

Document of
The World Bank

Report No: ICR00002097

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(TF-56588)

ON A

GRANT FROM THE GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF US\$ 14.4 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR THE

DEMONSTRATION OF ALTERNATIVES TO CHLORDANE AND MIREX IN
TERMITE CONTROL PROJECT

June 21, 2012

China and Mongolia Sustainable Development Unit
Sustainable Development Department
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective: December 31, 2011)

Currency Unit = Chinese Yuan (CNY)
CNY 6.3009 = US\$ 1

FISCAL YEAR
July 1 – June 30

ABBREVIATIONS AND ACRONYMS

| | |
|--------|--|
| CIO | Convention Implementation Office |
| CNAO | China National Audit Office |
| COP | Conference of Parties |
| CPS | Country Partnership Strategy |
| CTA | Chief Technical Advisor (international) |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| EPD | Environmental Protection Department |
| FAO | Food and Agriculture Organization of the United Nations |
| FECO | Foreign Economic Cooperation Office |
| GAC | General Administration of Customs |
| GEF | Global Environment Facility |
| GP | General Policies of the World Bank |
| ICAMA | Institute for the Control of Agrochemicals of Ministry of Agriculture |
| IPM | Integrated Pest Management |
| MEP | Ministry of Environment Protection |
| MOA | Ministry of Agriculture |
| MIS | Management Information System |
| MOCCom | Ministry of Commerce |
| MOC | Ministry of Construction |
| MOF | Ministry of Finance |
| MOFA | Ministry of Foreign Affairs |
| MOH | Ministry of Public Health |
| MOHURD | Ministry of Housing and Urban-Rural Development |
| MOST | Ministry of Science and Technology |
| MT | Metric Ton |
| NDRC | National Development and Reform Commission |
| NIP | National Implementation Plan |
| NLG | National Leading Group for Implementation of the Stockholm Convention in China |
| NRP | National Replication Program |
| NTA | National Technical Advisor |
| NTCC | The National Termite Control Center |
| PCN | Project Concept Note |
| PIU | Project Implementation Unit |
| PMP | Pest Management Plan |

| | |
|-------|---|
| POPs | Persistent Organic Pollutants |
| RMB | Renminbi (common name for Chinese currency – see also Yuan) |
| R&D | Research and Development |
| SEPA | State Environmental Protection Administration |
| SERC | State Electricity Regulatory Commission |
| TOR | Terms of Reference |
| UNDP | United Nations Development Program |
| UNEP | United Nations Environmental Program |
| UNIDO | United Nations Industrial Development Organization |
| WB | World Bank |
| WHO | World Health Organization |

| |
|--|
| <p>Vice President: Pamela Cox, EAPVP</p> <p>Country Director: Klaus Rohland, EACCF</p> <p>Sector Managers: Mark R. Lundell, EASCS; Magda Lovei, EASER</p> <p>Project Team Leader: Qing Wang</p> <p>ICR Team Leader Qing Wang</p> |
|--|

China

Demonstration of Alternatives to Chlordane and Mirex in Termite Control Project

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| A. Basic Information | | | |
|--|------------|----------------------|---|
| Country: | China | Project Name: | Demonstration of alternatives to Chlordane and Mirex in Termite Control Project |
| Project ID: | P082992 | L/C/TF Number(s): | TF-56588 |
| ICR Date: | 06/21/2012 | ICR Type: | Core ICR |
| Lending Instrument: | SIL | Borrower: | PEOPLE'S REPUBLIC OF CHINA |
| Original Total Commitment: | USD 14.36M | Disbursed Amount: | USD 14.36M |
| Revised Amount: | USD 14.36M | | |
| Environmental Category: A | | Global Focal Area: P | |
| Implementing Agencies: | | | |
| Ministry of Environmental Protection | | | |
| Co-financiers and Other External Partners: | | | |

| B. Key Dates | | | | |
|---------------------|------------|-------------------|---------------|--------------------------|
| Process | Date | Process | Original Date | Revised / Actual Date(s) |
| Concept Review: | 09/04/2003 | Effectiveness: | | 12/15/2006 |
| Appraisal: | 01/06/2006 | Restructuring(s): | | 03/15/2007 12/29/2010 |
| Approval: | 06/29/2006 | Mid-term Review: | | 10/28/2009 |
| | | Closing: | 12/31/2010 | 12/31/2011 |

| C. Ratings Summary | |
|--------------------------------------|-------------------------|
| C.1 Performance Rating by ICR | |
| Outcomes: | Moderate Satisfactory |
| Risk to Global Environment Outcome | Moderate |
| Bank Performance: | Moderately Satisfactory |
| Borrower Performance: | Satisfactory |

| C.2 Detailed Ratings of Bank and Borrower Performance | | | |
|--|-------------------------|-------------------------------|--------------|
| Bank | Ratings | Borrower | Ratings |
| Quality at Entry: | Moderately Satisfactory | Government: | Satisfactory |
| Quality of Supervision: | Moderately Satisfactory | Implementing Agency/Agencies: | Satisfactory |
| Overall Bank | Moderately Satisfactory | Overall Borrower | Satisfactory |

| | | | |
|---|-------------------|---------------------------------|-------------------------|
| Performance: | | Performance: | |
| C.3 Quality at Entry and Implementation Performance Indicators | | | |
| Implementation Performance | Indicators | QAG Assessments (if any) | Rating |
| Potential Problem Project at any time (Yes/No): | No | Quality at Entry (QEA): | Moderately Satisfactory |
| Problem Project at any time (Yes/No): | Yes | Quality of Supervision (QSA): | None |
| GEO rating before Closing/Inactive status | Satisfactory | | |

| D. Sector and Theme Codes | | |
|--|-----------------|---------------|
| | Original | Actual |
| Sector Code (as % of total Bank financing) | | |
| Central government administration | 16 | 16 |
| Housing construction | 64 | 64 |
| Petrochemicals and fertilizers | 4 | 4 |
| Sub-national government administration | 16 | 16 |
| | | |
| Theme Code (as % of total Bank financing) | | |
| Environmental policies and institutions | 20 | 20 |
| Other environment and natural resources management | 20 | 10 |
| Other human development | 20 | 20 |
| Pollution management and environmental health | 40 | 50 |

| E. Bank Staff | | |
|----------------------|-----------------|---------------------|
| Positions | At ICR | At Approval |
| Vice President: | Pamela Cox | Jemal-ud-din Kassum |
| Country Director: | Klaus Rohland | David R. Dollar |
| Sector Manager: | Mark R. Lundell | Magdolna Lovei |
| Project Team Leader: | Qing Wang | Helen Chan |
| ICR Team Leader: | Qing Wang | |
| ICR Primary Author: | Salim Rouhana | |
| | Qing Wang | |
| | Zhong Tong | |

F. Results Framework Analysis

Global Environment Objectives (GEO) and Key Indicators(as approved)

The Project Development Objective was to mitigate environmental and health risks associated with chlordane and mirex in termite control by (a) demonstrating the elimination of their use through the introduction of integrated pest management in selected areas, and (b) preparing a national replication program for complete phase-out of chlordane and mirex in China.

