the second coke oven and given sufficient time for the facilities to be fully operational so that more useful data are available to better assess project performance.

CHRONOLOGY OF MAJOR EVENTS

5 May 1996	Fact-Finding Mission fielded.
28 June 1996	Management review meeting held.
8 July 1996	Summary Environmental Impact Assessment circulated to the Board of the Asian Development Bank (ADB).
22 July 1996	Appraisal Mission fielded.
20 September 1996	Staff review committee meeting held.
16 October 1996	Loan negotiations held.
26 November 1996	ADB approves a loan of \$112 million from ADB's ordinary capital resources to the People's Republic of China (PRC) for the Anhui Environmental Improvement Project for Industrial Pollution Abatement (Loan 1491-PRC) and technical assistance (TA)—an \$800,000 grant—for the Formulation of an Integrated Environmental Management Plan for the Chao Lake Basin.
21 June 1997	Clarification Mission fielded.
25 June 1997	PRC Government asks to replace Anhui Vinylon Plant as the Implementing Agency for the construction of a cement plant using its solid wastes of the Chaohu Dongya Cement Plant (CDCP).
9 July 1997	Contract negotiations under TA held.
16 July 1997	Loan signing held.
29 July 1997	Review Mission fielded.
1 August 1997	Consultant for the TA commences services.
8 August 1997	Director, Infrastructure, Energy and Financial Sectors Department (IED) approves change in local cost funding arrangements for subprojects 2 and 3 from the China Construction Bank to the State Development Bank as a minor change in implementation arrangements.
14 October 1997	Loan becomes effective.
28 November 1997	Director, IED approves a minor change in scope to separate the Anhui Vinylon Plant (AVP) subproject into the Anhui Vinylon Plant and CDCP components, allocate \$40 million for the CDCP component, and designate AVP and CDCP as implementing agencies for their respective parts of the Project.
28 December 1997	Hefei Chemical Works is renamed Anhui Chlor-Alkali Chemical Group Co., Ltd.

December 1997	Hefei Chemical Fertilizer Plant is restructured and renamed Hefei Sifang Chemical Industrial Group Co., Ltd.
15 April 1998	First disbursement made.
May 1998	Hefei Iron and Steel Company is renamed Hefei Iron and Steel Group Corporation.
8 September 1998	Civil work for 2,000 tons/day clinker under subproject 1 commences.
5 October 1998	Review Mission fielded.
31 March 1999	Construction of wastewater treatment plant under subproject 4 commences.
10 May 1999	Construction of biochemical wastewater treatment plant under subproject 2 commences.
6 May 1999	Hefei Iron and Steel Corporation (HISC) asks for a change in procurement mode from international competitive bidding to international shopping for packages 4-1 and 4-2 to enable HISC to expedite the bidding process.
30 May 1999	The ADB vice-president (East) approves the change in procurement mode to international shopping for packages 4-1 and 4-2 as a minor change in implementation arrangements.
20 October 1999	Consultant submits final report for the TA.
October 1999	Wastewater treatment plant under subproject 3 completed and put into operation.
30 November 1999	The project management office (PMO) asks that \$1,300,000 of the loan proceeds be reallocated from interest during construction to the equipment category to cover expected cost overruns for procurement of equipment under subproject 2.
14 December 1998	Review Mission fielded.
15 December 1999	Water treatment plant under subproject 3 commissioned.
10 January 2000	Ministry of Finance concurs with ADB-PMO's request to reallocate \$1.3 million to the equipment category for subproject 2.
August 2000	Construction and installation of a 720,000 ton/year cement plant and pollution control systems under subproject 1 completed.
December 2000	Test run carried out for caustic soda production chlor-alkali.

December 2000	TA closed.
February 2001	Construction of a 130,000 ton/year fertilizer plant under subproject 2 completed.
February 2001	Construction of 50,000 ton/year membrane process-based caustic soda plant completed and commercial operation under way.
Mar 2001	Urea fertilizer plant under subproject 2 commences commercial operation.
9 April 2001	Ministry of Finance requests extension of loan closing date by 1 year from 30 June 2001 to 30 June 2002.
7 May 2001	Manager of Energy Division (East) approves extension of loan closing date from 30 June 2001 to 30 June 2002.
14 May 2001	Government asks that loan proceeds for training, consulting services, and unallocated categories be reallocated.
28 June 2001	Director, IED approves the Government's request to reallocate loan proceeds among the loan categories to procure equipment and materials as a minor change in project scope.
30 June 2001	Original loan closing date.
2 November 2001	PMO asks to reallocate \$800,000 from interest during construction to equipment and materials category to cover the costs of equipment under subproject 4.
29 November 2001	Approval given to reallocate \$800,000 to the equipment category to cover the costs for packages 9-9, 10-4, and part of 9-8 under subproject 4.
13 August 2002	Second extension of loan closing date to 31 December 2002 approved.
10 November 2003	Coke oven number 1 of subproject 4 commences operation.
10 June 2002	Review Mission fielded.
13 February 2004	Final disbursement.
18 February 2004	The undisbursed loan balance of \$3,226,933.26 is canceled and the loan account officially closed.
8 June 2004	Project Completion Review mission is fielded.

COST BREAKDOWN BY PROJECT COMPONENTS
(\$ million)

Component	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
	Exchange	Currency	Cost	Exchange	Currency	Cost
Subproject 1: Anhui Vinylon/Chaohu Dongya Cement Company						
Preliminary Expenses	0.00	0.00	0.00	0.00	0.00	0.00
Land Acquisition	0.00	1.80	1.80	0.00	2.33	2.33
Site Preparation	0.00	0.60	0.60	0.00	0.31	0.31
Engineering and Design	0.00	2.40	2.40	0.00	1.29	1.29
Equipment and Material (major process)	28.00	1.70	29.70	27.13	0.00	27.13
Auxiliary Equipment	1.60	0.40	2.00	0.00	0.00	0.00
Import Duties	0.00	12.40	12.40	0.00	0.00	0.00
Domestic Transport	0.00	0.70	0.70	0.00	0.00	0.00
Construction and Erections	5.30	26.00	31.30	0.00	8.30	8.30
Consulting Service	0.50	0.00	0.50	0.00	0.00	0.00
Training	0.00	0.30	0.30	0.00	0.11	0.11
Commissioning and Start Up	0.00	0.50	0.50	0.00	0.00	0.00
Energy and Environmental Management	0.00	0.10	0.10	0.00	0.00	0.00
Project Management	0.00	0.30	0.30	0.00	0.63	0.63
Base Cost	35.40	47.20	82.60	27.13	12.97	40.10
Physical Contingency	3.00	4.20	7.20	0.00	0.00	0.00
Subtotal	38.40	51.40	89.80	27.13	12.97	40.10
Price Contingency	2.50	3.40	5.90	0.00	0.00	0.00
Interest During Construction	3.90	5.40	9.30	2.74	2.20	4.94
Total	44.80	60.20	105.00	29.87	15.17	45.04
Subproject 2: Hefei Sifang Chemical Industrial Group Co., Ltd.						
Preliminary Expenses	0.00	0.00	0.00	0.00	0.00	0.00
Land Acquisition	0.00	0.30	0.30	0.00	0.63	0.63
Site Preparation	0.00	0.40	0.40	0.00	0.41	0.41
Engineering and Design	0.70	0.60	1.30	0.00	0.24	0.24
Equipment and Material (major process)	9.90	0.20	10.10	16.87	0.24	17.11
Auxiliary Equipment	0.00	2.50	2.50	0.00	0.00	0.00
Import Duties	0.00	4.20	4.20	0.00	0.00	0.00
Domestic Transport	0.00	0.50	0.50	0.00	0.00	0.00
Construction and Erections	0.60	2.40	3.00	0.00	6.35	6.35
Consulting Service	0.10	0.00	0.10	0.00	0.00	0.00
Training	0.00	0.10	0.10	0.00	0.12	0.12
Commissioning and Start Up	0.00	0.10	0.10	0.00	0.11	0.11
Energy and Environmental Management	0.00	0.20	0.20	0.00	0.46	0.46
Project Management	0.00	0.50	0.50	0.00	0.19	0.19
Base Cost	11.30	12.00	23.30	16.87	8.75	25.62
Physical Contingency	1.10	1.10	2.20	0.00	0.00	0.00
Subtotal	12.40	13.10	25.50	16.87	0.00	16.87
Price Contingency	0.80	0.80	1.60	0.00	0.00	0.00
Interest During Construction	1.40	1.50	2.90	0.00	0.00	0.00
Total	14.60	15.40	30.00	16.87	8.75	25.62

Continued on next page.

Component	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
Subproject 3: Anhui Chlor-Alkali Chemical Group Co., Ltd.						
Preliminary Expenses	0.00	0.00	0.00	0.00	0.00	0.00
Land Acquisition	0.00	0.50	0.50	0.00	0.76	0.76
Site Preparation	0.00	0.10	0.10	0.00	0.05	0.05
Engineering and Design	0.30	0.20	0.50	0.00	0.31	0.31
Equipment and Material (major process)	9.90	1.20	11.10	12.48	0.70	13.18
Auxiliary Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Import Duties	0.00	3.70	3.70	0.00	0.00	0.00
Domestic Transport	0.00	0.20	0.20	0.00	0.21	0.21
Construction and Erections	0.70	2.80	3.50	0.00	4.10	4.10
Consulting Service	0.20	0.00	0.20	0.00	0.00	0.00
Training	0.20	0.10	0.30	0.00	0.05	0.05
Commissioning and Start Up	0.10	0.10	0.20	0.00	0.98	0.98
Energy and Environmental Management	0.00	0.10	0.10	0.00	0.21	0.21
Project Management	0.00	0.20	0.20	0.00	0.17	0.17
Base Cost	11.40	9.20	20.60	12.48	7.54	20.02
Physical Contingency	1.10	0.90	2.00	0.00	0.00	0.00
Subtotal	12.50	10.10	22.60	12.48	0.00	12.48
Price Contingency	0.80	0.70	1.50	0.00	0.00	0.00
Interest During Construction	1.40	0.40	1.80	1.40	1.33	2.73
Total	14.70	11.20	25.90	13.88	8.87	22.75
Subproject 4: Hefei Iron and Steel Company						
Preliminary Expenses	0.00	0.00	0.00	0.00	2.60	2.60
Land Acquisition	0.00	0.00	0.00	0.00	0.00	0.00
Site Preparation	0.00	0.20	0.20	0.00	0.00	0.00
Engineering and Design	0.50	2.00	2.50	0.00	1.09	1.09
Equipment and Material (Major Process)	31.20	8.80	40.00	43.19	0.00	43.19
Auxiliary Equipment	1.80	0.70	2.50	0.00	1.06	1.06
Import Duties	0.00	13.90	13.90	0.00	0.00	0.00
Domestic Transport	0.00	0.50	0.50	0.00	0.00	0.00
Construction and Erections	3.80	15.30	19.10	0.00	23.31	23.31
Consulting Service	0.30	0.00	0.30	0.00	0.00	0.00
Training	0.30	0.40	0.70	0.00	0.00	0.00
Commissioning and Start Up	0.00	0.40	0.40	0.00	0.00	0.00
Energy and Environmental Management	0.00	0.20	0.20	0.00	0.00	0.00
Project Management	0.00	0.20	0.20	0.00	0.75	0.75
Base Cost	37.90	42.60	80.50	43.19	28.81	72.00
Physical Contingency	3.40	4.00	7.40	0.00	0.00	0.00
Subtotal	41.30	46.60	87.90	43.19	28.81	72.00
Price Contingency	2.90	3.40	6.30	0.00	0.00	0.00
Interest During Construction	4.10	6.70	10.80	4.96	0.00	4.96
Total	48.30	56.70	105.00	48.15	28.81	76.96

PROJECT COST AND FINANCING SOURCES
(\$ million)

Table A3.1: Project Cost

Subproject	Appraisal			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
Subproject 1	44.80	60.20	105.00	29.87	15.17	45.04
Subproject 2	14.60	15.40	30.00	16.87	8.75	25.62
Subproject 3	14.70	11.20	25.90	13.88	8.87	22.75
Subproject 4	48.30	56.80	105.10	48.15	28.81	76.96
Total	122.40^a	143.60	266.00	108.77	61.60	170.37

^a \$10.4 million of civil works was funded by each project implementing agency.
Source: Asian Development Bank estimates.

Table A3.2: Financing Sources

Subproject	Appraisal				Actual			
	ADB Loan	Commercial Bank Loan	Own Resources	Total	ADB Loan	Commercial Bank Loan	Own Resources	Total
Subproject 1	40.00	31.00	34.00	105.00	29.87	3.65	11.52	45.04
Subproject 2	14.00	4.70	11.30	30.00	16.87	0.00	8.75	25.62
Subproject 3	14.00	2.30	9.70	26.00	13.88	3.61	5.26	22.75
Subproject 4	44.00	24.60	36.40	105.00	48.15	0.00	28.81	76.96
Total	112.00^a	62.60	91.40	266.00	108.77	7.26	54.34	170.37

ADB = Asian Development Bank.

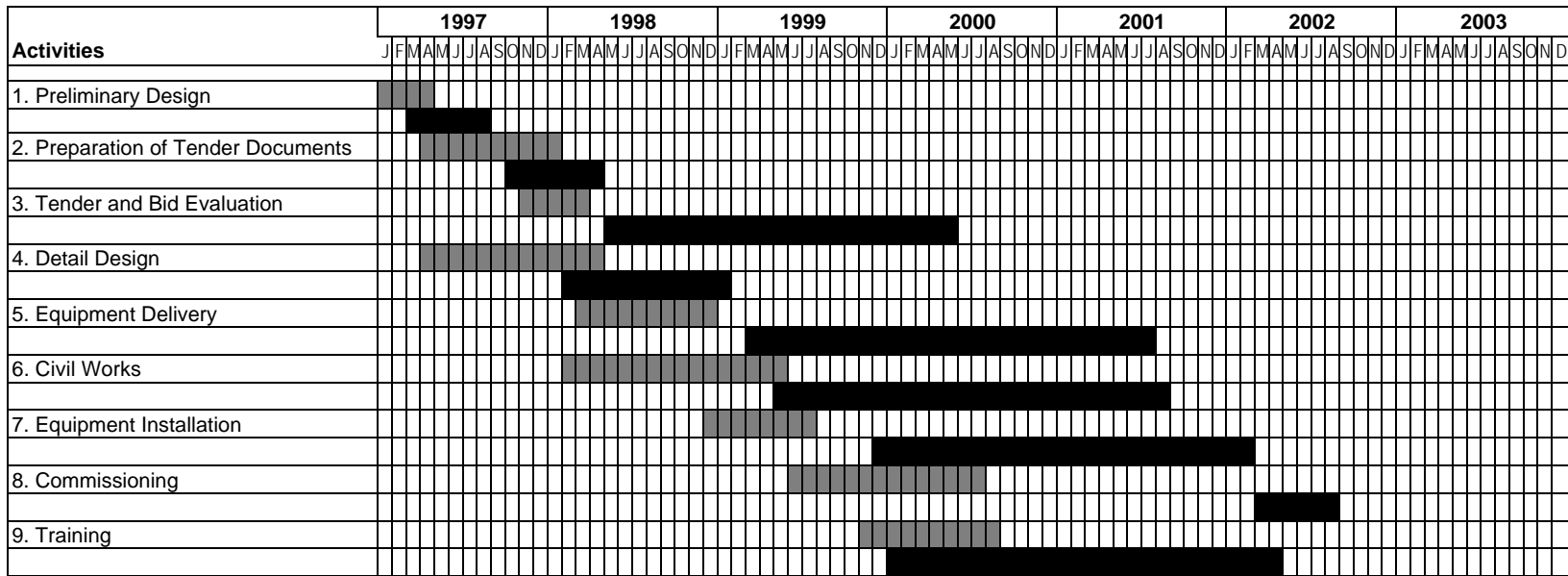
^a \$10.4 million of civil works was funded by each project implementing agency.
Source: Asian Development Bank estimates.

PROJECTED AND ACTUAL LOAN DISBURSEMENTS

Year	Quarter	Projected (\$ million)	Actual		% of Loan
			Quarterly Disbursement (\$ million)	Cumulative Disbursement (\$ million)	
1998	I	0.900	0.000	0.000	0.0
	II	4.000	0.074	0.074	0.1
	III	8.000	0.518	0.592	0.5
	IV	7.000	2.352	2.944	2.7
	Subtotal	19.900	2.944		
1999	I	1.900	2.123	5.067	4.7
	II	4.800	2.189	7.256	6.7
	III	15.000	1.921	9.177	8.4
	IV	12.200	9.327	18.504	17.0
	Subtotal	33.900	15.560		
2000	I	1.600	3.186	21.690	19.9
	II	6.100	9.140	30.830	28.3
	III	15.500	10.749	41.579	38.2
	IV	9.600	12.612	54.191	49.8
	Subtotal	32.800	35.687		
2001	I	6.000	8.601	62.792	57.7
	II	6.000	2.841	65.633	60.3
	III	8.100	5.898	71.531	65.8
	IV	7.500	12.172	83.703	77.0
	Subtotal	27.600	29.512		
2002	I	13.500	13.507	97.210	89.4
	II	5.500	7.830	105.040	96.6
	III	5.000	0.158	105.198	96.7
	IV	0.000	3.440	108.638	99.9
	Subtotal	24.000	24.935		
2003	I	1.000	0.134	108.772	100.0
	II	0.000	0.000	108.772	100.0
	IV	0.000	0.000	108.772	100.0
	IV	0.000	0.000	108.772	100.0
	Subtotal	1.000	0.134		
Total			108.772		

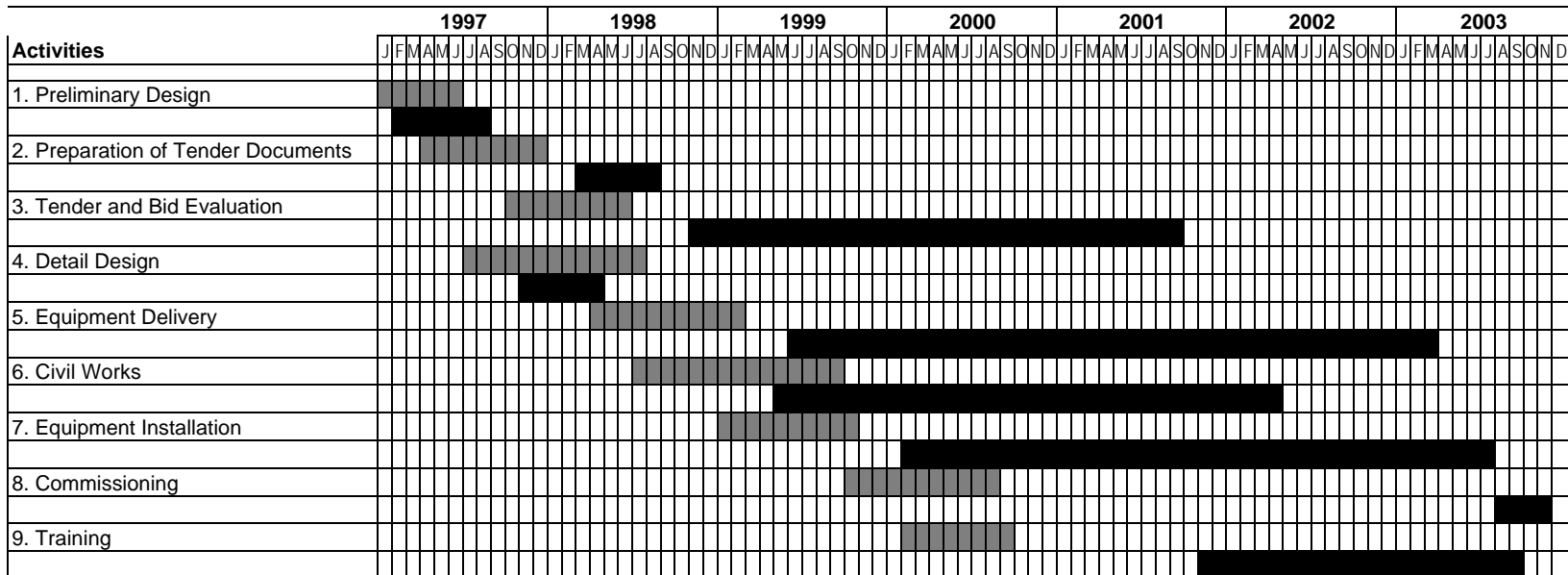
Source: Loan Financial Information System.

Figure A5.3: Hefei Chemical Works Subproject



Legend: Projected Actual

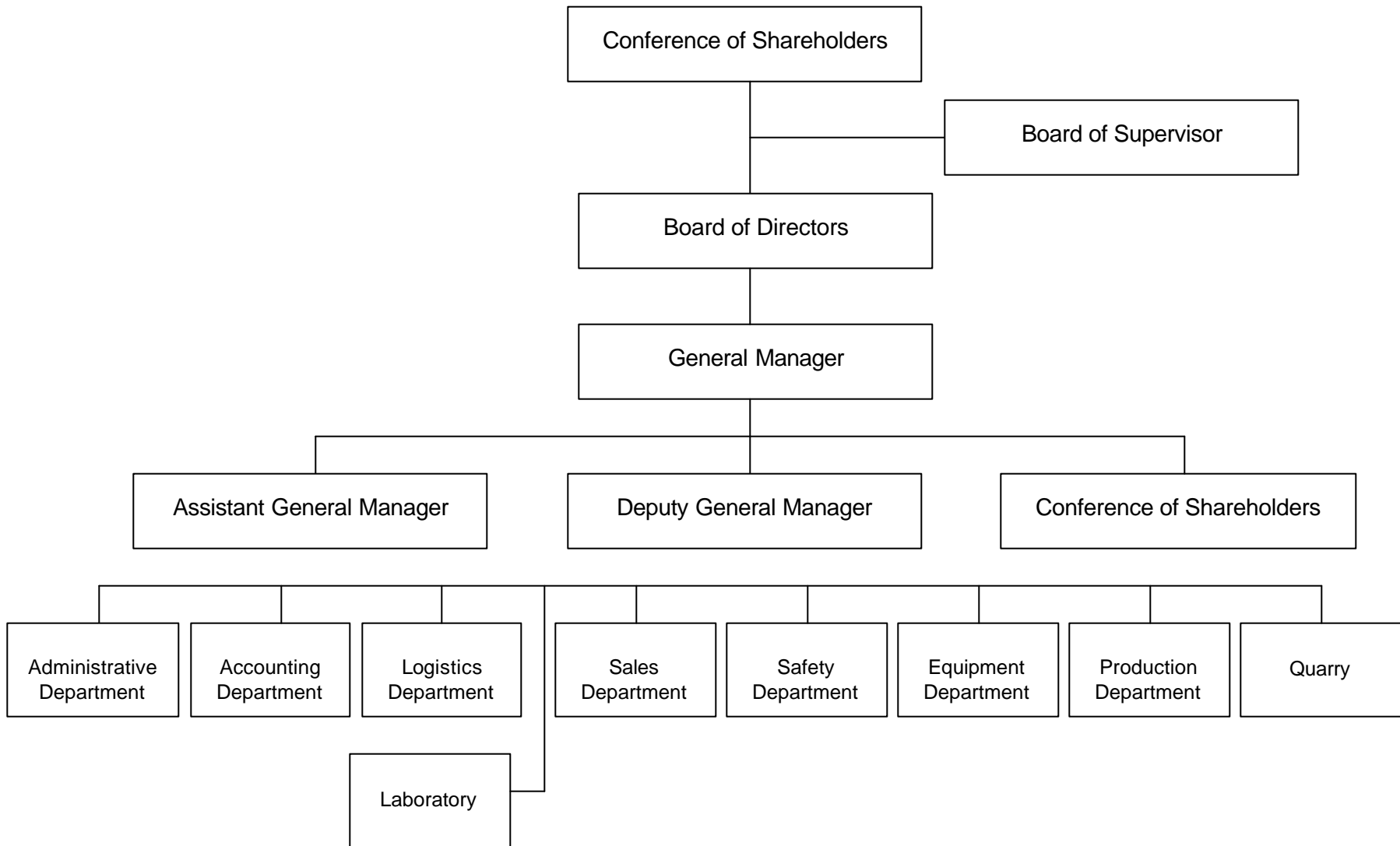
Figure A5.4: Hefei Iron and Steel Corporation Subproject