The above PDO is exactly as presented in the PAD and it had always been used during implementation for monitoring and reporting purposes. Consequently, this PDO is used in this ICR for final assessment of results. However, it should be noted that the PDO presented in the project Grant Agreement had a slightly different formulation: "to assist the Recipient in substituting the use of chlordane and mirex (which are harmful to human health and the environment) with integrated pest management techniques ("IPM") as a means to control termites in Jiangsu and Participating Provinces; and establishing a cost effective framework for promoting IPM in termite control."

Revised Global Environment Objectives (as approved by original approving authority) and Key Indicators and reasons/justifications

No change to the GEO.

(a) GEO Indicator(s)

| Indicator | Baseline Value | Original Target Values (from approval documents) | Formally Revised Target Values | Actual Value Achieved at Completion or Target Years |
|-------------------------------------|---|---|--------------------------------|---|
| Indicator 1 : | No use of chlordane and mirex by the termite control professionals in the demonstration area. | | | |
| Value (quantitative or Qualitative) | 150 MT of consumption of chlordane and mirex in the three demonstration provinces | 0 MT (complete phase out of chlordane and mirex in the three demonstration provinces) | | 0 MT (complete phased out in the project provinces) |
| Date achieved | 12/31/2001 | 12/31/2010 | | 05/17/2009 |
| Comments (incl. % achievement) | Fully achieved. Production and consumption of chlordane and mirex was banned in China May 2009 and there was a complete phase out of consumption of chlordane and mirex in the demonstration provinces. | | | |

(b) Intermediate Outcome Indicator(s)

| Indicator | Baseline Value | Original Target Values (from approval documents) | Formally Revised Target Values | Actual Value Achieved at Completion or Target Years |
|-------------------------------------|---|---|--------------------------------|--|
| Indicator 1 : | National and global dissemination workshop conducted for the project. | | | |
| Value (quantitative or Qualitative) | 0% - no dissemination workshops | Workshop completed. | | Not completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Not achieved. FECO decided to hold this workshop in July 2012 by using its own counterpart funding. | | | |
| Indicator 2 : | Eight EIAs prepared for the closure of the remaining eight C/M producers. | | | |
| Value (quantitative or Qualitative) | 0% - no EIAs for the remaining eight C/M manufacturers | Eight EIAs completed | | Eight EIAs completed |
| Date achieved | 06/01/2006 | 04/30/2010 | | 04/30/2010 |
| Comments (incl. % achievement) | Achieved. EIAs for 8 C/M producers were completed. Based on these EIAs, one site was selected to replace Liyang Guanhua and an additional site was selected also for cleanup. The project totally financed two sites for cleanup. | | | |
| Indicator 3 : | National Replication Program (NRP) finalized and submitted to GEF CEO for approval | | | |
| Value (quantitative or Qualitative) | 0% - no national replication program | NPR completed and submitted to GEF | | The NRP preparation was completed, but not submitted to GEF. |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Partially achieved. Since there were project cost savings under the project, it was agreed that GEF financing for the NRP was not necessary. China decided to include the NRP in its 12th Five Year Plan for termite control. | | | |
| Indicator 4 : | A national workshop for preparation of the NRP conducted. | | | |
| Value (quantitative or Qualitative) | 0% - no replication program workshop | The Workshop conducted | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2008 | | 04/30/2008 |
| Comments (incl. % achievement) | Achieved. | | | |
| Indicator 5 : | Computerized Management Information System (MIS) established. | | | |
| Value (quantitative or Qualitative) | 0% - no MIS | MIS developed and installed in participating Termite Control Stations | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |

| | | | | |
|--|---|--|--|-----------------------------------|
| Comments (incl. % achievement) | Achieved. MIS installed and functional in all participating Termite Control Stations. | | | |
| Indicator 6 : | Four annual implementation review meetings conducted. | | | |
| Value (quantitative or Qualitative) | 0% - no annual reviews | Four review meetings conducted. | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Achieved. Review meetings conducted several times a year. | | | |
| Indicator 7 : | Adequate project management information produced and semi-annual financial management reports (FMRs) produced | | | |
| Value (quantitative or Qualitative) | 0% | FMRs with required information to be prepared every six months | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Achieved. All management information and FMRs produced regularly. | | | |
| Indicator 8 : | A workshop on monitoring and evaluation conducted. | | | |
| Value (quantitative or Qualitative) | 0% | Workshop conducted. | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Achieved. The workshop on monitoring and evaluation was conducted Sept. 15-17, 2008, coinciding with a Bank supervision mission. Another M&E workshop was held in December 2011 focusing on preparation of completion reports by PIUs and other stakeholders. | | | |
| Indicator 9 : | Plant owners and workers compensated for lost income | | | |
| Value (quantitative or Qualitative) | 0%-no required compensation | Full compensation completed for plant owners and workers. | | Not completed |
| Date achieved | 06/01/2006 | 12/31/2009 | | 12/31/2011 |
| Comments (incl. % achievement) | Liyang Guanghua decided not to participate in the project. Liyang Xinhai was selected replacing Liyang Guanghua and was compensated for its closure. Liyang Guanghua was finally closed as requested by the Ban but without closure compensation. | | | |
| Indicator 10 : | Hazardous waste from the plant closure properly disposed. | | | |
| Value (quantitative or Qualitative) | 0% | 100% of hazardous waste disposed | Hazardous waste from two plant closures properly disposed. | 100% of revised targets completed |