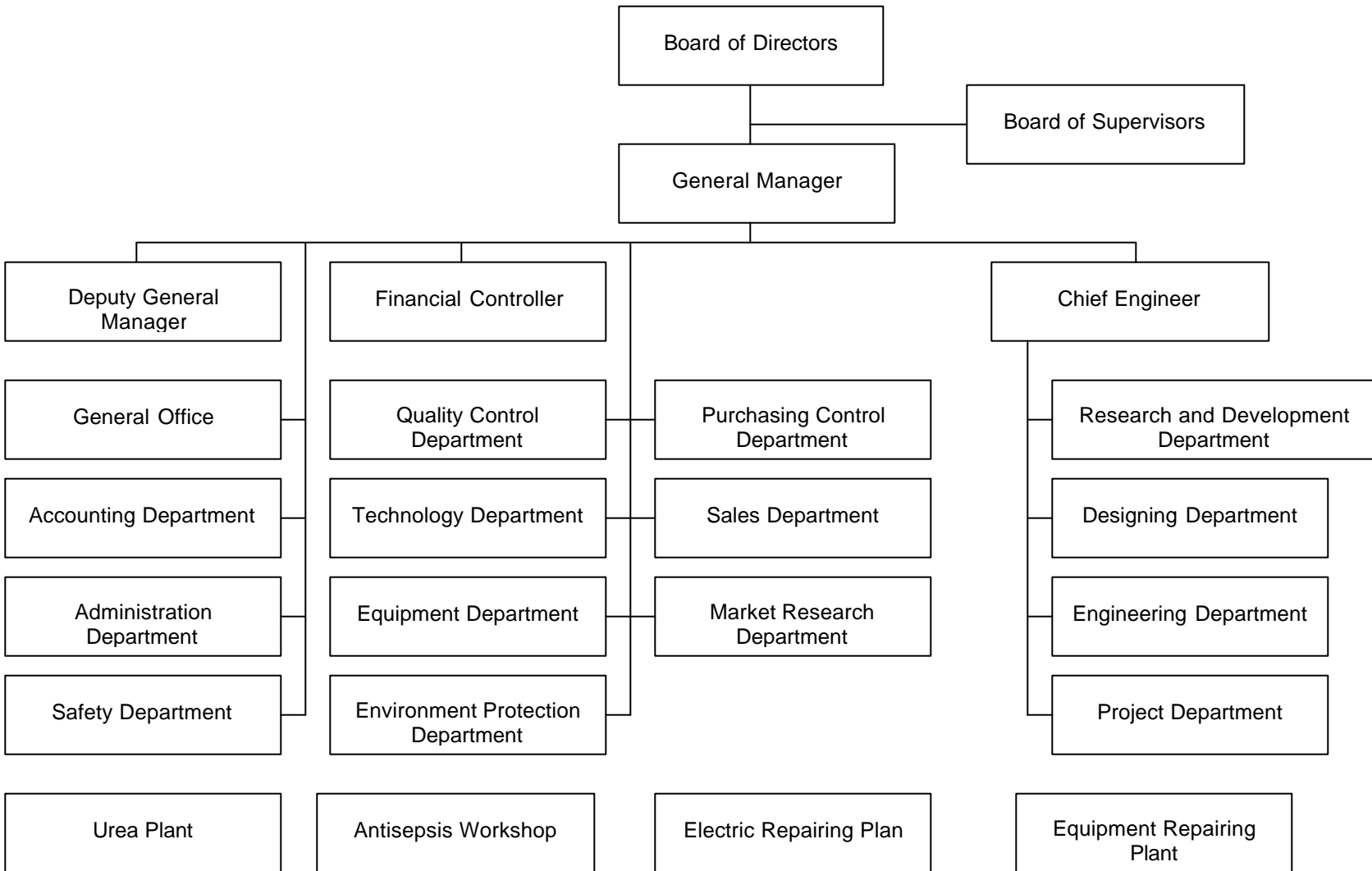
Legend: Projected Actual

ORGANIZATIONAL CHARTS OF PROJECT IMPLEMENTING AGENCIES

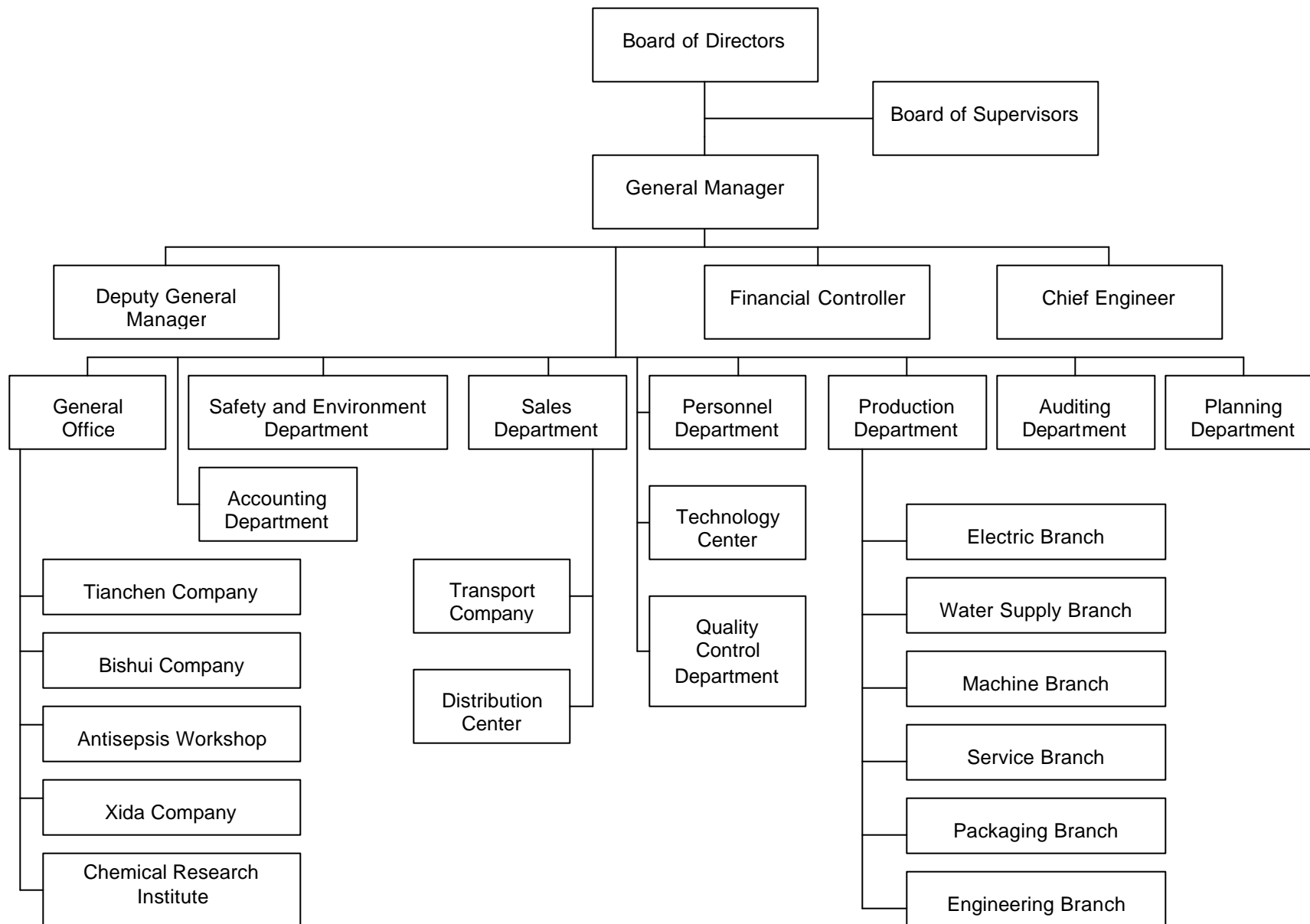
Figure A6.1: Organization Chart of Chao Dongya Cement Company
(Anhui Vinylon Plant)



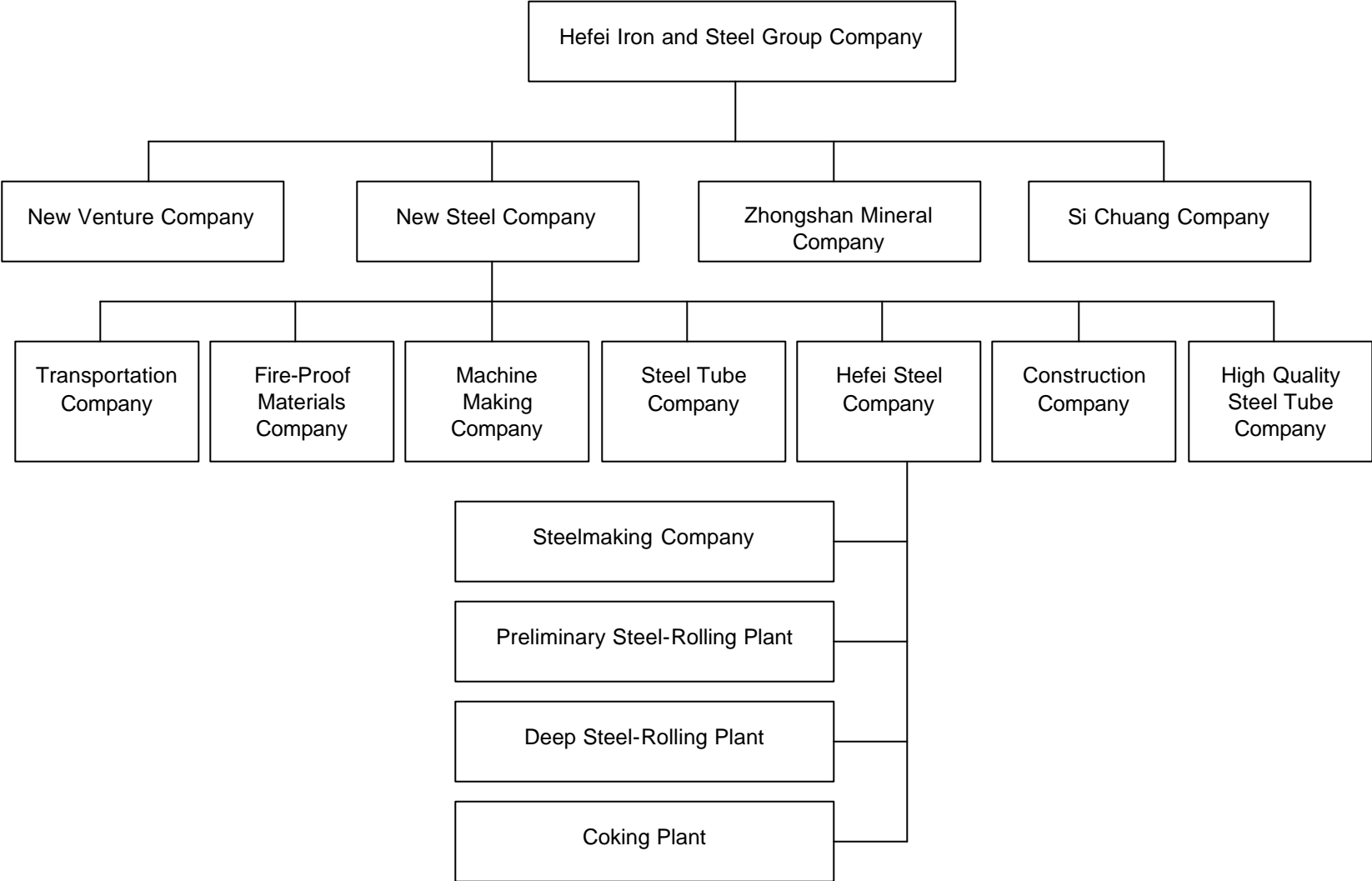
**Figure A6.2: Organization Chart of Hefei Sifang Chemical Industrial Group Company
(Hefei Chemical Fertilizer Plant)**



**Figure A6.3: Organization Chart of Anhui Chlor-Alkali Chemical Group Company
(Hefei Chemical Works)**



**Figure A6.4: Organization Chart of Hefei Iron and Steel Group
(Hefei Iron and Steel Corporation)**



COMPLIANCE WITH LOAN COVENANTS

Covenant	Reference	Remarks
Loan Effectiveness		
1. The State Council of the Government will approve the Loan Agreement (LA).	LA, Section 6.01	Complied with.
Procurement		
2. Procurement of goods and services will be subject to the provisions of the <i>Guidelines for Procurement</i> (March 1989) for Asian Development Bank (ADB) loans, as amended from time to time.	LA, Schedule 4, para. 2	Complied with.
Execution of the Project		
3. Anhui Provincial Government (APG) will be the Project's Executing Agency. APG will, throughout project implementation, maintain the project management office (PMO) for the Project. The PMO's main functions will be to act as the secretariat for APG (as Executing Agency), help the project implementing agencies (PIAs) fulfill their project responsibilities, coordinate the activities of the PIAs and the concerned departments and agencies of APG and the Government, and liaise between such institutions and ADB on all project-related matters. APG will also maintain, throughout the project implementation, a steering committee to ensure efficient and effective project implementation coordination. The steering committee will be chaired by the vice-governor of APG and comprise senior officials of the relevant APG departments, local office of the People's Bank of China, as well as a senior executive from each of the PIAs.	LA, Schedule 6, para. 1	Complied with.
4. Each PIA will be responsible for the financial, technical, and administrative control and execution of its part of the Project. The PIAs, through the PMO, will be responsible for coordination with the relevant national and local agencies of the Government and for liaison with ADB, including, without limitation, (i) day-to-day implementation of the Project; (ii) engagement and supervision of consultants; (iii) preparation of procurement and bidding documents; (iv) submission of all consultant recruitment, procurement, and related documents for ADB approval; (v) evaluation of offers and bids, and recommendations on the awards of contracts; (vi) management of staff training; (vii) supervision and commissioning of Project facilities; (viii) preparation of withdrawal applications; (ix) maintenance of project expenditure records, documentation, and accounting records; and (x) preparation and submission of the quarterly reports required under Section 2.08(b) of the Project Agreement.	LA, Schedule 6, para. 2	Complied with.

Covenant	Reference	Remarks
Environment		
A. In General		
<p>5. The Government will ensure that (i) APG strengthens and expands the integrated environmental management plan (IEMP), as agreed with the ADB based on the recommendations of the consultants engaged under the technical assistance for the Formulation of an Integrated Environmental Management Plan for the Chao Lake Basin, which will include time-bound actions plans, for the protection of the air, water, and soil quality in Chao Lake basin and Anhui Province, and monitoring programs; (ii) APG will provide adequate budgetary support and staff with appropriate training and qualifications to implement the IEMP; and (iii) APG will ensure that Anhui Environmental Protection Bureau (AEPB) and the PIAs implement the IEMP, including the monitoring programs.</p>	LA, Schedule 6, para. 3	Complied with. IEMP was finalized in 1999 and is being implemented by AEPB and the PIAs.
B. Anhui Vinylon Plant		
<p>The Government will cause APG to ensure that Anhui Vinylon Plant (AVP) rehabilitates its limestone mine once mining of any portion has been completed to prevent or minimize further erosion and restore the original vegetative cover.</p>	LA, Schedule 6, para. 8	Complied with.
<p>The Government will cause APG to ensure that the new cement plant to be constructed under the Project utilizes (i) the waste products produced by AVP, including the calcium hydroxide (lime), calcium bicarbonate and related materials and slurries, as well as the fly ash generated by the AVP power plant; and (ii) the existing stockpile of waste products produced by AVP. If the new cement plant has spare capacity, the Government will cause APG to ensure that AVP encourages other industries in the Chao Hu Lake watershed area that generate lime waste to use the cement plant at cost mutually beneficial to the parties concerned.</p>		Complied with.
<p>The Government will cause APG to ensure that AVP installs a new dry ash storage silo for the power plant, renovate the existing biological treatment plant to accommodate an additional 360,000 tons/year of organic wastewater currently being generated, and modify the existing solid waste storage area in an environmentally acceptable manner. Prior to completion of the cement plant, AVP will submit to ADB, for its approval, a detailed plan describing the means by which these actions will be completed.</p>		Complied with.

Covenant	Reference	Remarks
<p>The Government will cause APG to ensure that AVP provides for environmentally acceptable disposal of any solid waste produced but not utilized by the new cement facility. In addition, the Government will cause APG to ensure that once the existing stockpile of solid wastes has been fully utilized (approximately 2–3 years after commissioning of the new cement plant), (i) the existing wet process cement plant will be closed down and the site cleaned in an environmentally acceptable manner, and (ii) the existing solid waste storage area will be cleaned in an environmentally acceptable manner. Within 1 year from the completion of the cement plant, AVP will submit to ADB, for its approval, a detailed plan describing the means by which these actions will be completed.</p>		Complied with.
C. Hefei Chemical Works		
<p>6. The Government will cause APG to ensure that Hefei Chemical Works (HCW) (i) identifies all areas contaminated with asbestos and inform residents of those areas of the risks and safety requirements; (ii) provides personnel working in such areas with proper safety, and label all asbestos- and lead-contaminated materials and equipment prior to disposal in a secured landfill.</p>	LA, Schedule 6, para. 9	Complied with.
D. Hefei Iron and Steel Corporation		
<p>7. The Government will cause APG to ensure that Hefei Iron and Steel Corporation (HISC) (i) removes and properly disposes of all materials and soil contaminated with toxic and hazardous substances in the immediate vicinity of the existing coking plant prior to the complete operation of the coking plant to be constructed under the Project; and (ii) improves the dust control facilities in the coal and coke stockpile area.</p>	LA, Schedule 6, para. 10	Complied with.
Policy		
A. Pricing of Raw Materials and Products		
<p>8. The Government will ensure, and cause APG to ensure, that the price of cement, fertilizer, steel, caustic soda, and other products produced by the PIAs will, at all times, be decontrolled and market-determined in accordance with the integrated pricing policy of the Government.</p>	LA, Schedule 6, para 11	Complied with.
<p>9. The Government will ensure, and cause APG to ensure, that the price of coal, oil, coke, and other raw materials used by the PIAs will, at all times, be decontrolled and market-determined in accordance with the integrated pricing policy of the Government.</p>	LA, Schedule 6, para. 12	Complied with.

Covenant	Reference	Remarks
B. Enterprise Reform		
10. The Government will cause APG to ensure that AVP, HCFP, and HCW each prepare an outline corporate restructuring/enterprise modernization plan acceptable to ADB that covers asset restructuring, recapitalization, streamlining of the workforce, and separation of social welfare functions from business objectives by 31 January 1997. This plan will include an action plan detailing specific actions to be taken (with target completion dates), so that the PIA can be established as a limited liability company under the Company Law with at least two shareholders and a board of directors with outside directors by 31 December 1998.	LA, Schedule 6, para. 13	Complied with late.
Financial		
11. APG will ensure that all local currency financing, as agreed to with ADB, including through cash injection, equity contribution, and rebates of taxes/fees, is provided for the Project on a timely basis to enable the timely carrying out and implementation of the Project.	LA, Schedule 6, para. 20	All the 3 PIAs got timely local currency financing except HISC. For HISC, China Construction Bank did not realize its commitment on debt financing.
APG will arrange, or cause to be arranged, additional financing (above that agreed to with ADB), as required, to ensure (i) the timely completion and implementation of the Project, and (ii) sufficient cash flow for each of the PIAs to ensure smooth operations and ability to meet debt service obligations during project implementation without exceeding the maximum debt-equity ratio of 70:30.		Complied with.
APG will ensure that HISC (i) converts to equity the CNY99.0 million debt owed by it to Hua Neng Power Company by 31 December 1998, and (ii) exercises its best efforts to convert to equity the CNY92.9 million debt owed by it to the Nuclear Industrial Bureau by 31 December 2000.		Complied with.
APG will arrange for State Development Bank, China Construction Bank, and Hefei City Investment Corporation to provide long-term financing to the PIAs, on terms and conditions agreed to by the PIAs and ADB.		Complied with.

Covenant	Reference	Remarks
Reports		
12. Each PIA will provide ADB with quarterly reports on the execution of its part of the Project and on the operation and management of the project facilities. These reports will be submitted within 30 days of the end of each quarter, be in such form and in such detail as ADB reasonably requests, and indicate, among other things, the financial status of its part of the Project, progress made and problems encountered during the quarter under review, steps taken or proposed to be taken to remedy these problems, and a proposed program of activities and expected progress during the following quarter.	PA, Section 2.08(b)	Partly complied with. ADB was not informed of some important issues in a timely manner.
13. Promptly after physical completion of its respective part of the Project, but in any event not later than 3 months thereafter or such later date as ADB may agree for this purpose, each PIA will prepare and provide to ADB a report on the execution and initial operation of its part of the Project, including cost, PIA's performance meeting its obligations under the Project Agreement, and the accomplishment of the loan purposes.	PA, Section 2.08(d)	Complied with.
Accounts		
14. Each PIA will (i) maintain separate accounts for its part of the Project and for its overall operations; (ii) have such accounts and related financial statements (balance sheet, statement of income and expenses, and related statements) audited annually, in accordance with sound auditing standards by independent auditors acceptable to ADB; and (iii) provide to ADB, promptly but in any event not later than 3 months after the close of the fiscal year to which they relate, unaudited copies of such accounts and financial statements; and not later than 6 months after the close of the fiscal year to which they relate, certified copies of such audited accounts and financial statements, and the report of the auditors relating thereto. The reports are to be in English. Each PIA will provide ADB with additional information concerning the accounts and financial statements and their audit as ADB may reasonably request.	PA, Section 2.09(a)	Complied with.

Covenant	Reference	Remarks
Others		
A. Benefit Monitoring and Evaluation		
<p>15. The Government will ensure that the PIAs, through the PMO, provide an annual benefit monitoring and evaluation report to ADB for the first 5 years after commissioning of the project facilities. Each benefit monitoring and evaluation report will include (i) an assessment of the actual product output and quality; (ii) an assessment of the achievements in wastewater tariff levels, reduction in subsidies, and collection of discharge fees; (iii) a summary of relevant environmental indicators for water pollution and an assessment of the extent of the benefits realized by the Project (including reduction of emissions and effluent); and (iv) a summary of the reduction of emissions and effluent attributable to the subprojects; (v) an assessment of the overall environmental improvement resulting from the subprojects; (vi) an assessment of the improvements on public health achieved by the Project; (vii) a summary of the status of implementation of the IEMP; and (viii) an assessment of each subproject against the Government's standards.</p>	LA, Schedule 6, para. 21	<p>Not complied with. The operation years of all subprojects are all less than 5 years, except for the wastewater treatment component. Though related monitoring measures were adopted for each subproject, the benefit monitoring and evaluation reports were not prepared and submitted to ADB.</p>
B. Resettlement		
<p>16. The Government will ensure, and cause APG to ensure, that if any of the subprojects displaces any people, resettlement and compensation will be in accordance with the laws of the Government and ADB's resettlement policy. The Government will also ensure, and cause APG to ensure, that all land and property necessary for resettling people affected by the Project will be acquired or otherwise made available in sufficient time to avoid any delay in project implementation and operation.</p>	LA, Schedule 6, para. 23	<p>Complied with. No resettlement with the Project.</p>

SUMMARY OF CONTRACT PACKAGES

PCSS No.	Item	Mode of Procurement	Date of Contract	Contract Number	Contract Amount (\$)	Amount Disbursed (\$)
Subproject 1: Chaohu Dongya Cement Limited Liability Company						
0013	Limestone/Sandstone Crushing System	ICB	18-Mar-99	99UMXH/391002CN	825,218	742,687
0015	Pulverized Coal Burner	IS	8-Mar-99	99UMXH/391009FR	337,810	337,810
0016	Materials for Nonstandard Equipment	IS	2 Mar-99	99UMXH/391011CN	332,196	332,196
0018	Raw Material Grinding System	ICB	25-Mar-99	99UMXH/391004CN	3,417,393	3,026,447
0019	Limestone Preblending System, Sandstone, Iron Cinder, and Coal Preblending System	ICB	25-Mar-99	99UMXH/391003CN	799,680	799,680
0020	Clinker Burning System	ICB	13-Mar-99	99UMXH/391005CN	1,741,427	1,741,427
0021	Raw Meal Homogenizing and Kiln Feeding, Clinker Cooler	ICB	20-Mar-99	99UMXH/391006HK	1,640,431	1,640,431
0022	Pulverized Coal Weighfeed System	ICB	24-Mar-99	99UMXH/391008US	289,885	289,885
0023	Conditioning Tower and Electrostatic Precipitator	ICB	24-Mar-99	99UMXH/391010CN	712,574	641,317
0024	Coal-Grinding System and Main Exhaust Fan	ICB	19-Apr-99	99UMXH/391007CN	758,100	682,290
0025	Various Equipment	Others	1-May-99	Various	1,055,993	1,055,993
0039	Bag Filter	IS	15-Aug-99	99UMXH/241080CN	274,271	246,844
0040	Mechanical Conveying/Lifting Equipment, Loading/Unloading Equipment	ICB	27-Aug-99	99UMXH/241081CN	1,342,982	1,342,982
0041	Weighing and Measuring Equipment, Other Process Equipment	ICB	26-Aug-99	99UMXH/241082CN	790,295	790,295
0042	Clinker Conveying Loading Equipment Feeding Device	ICB	28-Aug-99	99UMXH/241083CN	1,003,037	887,291
0043	Transport Vehicles	ICB	28-Aug-99	99UMXH/241084CN	1,872,160	1,684,944
0044	Excavation Equipment	ICB	17-Aug-99	99UMXH/131085CN	1,066,147	1,066,147
0056	Computer Control System	ICB	23-Jun-00	00UMXH/471089HK	515,950	515,950
0057	Automatic Control Instrument	ICB	26-Jun-00	00UMXH/471090CN	558,947	558,947
0058	Motorized Actuators, Level Meter, and Air Cannon	ICB	26-Jun-00	00UMXH/471091CN	1,199,315	1,199,315
0060	Equipment and Material for Transformer Station, Control Instrument, Transformer	ICB	24-Jun-00	00UMXH/231093CN	905,526	905,526
0061	Cable, Cable Bridge, and Accessories	ICB	26-Jun-00	00UMXH/221094CN	1,703,447	1,533,102
0068	Steel Materials	ICB	8-Aug-00	00UMXH/0210115CN	1,862,592	279,389
0069	Various Equipment	D/P	5-Sep-00	Various	395,291	352,918
0073	Calcium Carbide Sludge Handling	ICB	20-Oct-00	00UMXH/2410160CN	591,059	531,953
0074	Refractory	ICB	20-Oct-00	00UMXH/2410161CN	850,761	850,761
0075	Anticorrosive Materials	ICB	20-Oct-00	00UMXH/2410162CN	449,838	404,854
0076	Water Pipe Equipment, Other Auxiliary Equipment and Accessories, Materials for Nonstandard Equipment	ICB	7-Nov-00	00UMXH/2410165CN	2,205,948	1,323,569
Subproject 2: Hefei Sifang Chemical Industrial Group Company						
0002	Nitrogen-Hydrogen Compressors	ICB	12-Jun-98	98UMXH/391037HK	2,977,075	2,977,075
0003	400 MTPD Urea Plant	ICB	14-Jul-98	98UMXH/501038CN	7,900,000	7,900,000

Continued on next page.