| | | | | |
|--|--|--|---|--|
| Date achieved | 06/01/2006 | 12/31/2009 | 12/31/2011 | 12/31/2011 |
| Comments (incl. % achievement) | Revised targets achieved. Hazardous waste was disposed from two plants (Liyang Xinhai and Changshu Fengjiang). | | | |
| Indicator 11 : | Contaminated facilities, equipment and waste from the manufacturing stie removed. | | | |
| Value (quantitative or Qualitative) | 0% | 100% | Contaminated facilities, equipment and waste from two manufacturing sites removed. | 100% of revised targets completed. |
| Date achieved | 06/01/2006 | 12/31/2009 | 12/31/2011 | 12/31/2011 |
| Comments (incl. % achievement) | Revised targets achieved. Contaminated facilities, equipment and waste from two sites were removed. | | | |
| Indicator 12 : | Production of 150 MT chlordane and mirex reduced permanently. | | | |
| Value (quantitative or Qualitative) | 450 MT of chlordane and mirex production | 300 MT of chlordane and mirex production | | 0 MT of chlordane and mirex production |
| Date achieved | 06/01/2006 | 12/31/2009 | | 05/17/2009 |
| Comments (incl. % achievement) | Achieved more than expected. A Ban on chlordane and mirex production, consumption, sales, import and export was issued for entire China in May 2009 which resulted in total elimination of chlordane and mirex production. | | | |
| Indicator 13 : | Integrated termite management website established and ready for public use. | | | |
| Value (quantitative or Qualitative) | 0% not existing | Website fully established and operational. | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2008 | | 10/31/2008 |
| Comments (incl. % achievement) | Achieved. A website was developed and operational. | | | |
| Indicator 14 : | About 500,000 above-ground (AG) stations installed for remedial treatment of buildings. | | | |
| Value (quantitative or Qualitative) | 0% installed | 500,000 AG bait systems installed | 151,500 above-ground stations installed for remedial treatment of buildings in the three demonstration provinces. | 100% of revised target completed |
| Date achieved | 06/01/2006 | 12/31/2010 | 12/31/2011 | 12/31/2011 |
| Comments (incl. % achievement) | Revised target achieved. The target was revised by an amendment to the GA in December 2010. | | | |

| | | | | |
|--|--|---|---|----------------------------------|
| Indicator 15 : | About 400,000 in-ground (IG) bait systems installed for preventive treatment of newly constructed buildings. | | | |
| Value (quantitative or Qualitative) | 0% | 400,000 IG bait systems installed. | 694,105 in-ground bait systems procured and installed for preventive treatment of newly constructed buildings during project life, 67,895 in-ground bait systems procured for maintenance beyond the project life in the three demonstration provinces. | 100% of revised target completed |
| Date achieved | 06/01/2006 | 12/31/2010 | 12/31/2011 | 12/31/2011 |
| Comments (incl. % achievement) | Revised target achieved. The target was revised by an amendment to the GA in December 2010. | | | |
| Indicator 16 : | IPM training conducted to train at least: 3 managerial personnel of each termite station; about 100 research personnel; 3 trainers from each city level station; and 10 termite control operators. | | | |
| Value (quantitative or Qualitative) | 0% training | 100% IPM training completed | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Achieved. A total of 94 training workshops on IPM concepts and techniques were held for 5,754 management staff and technicians/operators on termite prevention and control. | | | |
| Indicator 17 : | The IPM Operation and Training Manual disseminated. | | | |
| Value (quantitative or Qualitative) | 0% | 100% - IPM manual completed and disseminated in all demonstration provinces | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2007 | | 04/30/2008 |
| Comments (incl. % achievement) | Achieved. | | | |
| Indicator 18 : | National and provincial policy and regulatory documents reviewed, revised as | | | |

| | | | | |
|--|---|---|--|-----------------------|
| | necessary, or issued in respect to national and provincial construction codes. | | | |
| Value (quantitative or Qualitative) | 0% | 100% of documents reviewed, revised and some of them issued | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |
| Comments (incl. % achievement) | Achieved. A total of six national-level policies and 25 provincial-level policies were revised or newly formulated. | | | |
| Indicator 19 : | Chief technical advisor (CTA), national technical advisor (NTA), and technical experts recruited. | | | |
| Value (quantitative or Qualitative) | 0% recruited | CTA, NTA and technical advisors recruited | | 100% timely recruited |
| Date achieved | 06/01/2006 | 12/31/2007 | | 10/31/2008 |
| Comments (incl. % achievement) | Achieved. A CTA, a NTA and several technical advisors were recruited as needed. | | | |
| Indicator 20 : | The project team at CIO and provincial PIUs adequately staffed, trained and equipped. | | | |
| Value (quantitative or Qualitative) | 0% | All CIO and PIUs staffed. | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2008 | | 10/31/2008 |
| Comments (incl. % achievement) | Achieved. | | | |
| Indicator 21 : | Use of 150 MT of chlordane and mirex for termite control in the demonstration area is eliminated | | | |
| Value (quantitative or Qualitative) | 0%-no reduction in chlordane and mirex consumption | 100% consumption of chlordane and mirex phased out in the three provinces | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 05/17/2009 |
| Comments (incl. % achievement) | Achieved. Consumption of chlordane and mirex was banned in May 2009 nationwide. | | | |
| Indicator 22 : | Semi-annual provincial steering group (PSG) meetings conducted in each demonstration area | | | |
| Value (quantitative or Qualitative) | 0% no PSG meetings | All PSG meetings take place as scheduled (or ad hoc when needed) | | 100% completed |
| Date achieved | 06/01/2006 | 12/31/2010 | | 12/31/2011 |

| | | | | |
|--|--|--|--|----------------|
| Comments (incl. % achievement) | Achieved. The provincial PIUs organized PSG meetings as needed to review project progress and address issues incurred. | | | |
| Indicator 23 : | 41,250 monitoring-dusting systems installed during the project life in five newly-added provinces, 4,125 monitoring-dusting systems procured for maintenance beyond the project. | | | |
| Value (quantitative or Qualitative) | 0 | 41,250 monitoring-dusting systems installed. | | 100% completed |
| Date achieved | 01/01/2011 | 12/31/2011 | | 12/31/2011 |
| Comments (incl. % achievement) | Achieved. The piloting results for termite prevention and control is promising. | | | |

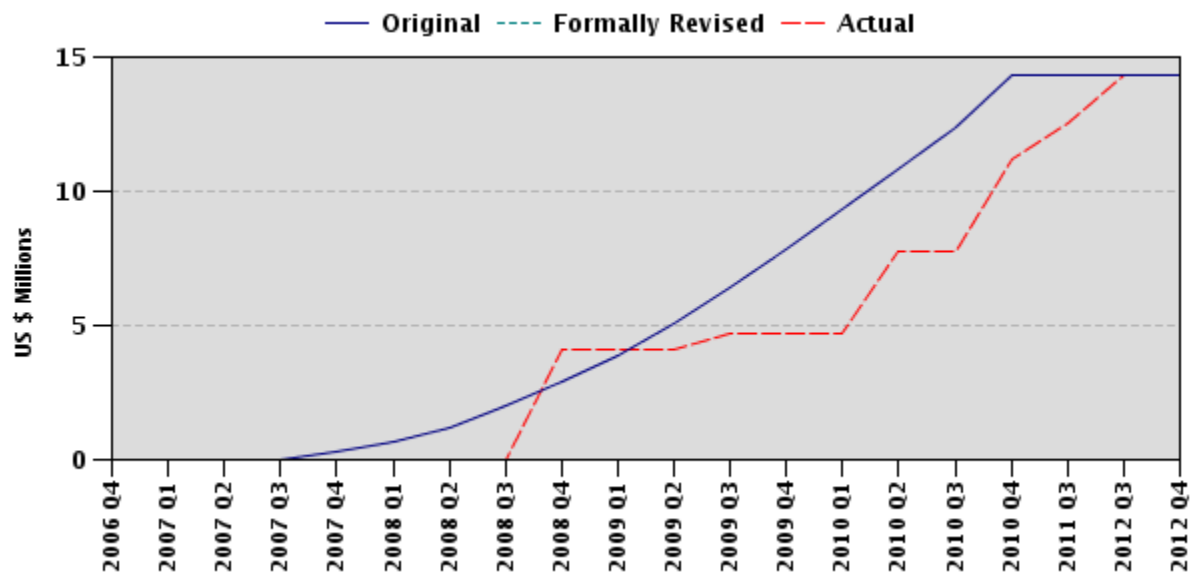
G. Ratings of Project Performance in ISRs