PCSS No.	Item	Mode of Procurement	Date of Contract	Contract Number	Contract Amount (\$)	Amount Disbursed (\$)
0034	Decomposition System of Ammonia Plant	IS	1-Jun-99	99UMXH/391043CN	277,008	277,008
0036	Synthetic System of Ammonia Plant	ICB	24-Jun-99	99UMXH/391042CN	967,800	967,800
0050	Static Equipment CO ₂ Removal System	IS	Jan-00	00UMXH/391007CN	421,353	421,353
0051	Equipment of Wastewater Treatment	IS	Feb-00	00UMXH/391003CN	373,349	373,349
0052	Static Equipment in Conversion System	IS	Jan-00	00UMXH/391008CN	539,372	539,372
0055	Distribute Control System	IS	15-Jun-00	00UMXH/471063CN	359,690	359,690
0071	General Machinery Equipment	ICB	26-Oct-00	00UMXH/3910158CN	659,052	659,052
0072	Urea Cir H ₂ O System Waste H ₂ O System	ICB	26-Oct-00	00UMXH/3910159CN	866,401	866,401
0089	Comprehensive Recovery. and Standby Equipment	ICB	15-Dec-01	01UMXH/20061118HK	1,525,393	1,525,393
Subproject 3: Anhui Chlor-Alkali Chemical Group Company						
0011	150 MTPD Caustic Soda Plant	ICB	3-Sep-98	98UMXH/501052JP	8,050,000	8,050,000
0013	Rectification Unit	ICB	12-Mar-99	99/UMXH/391017CN	700,000	700,000
0046	Steel Equipment	IS	13-Mar-00	00UMXH/391025CN	318,174	318,174
0047	Plastic Equipment	IS	12-Mar-00	00UMXH/391026CN	315,000	315,000
0048	Heat Exchanger and Non-Ferrous Metal	IS	13-Mar-00	00UMXH/391027HK	330,605	330,605
0049	Pumps, Fans, and Spec. Equipment	IS	13-Mar-00	00UMXH/391028CN	299,810	299,810
0053	Electrolysis Plant Instrument	IS	11-Apr-00	00UMXH/471047CN	468,500	468,500
0054	Transformer and Voltage Distribution Unit	IS	11-Apr-00	00UMXH/471048HK	483,200	483,200
0070	Piping Valves	ICB	17-Oct-00	00UMXH/3910157CN	1,298,291	1,298,291
Subproject 4: Hefei Iron and Steel Company						
0001	License and Process Concept Design	D/P	13-Jan-98	98TPJZA/4514001CD	494,890	494,890
0004	Cokemaking Plant for Oven Machinery	ICB	3-Aug-98	98TPJZA/4514004	2,518,000	2,518,000
0005	Equipment.Cokemaking/ Screening	ICB	25-Jul-98	98TPJZA/4514005	1,657,900	1,657,900
0006	Equipment for Gas Storage Distribution Station	ICB	1-Aug-98	98TPJZA/4514007	1,489,000	1,489,000
0007	Factory For Effluent Sys in #2 Plant	ICB	3-Aug-98	98TPJZA/4514008	720,000	720,000
0008	Coal Storage Yard	ICB	23-Jul-98	98/TPJZA/4514002	587,600	587,600
0009	Coal Preparation Unit	ICB	1-Aug-98	98TPJZA/4514003	771,000	771,000
0010	Refractory Bricks for Coke Ovens	ICB	30-Jul-98	98TPJZA/4514006	1,621,000	1,621,000
0012	Steel Products	ICB	Jan 99	98TPJZA/4514009	1,048,159	1,047,215
0025	Electrical Equipment—Waste H ₂ O Treatment System of No. 2 Plant Main	IS	31-Mar-99	99TPJZA/4514018	247,000	247,000
0025	Various Equipment	Others	01-May-99	Various	131,071	131,071
0026	Belt Conveyors	ICB	27-Mar-99	99TPJZA/4514010	326,500	326,500
0027	General Equipment of Gas Purification Plant	ICB	25-Mar-99	99TPJZA/4514011	346,200	346,200
0028	Nonstandard Equipment	ICB	17-Mar-99	99TPJZA/4514012	1,750,000	1,750,000
0029	Special Equipment	ICB	18-Mar-99	99TPJZA/4514013	649,389	649,389
0030	Gas Exhausters of Gas Purification Plant	ICB	26-Mar-99	99TPJZA/451014CD	1,122,413	1,122,413

Continued on next page.

PCSS No.	Item	Mode of Procurement	Date of Contract	Contract Number	Contract Amount (\$)	Amount Disbursed (\$)
0032	Public Utilities	ICB	25-Mar-99	99TPJZA/4514016	1,152,700	1,152,700
0033	Transportation and Machinery Repair	ICB	31-Mar-99	99TPJZA/4514017	1,294,200	1,294,200
0037	General Equipment of Phenol and Cyanide Containing Effluent Treatment Station H ₂ O Supply Facilities	ICB	14-Jul-99	99TPJZA/4514019	427,960	427,960
0038	Nonstandard Equipment of Phenol and Cyanide Cont Effluent Treatment Station H ₂ O Supply Facilities	IS	14-Jul-99	99TPJZA/4514020	441,139	441,139
0045	Steel Products and Cement for Construction	ICB	21-Feb-00	2000TPJZA/4514021	929,308	929,308
0062	DCS and PLC System	ICB	16-Jun-00	00TPJZA/4514022MR	525,000	525,000
0063	Control Valves/Analytical Inst.	ICB	17-Jun-00	2000TPJZA/4514023	691,453	691,453
0064	Transmitters and Temperature Transducers, etc.	ICB	18-Jun-00	200TPJZA/4514024	268,939	268,939
0065	General Electric Equipment	ICB	18-Jun-00	2000TPJZA/4514025	931,378	931,378
0066	Cable and Transformer	ICB	16-Jun-00	2000TPJZA/4514026	1,496,199	1,496,119
0067	2nd Proposal eng 110 kV Substation	ICB	12-Jul-00	2000TPJZA/4514027	870,379	870,379
0069	Various (Liquidation of Imprest Funds)	D/P	5 Sep 00	Various	326,534	326,534
0077	Steel Products II	ICB	06-Mar-01	2001TPJZA/4514028	2,416,573	2,416,573
0078	Steel Products IV	ICB	06-Mar-01	2001TPJZA/4514029	2,590,689	2,590,689
0079	Materials for Coke Oven	ICB	06-Mar-01	2001TPJZA/4514030	2,512,677	2,512,677
0080	Coke Supply and Handling System	ICB	06-Mar-01	01TPJZA/4514031	1,343,508	1,343,508
0081	Power Supply and Communications Equipment	IS	06-Aug-01	01TPJZA/4514032	176,865	176,865
0082	External Pipelines	ICB	06-Aug-01	91TPJZA/4514033	730,031	730,031
0083	Supplementary Equipment of Water Supply and Drainage Plant	ICB	06-Aug-01	01TPJZA/4514034	384,419	384,419
0084	Packing of Water Supply and Drainage	ICB	07-Aug-01	01TPJZA/4514035	737,303	737,303
0085	Supplementary Equipment for Coal Preparation and Cokemaking	ICB	06-Aug-01	01TPJZA/4514036	1,073,686	1,073,686
0086	Supplementary Equipment for Gas Purification Plant	ICB	07-Aug-01	01TPJZA/4514037	1,194,001	1,194,001
0087	Supplementary Equipment for Laboratory	ICB	08-Aug-01	01TPJZA/4514038	401,920	401,920
0088	Cable Rack	ICB	08-Aug-01	01TPJZA/4514039	324,145	324,145
0090	Steel Products I	ICB	16 Nov 02	02TPJZA/4514040	1,966,975	1,966,975
0091	Steel Products II	ICB	16 Nov 02	02TPJZA/4514041	1,473,019	1,473,019

CO₂ = carbon dioxide, DCS = data control system, D/P = direct purchase, ICB = international competitive bidding, IS = international shopping, kV = kilovolt, MTPD = metric ton per day, PLC = programmable logic controller.

WATER QUALITY AND WASTEWATER ANALYSIS

Table A9.1: Western Part of Chao Lake (mg/l)

Item	1996	1997	1998	1999	2000	2001	2002	2003
BOD	3.00	1.80	3.70	3.70	4.61	8.13	4.20	3.80
COD	5.50	4.70	4.80	6.22	7.08	5.78	6.22	5.84
SS	45.90	41.30	50.60	34.40	36.40	36.30	—	—
NH ₃ -N	—	0.50	0.08	0.91	0.73	0.37	0.46	1.21
TP	—	—	0.27	0.18	0.21	0.21	0.25	0.36
TN	—	—	2.02	1.99	2.60	1.97	2.97	4.16

— = data not available, BOD = biological oxygen demand, COD = chemical oxygen demand, NH₃-N = ammonia nitrogen, SS = suspended solid, TN = total nitrogen, TP = total phosphorus.

Source: Anhui Environmental Protection Bureau.

Table A9.2: Eastern Part of Chao Lake (mg/l)

Item	1996	1997	1998	1999	2000	2001	2002	2003
BOD	2.50	2.50	2.80	3.00	2.10	1.96	1.84	1.78
COD	6.20	3.10	4.20	4.15	4.58	4.26	4.20	4.19
SS	90.30	34.70	67.00	45.40	39.40	38.70	—	—
NH ₃ -N	—	0.40	0.93	0.21	0.62	0.24	0.31	0.32
TP	—	—	0.38	0.18	0.13	0.13	0.13	0.10
TN	—	—	—	3.45	1.38	2.11	2.20	2.11

— = data not available, BOD = biological oxygen demand, COD = chemical oxygen demand, NH₃-N = ammonia nitrogen, SS = suspended solid, TN = total nitrogen, TP = total phosphorus.

Source: Anhui Environmental Protection Bureau.

**Table A9.3: Cement Clinker Production and Solid Waste Usage by Year
Anhui Vinylon Plant/Chaohu Dongya Cement Company**

Year	Cement Clinker		
	Production (t/a)	Fly Ash (t/a)	Ferric Sulphate (t/a)
2001	550,200	22,205	21,220
2002	763,000	30,563	29,126
2003	781,000	26,558	23,240

t/a = tons per annum.

Source: Anhui Environmental Protection Bureau.

**Table A9.4: Pollutant Concentration of Inlet and Outlet Wastewater
Hefei Chemical Works**

Item	Index	pH value	SS (mg/l)	COD (mg/l)	NH ₃ -N (mg/l)	Mercury (µg/l)
	Average value of wastewater in 1999		3~11	107	180	18.3
Average value of effluent in 2003		6.7~7.58	28	128	10.8	0.34
Class II standard for wastewater discharge (ion membrane caustic soda process)		6-9	100	—*	—*	50

COD = chemical oxygen demand, mg/l = milligram(s) per liter, NH₃-N = ammonia nitrogen, SS = suspended solid.

* No applicable standard available.

Source: Anhui Environmental Protection Bureau.

Table A9.5: Wastewater Treated and Reused

Year	Wastewater Treated (m ³ /year)	Reuse Of Treated Wastewater (m ³ /year)	Wastewater Discharge (m ³ /year)
1999	25,800		
2000	9,731,934	480,000	9,251,934
2001	9,076,200	720,000	8,356,200
2002	8,017,131	960,000	7,057,131
2003	8,121,630	960,000	7,161,630

m³/year = cubic meter per year.

Source: Anhui Environmental Protection Bureau.

**Table A9.6: Discharged Wastewater and its Main Pollutants by Year
Hefei Chemical Fertilizer Plant**

Item	Wastewater Discharge (m ³ /day)	NH ₃ -N (mg/l)	COD (mg/l)	Phosphate (mg/l)
1999	495,000	914	431	22.6
2000	675,000	91.7	131.1	0.571
2001	885,000	89.7	132.4	0.496
2002	944,000	92.6	135.9	0.461
2003	921,000	92.1	132.5	0.530

COD = chemical oxygen demand, mg/l = milligram(s) per liter, m³/day = cubic meter per day, NH₃-N = ammonia nitrogen.

Source: Anhui Environmental Protection Bureau.

**Table A9.7: Pollutant Concentration of Discharged Wastewater (No. 2 Factory Area)
Before and After Project Construction
Hefei Iron and Steel Corporation**

Item	Wastewater Discharge (million tons)	SS (mg/l)	pH	Oil (mg/l)	COD (mg/l)	Cyanide (mg/l)	Phenol (mg/l)
1999	36.74	173	7.2	19.8	138	0.35	0.73
2003	27.00	120	7.1	12	102	0.107	0.103
Class I Standard for Wastewater Discharge (GB13456-92)		150	6-9	15	150	0.5	1.0

COD = chemical oxygen demand, mg/l = milligram(s) per liter, SS = suspended solid.

Source: Anhui Environmental Protection Bureau.

FINANCIAL PERFORMANCE OF SUBPROJECT ENTERPRISES

Table A10.1: Financial Performance of Anhui Vinylon Plant/Chaohu Dongya Cement Corporation
(CNY '000)

Year Ending December 31	2002	2003
Income Statement		
Sales	118,476	128,985
Less: Cost of Goods Sold	88,218	95,963
Sales Taxes	1,094	1,194
Gross Profit	29,164	31,828
Operating Costs	7,242	7,863
Other Operating Income	9	87
Operating Profit	21,931	24,052
Non-operating Income (Expenses)	(346)	(202)
Interest Expenses	17,186	5,234
Net Income Before Income Tax	4,399	18,616
Income Tax	2,198	6,159
Net income after tax	2,201	12,457
Balance Sheet		
Current Assets		
Cash and Bank	7,085	13,322
Accounts Receivable	10,002	16,573
Inventories	6,492	5,619
Prepayments and Other Current Assets	11,603	17,876
Total Current Assets	35,182	53,390
Non-current Assets		
Property, Plant and Equipment	343,194	343,050
Less: Accumulated Depreciation	27,090	44,773
Net Fixed Assets	316,104	298,277
Other Non-current Assets	34,637	30,698
Total Non-current Assets	350,741	328,975
Total Assets	385,923	382,365
Current Liabilities		
Accounts Payable	3,218	10,883
Short-term Debt	60,000	73,107
Other Payables	15,688	4,365
Accruals and Other Current Liabilities	14,513	21,874
Total Current Liabilities	93,419	110,229
Non-current Liabilities		
Term Loans	82,773	49,660
Other Long-term Liabilities	68	354
Total Non-current Liabilities	82,841	50,014
Total Liabilities	176,260	160,243
Equity		
Issued and Paid-up Capital	80,000	80,000
Accumulated Surpluses/(Deficits)	129,663	142,122
Total Equity	209,663	222,122
Total Liabilities and Equity	385,923	382,365
Cash Flow Statement		
Sources		
Net Income After Tax		12,457
Add: Non- Cash Charges		
Depreciation		17,683
Other Non-Cash Charges		(8,268)
Interest Expense		5,234
Internal Cash Generation		27,106
Borrowings		13,107
Total Sources		40,213
Applications		
Debt Service		38,347
Principal		33,113
Interest		5,234
Change in Other Assets		(4,371)
Total Applications		33,976
Net Cash Flow		6,237
Cash Balance, Beginning		7,085
Cash Balance, End		13,322
Ratios		
Debt Service Coverage Ratio ^a		0.71
Debt/Equity Ratio ^b		0.23

^a Ratio of internal cash generation to debt service requirement.

^b Ratio of term loan to total equity.

Source: Anhui Vinylon Plant-Chaohu Dongya Cement Company. Some accounts were estimated based on available information.

Table A10.2: Financial Performance of Hefei Chemical Fertilizer Company

	(CNY '000)					
Year Ending December 31	1998	1999	2000	2001	2002	2003
Income Statement						
Sales	278,443	290,005	318,595	369,663	455,049	391,886
Less: Cost of Goods Sold	243,180	261,065	282,486	338,128	407,103	356,644
Sales Taxes	597	883	703	663	161	555
Operating Costs	30,413	26,482	32,390	31,040	36,316	35,250
Other operating income (expense)	776	579	(791)	1,311	1,213	1,357
Operating Profit	5,029	2,154	2,225	1,143	12,682	794
Non-operating Income (Expenses)	4,699	7,975	8,280	11,340	(372)	8,767
Interest Expenses	6,833	7,111	7,452	11,758	11,064	7,481
Net Income Before Income Tax	2,895	3,018	3,053	725	1,246	2,080
Income Tax	955	996	1,007	204	474	686
Net Income After Tax	1,940	2,022	2,046	521	772	1,394
Balance Sheet						
Current Assets						
Cash and Bank	3,976	3,794	4,211	5,456	2,560	8,862
Accounts Receivable	16,141	42,203	41,132	6,051	1,556	5,024
Inventories	85,578	68,032	70,713	65,057	55,522	41,115
Prepayments and Other Current Assets	103,466	100,691	64,257	127,913	147,250	77,361
Total Current Assets	209,161	214,720	180,313	204,477	206,888	132,362
Non-current Assets						
Property, Plant, and Equipment	140,327	149,947	234,897	235,894	223,650	52,890
Less: Accumulated Depreciation	65,834	73,716	89,456	100,440	108,655	27,492
Net Fixed Assets	74,493	76,231	145,441	135,454	114,995	25,398
Capital Work in Progress	34,856	52,641	2,814	7,078	14,996	13,225
Other Non-current Assets	15,423	15,778	12,622	13,132	13,122	71,764
Total Non-current Assets	124,772	144,650	160,877	155,664	143,113	110,387
Total Assets	333,933	359,370	341,190	360,141	350,001	242,749
Current Liabilities						
Accounts Payable	75,717	91,799	80,121	66,011	52,501	20,740
Short-term Debt	89,550	84,000	79,380	116,200	98,850	39,750
Other Payables	14,194	13,945	1,584	2,173	3,343	1,998
Accruals and Other Current Liabilities	21,094	15,126	9,958	6,200	3,249	26,839
Total Current Liabilities	200,555	204,870	171,043	190,584	157,943	89,327
Non-current Liabilities						
Term Loans	17,580	39,180	51,180	46,740	65,890	11,280
Other Long-term Liabilities	716	280	8,545	8,554	11,073	6,232
Total Non-current Liabilities	18,296	39,460	59,725	55,294	76,963	17,512
Total Liabilities	218,851	244,330	230,768	245,878	234,906	106,839
Equity						
Issued and Paid-up Capital	65,559	69,384	70,027	70,027	70,027	70,027
Accumulated Surpluses/(Deficits)	49,523	45,656	40,395	44,236	45,068	65,883
Total Equity	115,082	115,040	110,422	114,263	115,095	135,910
Total Liabilities and Equity	333,933	359,370	341,190	360,141	350,001	242,749
Cash Flow Statement						
Sources						
Net Income After Tax		2,022	2,046	521	772	1,394
Add: Non- Cash Charges						
Depreciation		7,882	15,740	10,984	8,215	6,710
Other Non- Cash Charges		4,124	5,617	(40,198)	(20,598)	71,312
Interest Expense		7,111	7,452	11,758	11,064	7,481
Internal Cash Generation		21,139	30,855	(16,935)	(547)	86,897
Borrowings		21,600	88,780	188,420	19,450	35,080
Change in Equity		(2,064)	(6,664)	3,320	60	19,421
Total Sources		40,675	112,971	174,805	18,963	141,398
Applications						
Capital Expenditures		9,620	84,950	997	(12,244)	(82,887)
Debt Service		12,661	88,852	167,798	28,714	156,271
Principal		5,550	81,400	156,040	17,650	148,790
Interest		7,111	7,452	11,758	11,064	7,481
Long-Term Investment		17,785	(49,827)	4,264	7,918	(1,771)
Change in Other Assets		791	(11,421)	501	(2,529)	63,483
Total Applications		40,857	112,554	173,560	21,859	135,096
Net Cash Flow		(182)	417	1,245	(2,896)	6,302
Cash Balance, Beginning		3,976	3,794	4,211	5,456	2,560
Cash Balance, End		3,794	4,211	5,456	2,560	8,862
Ratios						
Debt Service Coverage Ratio ^a		1.67	0.35	(0.10)	(0.02)	0.56
Debt/Equity Ratio ^b		0.34	0.54	0.48	0.67	0.13

^a Ratio of internal cash generation to debt service requirement.

^b Ratio of term loan to total equity.

Source: Hefei Chemical Fertilizer Company. Some accounts were estimated based on available information.

Table A10.3: Financial Performance of Hefei Chemical Works
(CNY '000)

Year Ending December 31	1998	1999	2000	2001	2002	2003
Income Statement						
Sales	267,811	278,714	350,754	304,061	374,289	494,040
Cost of Goods Sold	268,090	237,778	281,549	263,106	317,786	425,654
Sales Taxes	732	589	1,497	1,029	1,519	2,416
Operating Costs	30,755	29,933	39,357	30,982	38,546	54,057
Other Operating Income		(305)	506	1,077	544	737
Operating Profit	(31,766)	10,109	28,857	10,021	16,982	12,650
Non-operating Income (Expenses)	(1,511)	(30)	(1,613)	(1,611)	(2,662)	(1,045)
Interest Expenses	10,797	10,035	25,683	6,844	7,260	8,511
Net Income Before Income Tax	(44,074)	44	1,561	1,566	7,060	3,094
Income tax		3	379	171	191	1,957
Net Income After Tax	(44,074)	41	1,182	1,395	6,869	1,137
Balance Sheet						
Current Assets						
Cash and Bank	11,484	2,108	9,488	2,769	18,572	27,164
Accounts Receivable	72,489	77,117	63,564	71,379	51,981	59,820
Inventories	43,968	56,847	85,100	63,583	65,468	52,336
Prepayments and Other Current Assets	20,879	42,465	52,319	42,464	70,580	81,780
Total Current Assets	148,820	178,537	210,471	180,195	206,601	221,100
Non-Current Assets						
Property, Plant and Equipment	622,767	626,100	643,371	543,682	561,690	672,021
Less: Accumulated Depreciation	155,760	171,398	189,798	217,596	245,368	202,071
Net Fixed Assets	467,007	454,702	453,573	326,086	316,322	469,950
Capital Work in Progress	1,872	3,575	1,179	12,825	19,196	35,226
Other Non-current Assets	1,819	663	109,706	228,833	239,121	276,464
Total Non-current Assets	470,698	458,940	564,458	567,744	574,639	781,640
Total Assets	619,518	637,477	774,929	747,939	781,240	1,002,740
Current Liabilities						
Accounts Payable	120,990	118,363	128,553	128,520	120,560	144,108
Short-term Debt	72,429	71,629	60,201	52,001	51,584	50,984
Other Payables	30,326	7,241	31,211	42,365	41,816	31,470
Accruals and Other Current Liabilities	103,719	132,580	45,909	45,909	54,469	88,283
Total Current Liabilities	327,464	329,813	265,874	268,795	268,429	314,845
Term Loans	235,793	240,499	32,531	32,302	63,583	218,366
Other Long-term Liabilities	9,963	12,948	13,330	2,833	1,823	26,115
Total Long-term Liabilities	245,756	253,447	45,861	35,135	65,406	244,481
Total Liabilities	337,427	583,260	311,735	303,930	333,835	559,326
Equity						
Issued and Paid-up Capital	50,000	51,000	459,554	368,307	375,323	375,323
Accumulated Surpluses/(Deficits)	(3,702)	3,217	3,640	75,702	72,082	68,091
Total Equity	46,298	54,217	463,194	444,009	447,405	443,414
Total Liabilities and Equity	619,518	637,477	774,929	747,939	781,240	1,002,740
Cash Flow Statement						
Sources						
Net Income After Tax		41	1,182	1,395	6,869	1,137
Add: Non- Cash Charges						
Depreciation		15,638	18,400	27,798	27,772	16,851
Other Non- Cash Charges		(35,944)	(77,245)	34,678	(10,552)	41,109
Interest Expense		10,035	25,683	6,844	7,260	8,511
Internal Cash Generation		(10,230)	(31,980)	70,715	31,349	67,608
Borrowings		47,814	(11,428)	48,717	82,503	249,041
Change in Equity		7,878	407,795	(20,580)	(3,473)	(5,128)
Total Sources		45,462	364,387	98,852	110,379	311,521
Applications						
Capital Expenditures		3,333	17,271	(99,689)	18,008	170,479
Debt Service		53,943	233,651	63,990	58,899	103,369
Principal		43,908	207,968	57,146	51,639	94,858
Interest		10,035	25,683	6,844	7,260	8,511
Long-Term Investment		1,703	(2,396)	11,646	6,371	16,030
Change in Other Assets		(4,141)	108,661	129,624	11,298	13,051
Total Applications		54,838	357,187	105,571	94,576	302,929
Net Cash Flow		(9,376)	7,200	(6,719)	15,803	8,592
Cash Balance, Beginning		11,484	2,108	9,488	2,769	18,572
Cash Balance, End		2,108	9,488	2,769	18,572	27,164
Ratios						
Debt Service Coverage Ratio ^a		(0.19)	(0.14)	1.11	0.53	0.65
Debt/Equity Ratio ^b		4.67	0.10	0.08	0.15	0.55

^a Ratio of internal cash generation to debt service requirement.

^b Ratio of term loan to total equity.

Source: Hefei Chemical Works. Some accounts were estimated based on available information.