| No. | Date ISR Archived | GEO | IP | Actual Disbursements (USD millions) |
|-----|-------------------|---------------------------|---------------------------|-------------------------------------|
| 1 | 05/22/2007 | Satisfactory | Moderately Satisfactory | 0.00 |
| 2 | 10/15/2007 | Satisfactory | Moderately Satisfactory | 0.00 |
| 3 | 09/20/2008 | Satisfactory | Moderately Satisfactory | 4.08 |
| 4 | 12/10/2008 | Satisfactory | Moderately Satisfactory | 4.08 |
| 5 | 06/28/2010 | Moderately Unsatisfactory | Unsatisfactory | 11.22 |
| 6 | 12/24/2010 | Moderately Satisfactory | Moderately Unsatisfactory | 11.22 |
| 7 | 09/22/2011 | Satisfactory | Satisfactory | 12.54 |
| 8 | 06/12/2012 | Satisfactory | Satisfactory | 14.36 |

H. Restructuring (if any)

| Restructuring Date(s) | Board Approved GEO Change | ISR Ratings at Restructuring | | Amount Disbursed at Restructuring in USD millions | Reason for Restructuring & Key Changes Made |
|-----------------------|---------------------------|------------------------------|----|---|--|
| | | GEO | IP | | |
| 03/15/2007 | N | | | 0.00 | Added two more demonstration provinces (Hunan and Anhui). At this time, there was no ISR yet, therefore no rating available on GEO and IP. |
| 12/29/2010 | N | MS | MU | 11.22 | Added new project activities, revised project indicators and extended the project closing date for one year. |

I. Disbursement Profile



1. Project Context, Global Environment Objectives and Design

1.1 Context at Appraisal

Country Context. The project was conceived in 2003 to contribute to China's efforts in complying with the Stockholm Convention on elimination of persistent organic pollutants (POPs)¹. The Stockholm Convention, that initially-listed twelve POPs, was adopted in 2001 and entered into force on May 17, 2004. As a country strongly committed to the Stockholm Convention, China ratified it and became a Party to the Convention on August 13, 2004. Parties are requested to prohibit and/or take the legal and administrative measures necessary to eliminate the production and use of the chemicals listed in Annex A of the Convention, which includes chlordane and mirex used as termiticides in China. China needed to completely eliminate the production and use of chlordane and mirex five years after the date of entry into force of the Convention (i.e. by May 17, 2009), unless it would request registration of specific exemptions for a period of up to another five years.

Sector Context. At project appraisal, China had one of the most diverse termite population and most severe termite damage in the world. Since their introduction to China in 1964 and 1979 respectively, chlordane and mirex were the main insecticides for termite prevention and control in termite control in residential and public buildings in China. Their effectiveness, persistence, low cost and ease of application have led to their widespread use and contributed to the fact that termite management in China heavily relies on chemical methods. In December 2004, there were nine chlordane and five mirex manufacturers in China, all located in Jiangsu Province. From 2000 to 2003, they produced between 450-820 tons of chlordane and 9-31 tons of mirex annually. It was widely recognized that the use of both termiticides posed significant local and global risks to human health and the environment.

Issues addressed by the Project. The project was designed to reduce the production and use of chlordane and mirex for termite prevention and control in the building constructions sector. The project tried to address the key challenges that hindered the phase-out of chlordane and mirex in China including: (1) lack of effective alternative chemicals; (2) lack of integrated pest management (IPM) expertise for termite control; (3) ineffective termite control policies and regulations; (4) weak institutional capacity for chlordane and mirex phase-out; and (5) insufficient public awareness and education.

Demonstration Approach. To address these sector issues comprehensively while allowing flexibility to fine tune the interventions along the way, a demonstration approach was selected. The demonstration of introducing Integrated Pest Management (IPM) concept

¹These chemicals were widely used for their low cost, stability and effectiveness. Their use in recent decades have become banned or severely restricted, however, due to increasing evidence of their toxicity to people and the environment, their tendency to accumulate in the food chain, and their ability to travel long distances through global ecosystems and persist in the environment.

and technologies (the monitoring-baiting system in this case) as a way for phasing out chlordane and mirex, took place at a provincial level in China. Demonstration experiences were expected to be incorporated into preparation and implementation of a nation-wide replication program.

Project Financing. The Global Environment Facility (GEF), the interim financial mechanism of the Stockholm Convention, supports demonstration projects under its Operational Program for Reducing and Eliminating Releases of Persistent Organic Pollutants (GEF Operational Program 14). The Bank, as an implementing agency of the GEF, has the responsibility to assist its client countries in achieving the global environmental objectives supported by the GEF, which is consistent with its 2001 Environment Strategy and its Country Partnership Strategy 2006-2010. The Bank's technical expertise in POPs management and its experience in the design and implementation of GEF projects made it well suited to extend its assistance to China's POPs program.

The Bank's Early Involvement in POPs Issues. The Bank's Canadian POPs Trust Fund supported China from 2002 to 2003 in developing and organizing awareness-raising workshops for public officials representing relevant provincial and municipal level authorities, POPs experts, scientists and researchers, and representatives of industries that produce or consume POPs.

It was in this context that the World Bank was requested to assist China in mitigating the environmental and health risks associated with chlordane and mirex through a demonstration project with the GEF financing. The project's high-level objectives were to help China meet its obligations under the Stockholm Convention and to contribute to the global effort to control POPs.

1.2 Original Global Environment Objectives (GEO) and Key Indicators

The Project (Global) Development Objective (PDO) stated in the PAD was to mitigate environmental and health risks associated with chlordane and mirex in termite control by (a) demonstrating the elimination of their use through the introduction of integrated pest management in selected areas, and (b) preparing a national replication program for complete phase-out of chlordane and mirex in China.