Table A10.4: Financial Performance of Hefei Iron and Steel Corporation
(CNY '000)

Year Ending December 31	1998	1999	2000	2001	2002	2003
Income Statement						
Sales	1,177,645	1,210,034	1,483,991	1,400,681	1,850,546	2,063,697
Less: Cost of Goods Sold	1,193,871	1,119,654	1,347,536	1,274,528	1,658,641	1,756,024
Sales Taxes	3,517	5,116	11,851	8,163	11,537	9,234
Operating Costs	137,423	125,196	109,333	121,670	161,034	270,785
Other Operating Income	26,386	23,207	4,222	10,997	5,356	4,818
Operating Profit	(130,780)	(16,725)	19,493	7,317	24,690	32,472
Nonoperating Income (Expenses)	(80,186)	(3,522)	(4,044)	5,818	(4,497)	164
Interest Expenses	52,195	30,988	24,580	12,504	11,889	12,390
Net Income Before Income Tax	(263,161)	(51,235)	(9,131)	631	8,304	20,246
Income Tax			86	(44)	6,794	40,288
Net Income After Tax	(263,161)	(51,235)	(9,217)	675	1,510	(20,042)
Balance Sheet						
Current Assets						
Cash and Bank	38,894	28,350	27,340	69,283	83,808	118,356
Accounts Receivable	90,925	91,785	85,003	118,252	104,958	74,960
Inventories	510,577	583,580	339,049	400,333	389,779	318,057
Prepayments and Other Current Assets	155,275	313,103	308,061	278,789	780,956	731,187
Total Current Assets	795,671	1,016,818	759,453	866,657	1,359,501	1,242,560
Non-current Assets						
Property, Plant and Equipment	2,407,468	2,312,678	2,339,013	2,821,086	2,676,073	2,789,775
Less: Accumulated Depreciation	766,535	762,720	819,437	886,599	855,454	935,988
Net Fixed Assets	1,640,933	1,549,958	1,519,576	1,934,487	1,820,619	1,853,787
Capital Work in Progress	297,824	485,987	794,778	575,564	752,258	879,103
Other Non-current Assets	115,061	136,156	43,045	15,475	58,160	11,034
Total Non-current Assets	2,053,818	2,172,101	2,357,399	2,525,526	2,631,037	2,743,924
Total Assets	2,849,489	3,188,919	3,116,852	3,392,183	3,990,538	3,986,484
Current Liabilities						
Accounts Payable	253,215	288,214	258,404	240,165	363,835	174,512
Short-term Debt	295,263	371,520	122,880	109,773	128,258	117,865
Other Payables	83,401	209,547	92,427	139,087	151,511	231,928
Accruals and Other Current Liabilities	605,653	611,308	374,113	460,315	799,212	854,511
Total Current Liabilities	1,237,532	1,480,589	847,824	949,340	1,442,816	1,378,816
Non-current Liabilities						
Term Loans	528,397	355,316	219,059	358,533	463,230	475,938
Other Long-term Liabilities	65,373	381,415	1,085,043	1,134,967	1,116,861	1,088,869
Total Non-current Liabilities	593,770	736,731	1,304,102	1,493,500	1,580,091	1,564,807
Total Liabilities	1,831,302	2,217,320	2,151,926	2,442,840	3,022,907	2,943,623
Equity						
Issued and Paid-up Capital	1,117,745	1,117,843	1,117,843	1,117,843	1,117,843	1,233,804
Accumulated Surpluses/(Deficits)	(99,558)	(146,244)	(152,917)	(168,500)	(150,212)	(190,943)
Total Equity	1,018,187	971,599	964,926	949,343	967,631	1,042,861
Total Liabilities and Equity	2,849,489	3,188,919	3,116,852	3,392,183	3,990,538	3,986,484
Cash Flow Statement						
Sources						
Net Income After Tax		(51,235)	(9,217)	675	1,510	(20,042)
Add: Non-Cash Charges						
Depreciation		(3,815)	56,717	67,162	70,527	80,534
Other Non-Cash Charges		(64,891)	(127,770)	49,362	(3,328)	97,882
Interest Expense		30,988	24,580	12,504	11,889	12,390
Internal Cash Generation		(88,953)	(55,690)	129,703	80,598	170,764
Borrowings		76,257	(248,640)	196,007	231,568	794,756
Changes in Equity		4,647	2,577	(16,258)	16,778	95,272
Total Sources		(8,049)	(301,753)	309,452	328,944	1,060,792
Applications						
Capital Expenditures		(94,790)	26,335	482,073	(43,341)	113,702
Debt Service		204,069	160,837	82,144	120,275	804,831
Principal		173,081	136,257	69,640	108,386	792,441
Interest		30,988	24,580	12,504	11,889	12,390
Long-Term Investment		188,163	308,791	(219,214)	176,694	126,845
Dividends		0	33	0	0	0
Change in Other Assets		(294,947)	(796,739)	(77,494)	60,791	(19,134)
Total Applications		2,495	(300,743)	267,509	314,419	1,026,244
Net Cash Flow		(10,544)	(1,010)	41,943	14,525	34,548
Cash Balance, Beginning		38,894	28,350	27,340	69,283	83,808
Cash Balance, End		28,350	27,340	69,283	83,808	118,356
Ratios						
Debt Service Coverage Ratio ^a		(0.44)	(0.35)	1.58	0.67	0.21
Debt/Equity Ratio ^b		0.76	1.35	1.57	1.63	1.50

^a Ratio of internal cash generation to debt service requirement.

^b Ratio of term loan to total equity.

Source: Hefei Iron and Steel Corporation. Some accounts were estimated based on available information.

FINANCIAL REEVALUATION

1. The financial internal rate of return (FIRR) was reevaluated using financial data and assumptions provided by the enterprises. Projection of future financial performance of the four subprojects was prepared on an incremental basis. Incremental revenues are based on sales of products associated with the investments made under the Project. Following the assumptions at appraisal, the economic lives of the four subprojects are assumed to be 15 years with zero residual value. The maturity period of the Asian Development Bank (ADB) loan is 14 years including a grace period of 4 years as stated at appraisal. All actual capital costs in both foreign exchange and local currency are expressed in constant 2003 prices converted by using a local price index and a foreign price index. The official exchange rate is applied to convert those foreign exchange financial capital costs into the local currency.

2. The product selling prices of the subprojects are based on actual in 2003. Anhui Vinylon Plant has an installed capacity of 620,000 tons (t) of cement clinker per year and reached 126% of this capacity in 2003, so 120% annual capacity is assumed for future years. The cement price at 2003 is kept constant. For the Hefei Chemical Fertilizer Plant subproject, the installed capacity is 150,000 t of urea per year. The subproject achieved 88% of the full capacity in 2003 and is projected to reach 100% in 2005. The installed capacity of the Hefei Chemical Works subproject is 50,000 t of ionic membrane caustic soda per year, and is expected to be fully utilized in 2004. The proportion of sales between ionic membrane caustic soda and flaky caustic soda is assumed to be 70:30. The output of liquid chlorine is assumed to be as much as 85% of the soda output. Hefei Iron and Steel Corporation will have an installed capacity of 600,000 t of coke per year. Since only one coke oven is in production thus far, 50% of the normal capacity is assumed for 2004 and 2005, with full capacity being reached in 2007 after installation of the second coking oven. The coke price is kept at CNY980/t as coal is expected to become more expensive.

3. The FIRRs for all the four subprojects exceeded the corresponding weighted average cost of capital (WACC). The FIRR for Hefei Chemical Works of 12.3% is similar to that at appraisal and the FIRRs for Anhui Vinylon Plant and Hefei Chemical Fertilizer Plant, 11.4% and 8.3%, respectively, are lower than those at appraisal. The lower FIRRs of the two subprojects are mainly because actual product selling prices are lower than estimated at appraisal. The lower prices were due to strong competition, combined with lower than expected demand for the products. The FIRR for Hefei Iron and Steel Corporation was much lower than at appraisal due to only one coking oven being installed by November 2003; therefore, data for only 5 months (January–May of 2004) were available for analysis. As a result, the operating costs and expenses do not reflect normal production. Full benefits can be expected only after the second coking oven is constructed and mobilized. The FIRR of the whole Project is 9.3% and is considered satisfactory being higher than the WACC of 4.6%.

4. The estimated WACC for the subprojects—in real terms and after tax—was derived following the methodology in ADB's *Guidelines for the Financial Governance and Management of Investment Projects Financed by the Asian Development Bank*. The average nominal cost for the ADB loan is 6.5% versus 7% at appraisal, while the nominal interest rate for the domestic loans ranged from 5.76% to 8%, versus 15.3% at appraisal. The cost of equity or opportunity cost for the owners' equity was 8%—the same as at appraisal. The standard income tax rate in the People's Republic of China is 33%. The local inflation projection is 3% compared with 8% at appraisal. According to the guidelines no foreign inflation rate needs to be applied in WACC calculation for foreign-sourced loans, while 2.4% of international inflation was applied at appraisal.

**Table A11.1: Financial Internal Rate of Return
Anhui Vinylon Plant/Chaohu Dongya Cement Corporation**
(CNY million)

Year	Incremental Revenues	Capital Cost	Incremental Operating Cost	Net Cash Flow
1997		4.03		(4.03)
1998		19.30		(19.30)
1999		28.59		(28.59)
2000		90.35		(90.35)
2001	78.99	156.93	69.16	(147.10)
2002	128.02	35.62	88.25	4.15
2003	145.67		104.86	40.81
2004	160.97		107.99	52.98
2005	149.70		101.15	48.55
2006	149.70		101.15	48.55
2007	149.70		101.15	48.55
2008	149.70		101.15	48.55
2009	149.70		101.15	48.55
2010	149.70		101.15	48.55
2011	149.70		101.15	48.55
2012	149.70		101.15	48.55
2013	149.70		101.15	48.55
2014	149.70		101.15	48.55
2015	149.70		101.15	48.55
2016	149.70		101.15	48.55
2017	149.70		101.15	48.55
2018	149.70		101.15	48.55
Total	2,609.45	334.82	1,786.36	488.27
FIRR				11.35%

CNY = yuan, FIRR = financial internal rate of return.
Source: Staff estimates.

Table A11.2: Financial Internal Rate of Return
Hefei Chemical Fertilizer Plant
(CNY million)

Year	Incremental Revenues	Capital Cost	Incremental Operating Cost	Net Cash Flow
1997				
1998		25.02		(25.02)
1999		11.10		(11.10)
2000		110.74		(110.74)
2001	132.65	46.77	97.77	(11.89)
2002	136.77	3.32	132.78	0.67
2003	148.94		137.14	11.80
2004	170.39		148.27	22.12
2005	179.36		156.00	23.36
2006	179.36		156.00	23.36
2007	179.36		156.00	23.36
2008	179.36		156.00	23.36
2009	179.36		156.00	23.36
2010	179.36		156.00	23.36
2011	179.36		156.00	23.36
2012	179.36		156.00	23.36
2013	179.36		156.00	23.36
2014	179.36		156.00	23.36
2015	179.36		156.00	23.36
2016	179.36		156.00	23.36
2017	179.36		156.00	23.36
2018	179.36		156.00	23.36
Total	3,099.79	196.95	2,699.96	202.88
	FIRR			8.33%

CNY = yuan, FIRR = financial internal rate of return.

Source: Staff estimates.

**Table A11.3: Financial Internal Rate of Return
Hefei Chemical Works**
(CNY million)

Year	Incremental Revenues	Capital Cost	Incremental Operating Cost	Net Cash Flow
1997				
1998		11.97		(11.97)
1999		27.80		(27.80)
2000		81.65		(81.65)
2001	47.96	22.04	46.98	(21.06)
2002	93.72	23.40	81.26	(10.94)
2003	114.17		91.29	22.88
2004	125.56		95.69	29.87
2005	126.68		96.06	30.62
2006	126.68		96.06	30.62
2007	126.71		97.35	29.36
2008	126.71		97.35	29.36
2009	126.71		97.35	29.36
2010	126.71		97.35	29.36
2011	126.71		97.35	29.36
2012	126.71		97.35	29.36
2013	126.71		97.35	29.36
2014	126.71		97.35	29.36
2015	126.71		97.35	29.36
2016	126.71		97.35	29.36
2017	126.71		97.35	29.36
2018	126.71		101.57	25.14
Total	2,155.29	166.86	1,679.76	308.67
FIRR				12.37%

CNY = yuan, FIRR = financial internal rate of return.

Source: Staff estimates.

**Table A11.4: Financial Internal Rate of Return
Hefei Iron and Steel Corporation**
(CNY million)

Year	Incremental Revenues	Capital Cost	Incremental Operating Cost	Net Cash Flow
1997				
1998		14.95		(14.95)
1999		37.81		(37.81)
2000		53.62		(53.62)
2001		157.23		(157.23)
2002		153.19		(153.19)
2003		37.84		(37.84)
2004	162.98	33.95	149.52	(20.49)
2005	167.66	71.25	151.07	(54.65)
2006	427.40		371.53	55.86
2007	495.60		428.31	67.29
2008	531.77		457.38	74.39
2009	567.81		486.41	81.40
2010	571.83		487.73	84.10
2011	575.73		489.02	86.71
2012	579.51		490.27	89.24
2013	583.18		491.48	91.70
2014	586.74		492.65	94.08
2015	590.19		493.79	96.39
2016	593.53		494.90	98.64
2017	596.78		495.97	100.81
2018	599.93		497.01	102.92
Total	7,630.63	559.84	6,477.03	593.76
	FIRR			7.39%

CNY = yuan, FIRR = financial internal rate of return.

Source: Staff estimates.