This PDO is the one presented in the PAD, which had always been used during implementation for monitoring and reporting purposes. Consequently, this PDO is used in this ICR for final assessment of results. However, it should be noted that the PDO presented in the project Grant Agreement is a slightly different formulation: "to assist the Recipient in substituting the use of chlordane and mirex (which are harmful to human health and the environment) with integrated pest management techniques ("IPM") as a means to control termites in Jiangsu and Participating Provinces; and establishing a cost effective framework for promoting IPM in termite control."

The only performance indicator of project outcomes (the PDO-level indicator) was “no use of chlordane and mirex by termite control professionals in the demonstration area”. The performance indicators of project outputs (results indicators) were the following as stated in PAD Annex 3:

- a. Component 1: (1) The project team at CIO and local PIUs adequately staffed, trained and equipped; (2) CTA, NTA, and technical experts recruited; (3) Semi-annual Provincial Steering Group meetings conducted.
- b. Component 2: Five national and seven provincial policy and regulatory documents reviewed, revised if necessary, or issued.
- c. Component 3: (1) The IPM Operation and Training Manual disseminated; (2) IPM training conducted to train at least: (i) 3 managerial personnel from each termite station; (ii) about 100 researchers; (iii) 3 trainers from each participating city level station; and (iv) 10 termite control operators from each termite station; (3) About 400,000 in-ground bait systems installed for preventive treatment of newly constructed buildings; (4) About 500,000 above-ground stations installed for remedial treatment of buildings; (5) Use of 150 MT chlordane and mirex for termite control in the demonstration area eliminated; (6) Integrated termite management website published.
- d. Component 4: (1) Production of 150 MT chlordane and mirex reduced permanently; (2) Contaminated facilities, equipment and waste from the manufacturing site removed; (3) Hazardous waste from the plant closure properly disposed; (4) Plant owners and workers compensated for lost income.
- e. Component 5: (1) Workshop on monitoring and evaluation conducted; (2) Adequate project management information produced in the semi-annual progress reports; (3) Four annual implementation review meetings conducted; (4) Computerized MIS established.
- f. Component 6: (1) National workshop for preparation of the national replication program conducted; (2) National replication program finalized and approved by CIO; (3) Eight EIAs prepared for the closure of the remaining chlordane and mirex producers; (4) National and global dissemination workshop conducted.

It should be noted that the presentation of three results indicators under Component 4 (1, 2, and 4) in the ISRs is slightly different with the above in the PAD. The rest of the indicators are the same in both and ISRs. Since the nature of the three results indicators are the same in ISRs and PAD, the PAD indicators were used as presented in the ICR datasheet for the ICR assessment.

1.3 Revised GEO and Key Indicators, and reasons/justification

There was no revision of the project development objective or the PDO-level indicators.

1.4 Main Beneficiaries

The project main beneficiaries were the Termite Control Stations (TCSs) in the demonstration areas (initially-included Jiangsu province, Anhui and Hunan provinces

identified at the beginning of project implementation, and the other five provinces: Guangdong, Guangxi, Sichuan, Jiangxi, Zhejiang added at the later stage of project implementation) that used chlordane and mirex for termite prevention and control before the project. The project provided free monitoring-baiting and monitoring-dusting systems to these TCSs and provided incremental cost for installation and monitoring of these systems (labor, travel etc.). The managers and technical staff benefited from the project investments in better understanding the IPM concept and use of IPM technologies for termite prevention and control, as well as better working environment and safety conditions.

Urban population especially those living in termite rich areas in the three provinces and five provinces where IPM technologies were demonstrated or tested as alternatives to chlordane and mirex for termite prevention and control were also important beneficiaries of the project as their exposure to toxic chemicals were reduced. In the long-run, the ban on use of these POPs will benefit the entire population. Other project stakeholders also included the national and local government agencies including the Ministry of Finance (MOF), Ministry of Housing and Urban-Rural Development (MOHURD), the National Termite Control Center (NTCC) of MOHURD, the provincial and city-level Financial Departments, Environmental Protection Departments, Construction Departments, and Pricing Bureaus.

1.5 Original Components

The project had six components at appraisal which are summarized as below:

Component 1. Institutional Capacity Strengthening (GEF US\$971,919), including establishment of the project team in FECO/MEP and the three PIUs (incremental operating cost); hiring project CTA, NTA and other individual experts; project inception workshops and project management training workshops.

Component 2. Policy Framework for Elimination of Chlordane and Mirex (GEF US\$640,000), including formulation and revision of policies, regulations and standards at both the national and provincial levels in order to facilitate the phase-out of chlordane and mirex and promote IPM for termite control.

Component 3. IPM implementation (GEF US\$9,677,281), including development of IPM training manual and conduct training programs for different target groups; public awareness and information dissemination campaigns; demonstration of the IPM technology (monitoring-baiting systems); and research and development activities.

Component 4. Closure of Chlordane and Mirex Manufacturer (GEF US\$940,800), including permanent physical closure and dismantling of the chlordane and mirex manufacturing facility of the Liyang Guanghua Chemical Company; and clean up the facility's chlordane and mirex contaminated site and disposal of chlordane and mirex waste.

Component 5. Monitoring and Evaluation (GEF US\$74,000), including a monitoring and evaluation workshop, annual project review meetings, and development of management information systems to track project progress.

Component 6. National Replication Program for Elimination of Chlordane and Mirex in China (GEF US\$748,000), including a technical consultation workshop; development of a national replication program (NRP) for elimination of chlordane and mirex in termite control based on the experiences gleaned from the demonstration area; preparation of environment impact assessment (EIA) reports for the rest eight chlordane and mirex production sites; a national consultation and dissemination workshop and an international workshop by project completion.

1.6 Revised Components

The project Grant Agreement was amended in March 2007 as expected to include additional demonstration provinces: Anhui and Hunan. Under this amendment, the project funds were reallocated. There was no any change to the project components and indicators.

The project was restructured again in December 2010, because of the following: (a) the project implementation suffered delays (see details in section 2.2) since its beginning and some project activities were not completed by the original closing date (December 31, 2010); (b) by the end of 2010, the project had savings of about US\$ 3.8 million resulted from the procurement of bait systems; and (c) the IPM option - monitoring-baiting technology demonstrated in the three provinces proved effective for termite prevention and control but with higher cost than use of chlordane and mirex. FECO proposed to pilot another IPM option – monitoring-dusting technology which the Chinese considered more cost-effective than the monitoring-baiting technology. Therefore, FECO through MOF proposed to extend the project closing date for one year in order to fully achieve the PDOs by completing the originally-designed and newly-added project activities.

The newly-added activities to address project delays and sustainability issues included: (a) a second-round IPM training, additional public awareness activities, MIS installation, training and use in all involved TCSs, and monitoring and evaluation activities in the three demonstration provinces; (b) one more contaminated site for cleanup in Jiangsu, (c) a pilot program on monitoring-dusting technology in five new provinces representing different region and climates, by which the IPM concept can also be introduced to more provinces since FECO decided not to seek further GEF financing to support the NRP, and (d) IPM training for all other provinces in China infested by termites. All these activities were considered to fall into the same definition of the PDO as presented in the PAD. Under the second restructuring approved by the Country Director, the project component 3 and 4 were modified in the Grant Agreement as below:

1. An additional activity was added to Component 3, “Integrated Pest Management”:
Carrying out program for the pilot application of monitoring-dusting system for termite control in the building construction sector in selected participating termite

stations. Termite Stations in five new provinces (Guangxi, Guangdong, Zhejiang, Jiangxi, and Sichuan) were selected based on termite infestation situation, termite species, region representativeness, the management and implementation capacity, as well as the willingness and support from the local governments.

2. Component 4, “Closure of Liyang Facility in Jiangsu Province” was revised to *“Closure of Selected Chlordane and Mirex Facilities in Jiangsu Province”: Permanently closing and dismantling selected facilities that produce and store chlordane and mirex; cleaning up the chlordane and mirex contamination at the facilities; and disposing the chlordane and mirex wastes.*

Under Component 4, the Liyang Guanghua Chemical Co. was identified as having the largest production of chlordane and mirex and it was selected during the project preparation for closure and dismantling of its plant and cleanup of its contaminated site. The company was consulted and agreed to participate the project. However, during the project implementation, the company changed its mind and decided not to participate in the project because it considered compensation from the Chinese government for its closure to be insufficient for re-building the entire plant. Therefore, another chlordane and mirex producer (Liyang Xinhai Chemical Factory) was selected to replace Liyang Guanghua based on the EIAs conducted under the Component 6. At the later stage of the project, one more chlordane and mirex production site (Changshu Fengjiang) was added for cleanup under the project based on the EIAs as well. In total, the project financed dismantling and cleanup of two chlordane and mirex contaminated sites. Closure of the two plants was compensated by the Chinese government.

FECO/MEP, Jiangsu Environment Protection Department, local government in Liyang, and Liyang Environment Protection Bureau had also urged closure, dismantling and cleanup of the Liyang Guanghua Company site. By the end of 2011, the Liyang Guanghua contaminated site has also been cleaned up with Liyang government’s financial support, but its closure was not compensated.

Another change is the number of bait systems. The total 400,000 in-ground (IG) bait systems (for termite prevention) and 500,000 above-ground (AG) (for termite remediation) bait systems were originally estimated based on the construction area treated by chlordane and mirex in 2003 (most recent data during project preparation) in Jiangsu and Zhejiang provinces (Zhejiang dropped from the project before the project appraisal), and then were reallocated to the finally selected three provinces (Jiangsu, Anhui and Hunan) based on their consumption proportion of chlordane and mirex.

During the March 2008 supervision mission, the Chinese experts (based on an assessment report) proposed to reduce the number of AG bait systems to 150,000 sets and increase the number of IG bait systems to 1,042,860 sets based on experience gained from use of bait systems through a small-scale pilot procurement. The reasons were (a) the number of AG was overestimated (seven systems per infestation as originally designed against newly proposed two systems per infestation, and (b) both AG and IG should be used for termite remediation instead of using AG only. This change was agreed among FECO, the

three PIUs and the Bank team during the mission and reflected in the second Grant Agreement Amendment in December 2010.

In April 2010, due to implementation delays on installation of bait systems, procurement of about 30% IG bait systems was cancelled. Therefore, the final number of the AG and IG bait systems procured under the project, including the small-scale pilot procurement, two competitive procurements, a procurement for maintenance purpose beyond the project life, and a procurement proposed by Anhui only and used for its historic buildings, were: 151,500 AG and 762,000 IG bait systems.

The above project activity changes resulted in project intermediate results indicator changes as listed in the table below.

| Original Intermediate Results Indicators | Approved Amendments in December 2010* |
|--|--|
| Component Three: | |
| Indicator 3: About 400,000 in-ground bait systems installed for preventive treatment of newly constructed buildings. | 694,105 in-ground bait systems procured and installed for preventive treatment of newly constructed buildings during project life, 67,895 in-ground bait systems procured for maintenance beyond the project life in the three demonstration provinces. |
| Indicator 4: About 500,000 above-ground stations installed for remedial treatment of buildings. | 151,500 above-ground stations installed for remedial treatment of buildings in the three demonstration provinces. |
| New indicator 5: | 41,250 monitoring-dusting systems installed for termite control and treatment of newly constructed buildings during the project life in five newly-added project provinces, 4,125 monitoring-dusting systems procured for maintenance beyond the project life. |
| Component four: | |
| Indicator 2: Contaminated facilities, equipment and waste from the manufacturing site removed. | Contaminated facilities, equipment and waste from two manufacturing sites removed. |
| Indicator 3: Hazardous waste from the plant closure properly disposed. | Hazardous waste from two plant closures properly disposed. |

*These amendments were unintentionally missed in the ISRs in 2010. But the last ISR in 2012 updated these indicators.

1.7 Other significant changes

None

2. Key Factors Affecting Implementation and Outcomes

The project implementation evolved beyond its original scope and scale, but always within the originally-designed PDO. At a later stage of the project, project activities were adjusted according to the project circumstances. Its implementation focus was shifted from demonstrating one single alternative IPM technology (monitoring-baiting technology) to diversifying IPM technologies (adding dusting technologies), engaging more TCSs to participate the project, deepening policy outreach, IPM training and public awareness, establishing and using management information system for termite control practices, as well as expanding the scale and demonstration effect of contaminated site clean-up activities.

2.1 Project Preparation, Design and Quality at Entry

Factors during preparation that contributed project implementation and outcomes

Firstly, project component design were appropriately responsive to the following key issues facing China on elimination of the two POPs in order to meet the Stockholm Convention requirements as well as to the government's efforts to reduce environment pollution and to protect human health.

- a. *Policy constraints.* Before the project was conceived, some strategic directions and policies as stated in the PAD Annex 1 were undertaken and established by the GoC on control of production and use of chlordane and mirex. However, the background analysis concluded that these policies were not effective in helping China reduce and phase out the production and use of chlordane and mirex in termite prevention and control, in particular, the 15 years quality guarantee and pricing policies.
- b. *Lack of appropriate alternative technology.* The background analysis also identified that as of 2004 China registered and applied some chemical alternatives to chlordane. Such chemicals include fenvalerate, permethrin, bifenthrin, imidacloprid, and chlorpyrifos. However, these alternatives have some serious limitations in comparison with chlordane, including short preventive protection period (less persistent), higher price and unfavorable odor. Moreover, these alternative chemicals are not necessarily safer than chlordane (oral LD₅₀ for rat: 200-700 mg/kg). Due to potential health risks, chlorpyrifos (oral LD₅₀ for rat: 95-270 mg/kg), for example, was removed from the market for termite control in the United States in 2000.
- c. *Limit of Public awareness.* The background analysis found that public awareness about the adverse impacts of chlordane and mirex on human health and environment was very limited.