Table A11.5: Financial Internal Rate of Return
Summary of Financial Internal Rate of Return
(CNY million)

Year	Incremental Revenues	Capital Cost	Incremental Operating Cost	Net Cash Flow
1997		4.03		(4.03)
1998		71.24		(71.24)
1999		105.30		(105.30)
2000		336.36		(336.36)
2001	259.60	382.97	213.91	(337.28)
2002	358.51	215.53	302.29	(159.31)
2003	408.78	37.84	333.29	37.65
2004	619.90	33.95	501.47	84.48
2005	623.40	71.25	504.28	47.88
2006	883.14		724.74	158.39
2007	951.37		782.81	168.56
2008	987.54		811.88	175.66
2009	1,023.58		840.91	182.67
2010	1,027.60		842.23	185.37
2011	1,031.50		843.52	187.98
2012	1,035.28		844.77	190.51
2013	1,038.95		845.98	192.97
2014	1,042.51		847.15	195.35
2015	1,045.96		848.29	197.66
2016	1,049.30		849.40	199.91
2017	1,052.55		850.47	202.08
2018	1,055.70		855.73	199.97
Total	15,495.16	1,258.47	12,643.11	1,593.58
	FIRR			9.31%

CNY = yuan, FIRR = financial internal rate of return.

Source: Staff estimates.

ECONOMIC REEVALUATION

A. Methodology

1. Through economic reevaluation, the economic internal rate of return (EIRR) of the Anhui Environmental Improvement for Industrial Pollution Abatement Project is calculated based on the quantification of benefits and costs. The benefits include (i) improved product quality (product sales), and (ii) environmental benefits due to reduced wastewater discharge. The costs include (i) capital cost, (ii) fixed operation cost, and (iii) variable operation cost. The cost-savings benefit resulting from higher productivity is incorporated into the lower operation cost. The stressors of environmental impact are different than those at appraisal. In the appraisal report, the benefits took into account the reduction of both wastewater discharge and air pollution, whereas in the project completion review, only the benefit of wastewater discharge reduction is incorporated. The expected air pollution reduction mainly in the Hefei Iron and Steel Corporation subproject was not realized until 2004 because the planned retirement of the existing aged coke oven was postponed.

B. Project Benefits and Costs

2. The shadow price is adopted to calculate all costs. The imported goods and import substitutes are valued at their border price plus their inland freight and load/unload cost. Domestically produced and traded goods are valued at local prices, while the tax and duties are excluded. Other items are applied with the conversion factor to convert from their financial cost to economic cost. The social discount rate of 12% is used, and the economic life is assumed to be 15 years after full operation. The methodology to calculate the constant price of capital cost is according to Asian Development Bank (ADB) guidelines. The group conversion factors used to convert the financial cost to economic cost were selected based on related projects funded by ADB: Fixed operational cost includes labor cost, administrative and marketing expenses, and other fixed operational cost. The cost of skilled labor is adjusted by a conversion factor of 2.0, while the cost of unskilled labor is adjusted by a conversion factor of 0.67 based on international experience. Variable operational cost includes cost of raw materials, coal, electricity, etc. The economic price of coal is estimated based on its border price and adjusted by the freight and load/unload cost. The derived coal price in Anhui province is CNY334.8/ton of coal equivalent. The economic price of electricity is estimated as the market price in 2003 (excluding the tax and duties), which is CNY0.498/kilowatt-hour. For other items, the local prices (excluding taxes and duties) are taken as their economic prices.

3. The major project outputs include cement clinker (intermediary material of cement), urea, caustic soda and other chemical products, and coke. Except for urea, which is an important product and its price is controlled by the Government, the prices of other products are largely market-determined and comparable to the world market price. Similar to the appraisal report, the economic price of urea is estimated based on its border price and adjusted by its freight and load/unload cost. For other products, the local market prices (excluding taxes and duties) are taken as their economic price.

4. The environmental benefit quantified in this report only includes the reduction of wastewater discharge. The economic value of wastewater treatment is priced as CNY1.0/cubic meter, comparable to the willingness-to-pay of local residents noted in the appraisal report.

C. Economic Analysis

5. The EIRR for the whole Project is estimated at 14.8% without environmental benefits. If environmental benefits are included, the derived EIRR is 16.0%. Table A12.1 summarizes the EIRR of each subproject and the whole Project. Tables A12.2 to A12.6 present the EIRR calculation for each subproject and the whole Project.

Table A12.1: Summary of the Economic Internal Rate of Return Calculation

Project/Subproject	Without Environmental Benefit	With Environmental Benefit
AVP/CDCC	16.3%	18.1%
HCFP	19.7%	19.5%
HCW	15.8%	16.8%
HISC	11.6%	13.2%
The Whole Project	14.8%	16.0%

AVP/CDCC = Anhui Vinylon Plant/Chaohua Donya Cement Company, HCFP = Hefei Chemical Fertilizer Plant, HCW = Hefei Chemical Works, HISC = Hefei Iron and Steel Corporation.

Source: Staff estimates.

**Table A12.2: Economic Internal Rate of Return
Anhui Vinylon Plan/Chaohu Dongya Cement Corporation
(CNY million)**

Year	Products Sales Benefit	Capital Cost	Operation Cost	Net Benefit	Environmental Benefit	Net Benefit with Environment
1997		4.31		(4.31)		(4.31)
1998		20.43		(20.43)		(20.43)
1999		28.94		(28.94)		(28.94)
2000		90.85		(90.85)		(90.85)
2001	112.75	162.74	73.74	(123.73)	3.87	(119.85)
2002	156.42	35.70	95.07	25.64	5.37	31.01
2003	160.11		97.73	62.38	5.50	67.88
2004	164.00		99.44	64.56	5.63	70.20
2005	152.52		94.40	58.12	5.24	63.36
2006	152.52		94.40	58.12	5.24	63.36
2007	152.52		94.40	58.12	5.24	63.36
2008	152.52		94.40	58.12	5.24	63.36
2009	152.52		94.40	58.12	5.24	63.36
2010	152.52		94.40	58.12	5.24	63.36
2011	152.52		94.40	58.12	5.24	63.36
2012	152.52		94.40	58.12	5.24	63.36
2013	152.52		94.40	58.12	5.24	63.36
2014	152.52		94.40	58.12	5.24	63.36
2015	152.52		94.40	58.12	5.24	63.36
2016	152.52		94.40	58.12	5.24	63.36
2017	152.52		94.40	58.12	5.24	63.36
2018	152.52		94.40	58.12	5.24	63.36
NPV 2003	1,525.77	461.81	944.13	119.82	52.41	172.24
EIRR				16.3%		18.1%

CNY = yuan, EIRR = economic internal rate of return, NPV = net present value.

Source: Staff estimates.

**Table A12.3: Economic Internal Rate of Return
Hefei Chemical Fertilizer Plant**
(CNY million)

Year	Products Sales Benefit	Capital Cost	Operation Cost	Net Benefit	Environmental Benefit	Net Benefit with Environment
1997						
1998		25.94		(25.94)		(25.94)
1999		11.43		(11.43)		(11.43)
2000		113.10		(113.10)		(113.10)
2001	136.55	48.27	101.37	(13.08)	(0.32)	(13.41)
2002	171.23	16.77	130.08	24.38	(0.40)	23.97
2003	180.84	3.07	138.30	39.47	(0.43)	39.04
2004	194.30		147.93	46.36	(0.46)	45.90
2005	204.52		155.26	49.26	(0.48)	48.78
2006	204.52		155.26	49.26	(0.48)	48.78
2007	204.52		155.26	49.26	(0.48)	48.78
2008	204.52		155.26	49.26	(0.48)	48.78
2009	204.52		155.26	49.26	(0.48)	48.78
2010	204.52		155.26	49.26	(0.48)	48.78
2011	204.52		155.26	49.26	(0.48)	48.78
2012	204.52		155.26	49.26	(0.48)	48.78
2013	204.52		155.26	49.26	(0.48)	48.78
2014	204.52		155.26	49.26	(0.48)	48.78
2015	204.52		155.26	49.26	(0.48)	48.78
2016	204.52		155.26	49.26	(0.48)	48.78
2017	204.52		155.26	49.26	(0.48)	48.78
2018	204.52		155.26	49.26	(0.48)	48.78
NPV 2003	1,927.75	305.01	1,462.04	160.69	(4.54)	156.15
EIRR				19.7%		19.5%

CNY = yuan, EIRR = economic internal rate of return, NPV = net present value.
Source: Staff estimates.

**Table A12.4: Economic Internal Rate of Return
Hefei Chemical Works**
(CNY million)

Year	Products Sales Benefit	Capital Cost	Operation Cost	Net Benefit	Environmental Benefit	Net Benefit with Environment
1997						
1998		13.81		(13.81)		(13.81)
1999		31.13		(31.13)		(31.13)
2000		85.38		(85.38)		(85.38)
2001	49.96	21.71	51.08	(26.83)	1.83	(25.00)
2002	89.92	31.31	75.70	(17.09)	2.14	(14.95)
2003	115.31		83.79	31.52	2.34	33.86
2004	126.54		84.73	41.81	2.37	44.18
2005	127.68		84.73	42.95	2.37	45.32
2006	127.68		84.73	42.95	2.37	45.32

Year	Products Sales Benefit	Capital Cost	Operation Cost	Net Benefit	Environmental Benefit	Net Benefit with Environment
2007	127.68		84.73	42.95	2.37	45.32
2008	127.68		84.73	42.95	2.37	45.32
2009	127.68		84.73	42.95	2.37	45.32
2010	127.68		84.73	42.95	2.37	45.32
2011	127.68		84.73	42.95	2.37	45.32
2012	127.68		84.73	42.95	2.37	45.32
2013	127.68		84.73	42.95	2.37	45.32
2014	127.68		84.73	42.95	2.37	45.32
2015	127.68		84.73	42.95	2.37	45.32
2016	127.68		84.73	42.95	2.37	45.32
2017	127.68		84.73	42.95	2.37	45.32
2018	127.68		84.73	42.95	2.37	45.32
NPV 2003	1,142.23	255.56	809.70	76.96	23.18	100.15
EIRR				15.8%		16.3%

CNY = yuan, EIRR = economic internal rate of return, NPV = net present value.
Source: Staff estimates.

**Table A12.5: Economic Internal Rate of Return
Hefei Iron and Steel Corporation
(CNY million)**

Year	Products Sales Benefit	Capital Cost	Operation Cost	Net Benefit	Environmental Benefit	Net Benefit with Environment
1997						
1998		15.87		(15.87)		(15.87)
1999		38.65		(38.65)		(38.65)
2000		54.81		(54.81)		(54.81)
2001		158.40		(158.40)	3.25	(155.25)
2002		175.27		(175.27)	6.50	(168.77)
2003		61.37		(61.37)	9.75	(51.62)
2004	318.99	36.24	271.36	11.39	9.75	21.14
2005	318.99	76.06	271.36	(28.43)	9.75	(18.68)
2006	574.18		474.80	99.38	9.75	109.13
2007	637.98		525.66	112.32	9.75	122.07
2008	669.88		551.09	118.79	9.75	128.54
2009	701.78		576.52	125.26	9.75	135.00
2010	701.78		576.52	125.26	9.75	135.00
2011	701.78		576.52	125.26	9.75	135.00
2012	701.78		576.52	125.26	9.75	135.00
2013	701.78		576.52	125.26	9.75	135.00
2014	701.78		576.52	125.26	9.75	135.00
2015	701.78		576.52	125.26	9.75	135.00
2016	701.78		576.52	125.26	9.75	135.00
2017	701.78		576.52	125.26	9.75	135.00
2018	701.78		576.52	125.26	9.75	135.00
NPV 2003	3,983.32	715.14	3,291.69	(23.52)	87.47	63.95
EIRR				11.6%		13.2%

CNY = yuan, EIRR = economic internal rate of return, NPV = net present value.
Source: Staff estimates.

Table A12.6: Summary of Economic Internal Rate of Return
(CNY million)

Year	Products Sales Benefit	Capital Cost	Operation Cost	Net Benefit	Environmental Benefit	Net Benefit with Environment
1997		4.31		(4.31)		(4.31)
1998		76.05		(76.05)		(76.05)
1999		110.15		(110.15)		(110.15)
2000		344.14		(344.14)		(344.14)
2001	295.26	391.11	226.19	(322.04)	8.63	(313.40)
2002	417.56	259.05	300.85	(142.34)	13.60	(128.74)
2003	456.25	64.44	319.81	72.00	17.16	89.16
2004	803.82	36.24	603.45	164.12	17.29	181.42
2005	803.71	76.06	605.74	121.91	16.87	138.78
2006	1,058.90	–	809.18	249.72	16.87	266.60
2007	1,122.70	–	860.04	262.66	16.87	279.53
2008	1,154.60	–	885.47	269.13	16.87	286.00
2009	1,186.50	–	910.90	275.60	16.87	292.47
2010	1,186.50	–	910.90	275.60	16.87	292.47
2011	1,186.50	–	910.90	275.60	16.87	292.47
2012	1,186.50	–	910.90	275.60	16.87	292.47
2013	1,186.50	–	910.90	275.60	16.87	292.47
2014	1,186.50	–	910.90	275.60	16.87	292.47
2015	1,186.50	–	910.90	275.60	16.87	292.47
2016	1,186.50	–	910.90	275.60	16.87	292.47
2017	1,186.50	–	910.90	275.60	16.87	292.47
2018	1,186.50	–	910.90	275.60	16.87	292.47
NPV 2003	8,579.06	1,737.53	6,507.57	333.96	158.52	492.48
EIRR				14.8%		16.02%

CNY = yuan, EIRR = economic internal rate of return, NPV = net present value.

Source: Staff estimates.