Secondly, in accordance with Article 5e of the Stockholm Convention to “...promote the use of best environmental practices...,” it was suggested by the Bank to consider introducing IPM concept for termite prevention and control in China as an alternative approach to phase out chlordane and mirex in order to fulfill the Stockholm Convention and also avoid large-area treatment by using other non-POPs toxic chemicals. The IPM approach is to use the least amount of bio-pesticides (less toxic and less persistent control agents) to prevent and control termite population by eliminating termite colonies near structures. Selection of an IPM technology during the project preparation was based on a review of different IPM technologies and scientific data of successful colony elimination were available only for certain bait systems, thus the monitoring-baiting technology was chosen as the core technology and the most suitable for achieving elimination of chlordane and mirex through best environmental practices. However, China had no field experiences on Integrated Pest Management (IPM) for termite control before the project.

Thirdly, the provincial PIUs were proposed and established. At the national level, China established the National Leading Group for Implementation of the Stockholm Convention in 2003 when developing the National Implementation Plan for POPs. SEPA (now MEP) was the lead agency and was authorized to manage all POPs activities in China. The Convention Implementation Office (CIO) under FECO of SEPA is responsible for day-to-day compliance work. A termite project team was established in CIO/FECO. However, the project selected establishment of the provincial PIUs to manage most project activities instead of limiting to individual demonstration sites only managed by CIO/FECO, this was because the project aimed to promote a partial shift by demonstration from the chemical approach to the IPM approach for termite control and therefore it considered effective capacity building focusing on perception and behavior changes crucial for promoting IPM concepts and technologies. The implementation mechanism of setting up provincial PIUs was adopted in order to build the technical and management capacity at the provincial level with involvement of more TCSs and the provincial government agencies. These PIUs were jointly established by the provincial government departments including the Environment Protection Departments (EPDs), the Construction Departments and the Termite Prevention and Control Associations and housed either in the EPD or in the Construction Departments. Project activities including IPM manual development and training, policy reforms, public awareness-raising activities and demonstration use of bait systems were designed to support in building the management and technical capacity.

Fourthly, project preparation was built on public awareness workshops on POPs for high-level officials in China and linked to the ongoing termite studies financed by the Canadian POPs Trust Fund and pesticide studies financed by the Italy Trust Fund. Both Trust Funds were supervised by the Bank. Therefore, there was strong support from MOF, MEP and the three provincial governments to the project including counterpart funding commitments for both project implementation period (originally 4 years) and 11 years after the project life for continued monitoring of installed bait systems. This arrangement was based on the 15-year quality guarantee policy.

Fifthly, the project design considered simultaneous phase-out of chlordane and mirex consumption and production. This approach has emerged as one of the main lessons from the implementation of a highly successful program on phase-out of ozone depleting substances in China. It was expected that by the end of the project, the three provinces would completely stop the use of chlordane and mirex. Accordingly, equal amount of production of chlordane and mirex would be reduced as well. This would sustain the phase-out. In addition, as chlordane and mirex are toxic chemicals, the project financed not only dismantling of the selected chlordane and mirex producer's facilities, but also cleanup of the contaminated production sites.

Factors during preparation that delayed project implementation and outcomes

However, there were some factors and events during the project preparation and design, which caused substantial delays in project implementation since it started. Firstly, this project was one of the few projects in China for the first time to apply financial monitoring report (FMR)-based disbursement method. However, the FMR was not well understood by the participating provinces and lack of immediate training hindered initial project implementation progress.

Secondly, the demand of AG bait systems was largely overestimated. Although almost all TCSs in the three provinces were invited to participate in the project for use of AG bait systems, installation of AG was not able to be completed by the original project closing date and waste installation of AG bait systems still existed during the project implementation.

Thirdly, most of the project indicators are output-based instead of outcome-based; especially indicators for measuring effectiveness of bait systems are missing. It caused difficulty by the end of project to collect sufficient data for proving the demonstration effectiveness of bait systems applied in the three provinces. And the project design encouraged the participating TCSs to install IG bait systems as preventative measure mainly in newly-constructed buildings, which normally do not have apparent termite activities in early years after construction, thus no bait consumption (woods need to be replaced with baits when sufficient termites are found in the bait stations) was recorded in most of the IG-installed sites during the short monitoring period after installation from 2009-2011. This led to insufficient data collected and available for analysis on effectiveness of bait systems.

Fourthly, the project provided support to facilitate some policy and regulatory reforms considered essential to the achievement and sustainability of the project objectives, but it would have been better to include stronger measures to help guarantee these reforms were carried out within the project time-frame (i.e. some key policies should be in place before the project close).

Fifthly, during project appraisal, the risk that use of baiting systems would be more expensive than the use of chlordane and mirex in termite control mainly due to the high labor cost for installation and monitoring during the 15-year quality guarantee was rated

as moderate. This was under-rated in terms of its sustainable and replicable use after the project life and mitigation measures were not sufficiently considered to be incorporated in the project design.

Lastly, if participating provinces (Jiangsu and Zhejiang) had been selected through a competitive process at early stages of project preparation, it might have been possible to avoid implementation delays caused from adding other provinces to the project (see details in section 2.2).

A “Quality at Entry” review conducted by the QAG in 2007 rated project preparation as Moderately Satisfactory (3) overall. Strategic Relevance and Approach, Technical, Financial and Economic Aspects, Environmental Aspects, and Risk assessment were each rated Moderately Satisfactory. Poverty, Gender and Social Development, Fiduciary Aspects, Policy and Institutional Aspects and Implementation Arrangements were each rated Satisfactory (2). Bank Inputs and Processes were rated Moderately Satisfactory.

2.2 Implementation

Factors during implementation that contributed to project outcomes

Ban of the two POPs. During project implementation, a public notice, *banning the production, consumption, use, import and export of chlordane and mirex in China from May 17, 2009*, was issued to fully fulfill Chinese commitments to the Stockholm Convention regarding these two POPs. This Ban provided a solid legal base for completely phasing out the two POPs, although this was not expected at project appraisal. This marked the achievement of one part of the PDO (phase-out of chlordane and mirex production and consumption), exceeding the goal of 150 tons set up in the original project design well ahead of schedule.

Stronger Capacity building. The project implementation supported two rounds of IPM technical trainings to different target groups: managers, technicians, operators in TCSs. Additional trainings on IPM concepts for financial management staff of the TCSs, staff from property management companies for demonstration sites, and local government officials were also provided. A total of over 5,000 managers and technicians were trained on the IPM concepts and practices. In addition, Management Information Systems (MIS) for recording applications of bait systems were installed and trained to all participating TCSs (more than expected at appraisal stage) in the three provinces (Jiangsu: 59, Hunan: 105, Anhui: 86) during the project implementation.

Broader public awareness. Through the project implementation, public awareness on risks associated with chlordane and mirex and the IPM concepts and benefits was broadly raised. It turned out that many public and private institutions (enterprises, schools, residence communities) actively requested the TCSs to install bait systems for termite control in and around their buildings or houses, and also offered support to prevent bait systems from being stolen or removed.

Strong local government support. The support from the provincial government agencies to the project implementation was significantly stronger than expected. The provincial Department of Environmental Protection, Department of Housing and Urban-Rural Development, the Bureaus of Finance and Pricing were all involved in the project, receiving IPM concept trainings and reviewing and issuing revised policies and regulations, and providing counterpart-funding in a timely manner. In particular, the site cleanup was strongly supported by the Liyang city and Changshu city governments. It guaranteed timely completion of cleanup.

Project activity adjustment. In order to overcome the project delays, project activities were adjusted, including: (a) reducing procurement of overestimated AG bait systems and cancelling the last tranche procurement of IG bait systems; (b) inviting all TCSs in Anhui and Hunan and most TCSs in Jiangsu to participate the project; (c) allocating more project funds saved from the procurement of bait systems to support second-round IPM technical training and public awareness on IPM; (d) urging issuances of policy reforms to promote IPM; (e) revising the standard “Experimental Method and Evaluation on Effectiveness of Pesticides Registered for Termite Prevention and Control” in China to encourage registration of safer and less persistent pesticides for termite control; (f) MIS installation and use in all participating TCSs; (g) collecting data for evaluation of demonstration effectiveness of bait systems; (h) carrying out cost analysis of bait systems and chemical treatment; (i) testing another IPM technology (monitoring-dusting technology) in five new provinces; and (j) cleaning up one more contaminated site. FECO also proposed to conduct a project implementation evaluation for the three provinces. All these adjusted measures facilitated project completion and achievement of the PDOs.

Factors during implementation that delayed achievement of project outcomes

The project implementation experienced substantial delays that delayed timely achievement of project outcomes. Actions were taken to overcome those delays, while the project closing date had to be extended. The project implementation progress was rated moderately satisfactory (MS) from the first Implementation Status and Results (ISR) report of the Bank in May 2007, and had been MS until the December 2008 ISR. As a result, the Bank rated the project progress unsatisfactory in June 2010.

Late start of project implementation due to changes in project provinces. Two demonstration provinces with the highest consumption of chlordane and mirex (Jiangsu and Zhejiang) were originally selected for the project in order to gain sufficient experiences in different termites and different ecological and climatic conditions. However, Zhejiang decided not to participate in the project in January 2006 just before the planned project appraisal. The Project was processed and approved with only Jiangsu province confirmed and one or two more provinces to be identified during implementation. This was considered as the best option by the Bank, MOF and SEPA in order to start project implementation earlier as the selection of new provinces would take at least six months. It was very difficult to identify one province to match exactly the chlordane and mirex consumption of 71.2 MT (150 MT-78.8 MT committed by Jiangsu)

that was required in the Project, and only Anhui and Hunan expressed their interests and met all agreed selection criteria, therefore both provinces were proposed to be included in the Project, resulting in a total consumption phase-out of 139.4 MT in the two provinces². The project Grant Agreement was amended in March 2007 to include Anhui and Hunan. However, before the two provinces were added, no project activities were initiated as expected.

Low government efficiency and inefficient disbursement. The implementation agreement between MOF and SEPA was signed only on August 22, 2007, and the project designated account under MOF was finally opened in September 2007, 14 months after the Grant Agreement was signed in July 2006³. Due to lack of timely training on FMR-based disbursement arrangements during the project preparation stage and early project implementation stage, the first withdrawal application was made in June 2008, which means 24 months after the Grant Agreement was signed. This halted initiation of some key project activities: policy revisions, public awareness activities and IPM training for TCSs which were very important to facilitate smooth installation and monitoring of bait systems and avoid many technical difficulties, public's interference and losses of bait systems. These activities were only initiated after June 2008 when project funds were available to the PIUs. This consequently resulted in delays of installation of bait systems, thus insufficient data collection on effectiveness of bait systems and cancellation of the last tranche procurement of IG bait systems due to project duration constraints.

Bait system procurement and installation delays. During the early project implementation stage, there were only three suppliers of bait systems registered in China: Dow AgroScience (Sanction bait system), Ensystex (Exterra bait system) and Changzhou Yekang (Yekang bait system). In order to quickly gain hand-on experiences of using bait systems, it was proposed and agreed to do a small-scale pilot procurement through direct contracting first. However, the small-scale pilot procurement was not started until July 2007 after Anhui and Hunan were added to the project. Although the project was launched in Jiangsu earlier in July 2006, it had to wait for the other two provinces as FECO had arranged during the project preparation to procure the first batch (30%) of bait systems together for all three provinces (the small-scale procurement was considered as part of the first procurement) considering the PIUs did not have procurement experiences following the Bank's procurement rules. The following table provides a snapshot of bait system procurement and installation.

² The Bank team completed the appraisal report for the two provinces in December 2006 and GEF approved it in January 2007. Under the GA amendment in 2007, the project indicator on chlordane and mirex production phase-out was not revised.

³ The ICR team was not able to find the reasons why the implementation agreement between MOF and SEPA was signed and the project account was opened so late.

| | Procurement started | Contract awarded | Bait systems delivered | Installation completion |
|--------------------|----------------------------|-------------------------|-------------------------------|--------------------------------|
| Pilot procurement | July 2007 | Sept 2007 | Dec. 2007/Mar. 2008 | Sept. 2008 |
| First procurement | Jan. 2008 | Mar. 2008 | Sept. 2008 | Mar. 2010 |
| Second procurement | Feb. 2009 | May/June 2009 | Aug. 2009/Feb. 2010 | Nov. 2011 |

In addition, site cleanup also encountered delays due to the decision by the Liyang Guanghua Co. to withdraw from the project; however, this did not affect the project progress and the final achievement of outcomes. Jiangsu PIU made great efforts to facilitate the completion of cleanup at the alternative site by the end of 2010.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

M&E Design. The project had weaknesses on M&E design. Firstly, there was just one outcome indicator and it focused on phase-out of use of chlordane and mirex only, without any outcome indicators for monitoring IPM demonstration. Production phase-out of 150 tons chlordane and mirex was considered as a results indicator (not an outcome indicator) under the project component 4. Secondly, too many results indicators were proposed and most of these results indicators are outputs-focused (not outcome-oriented), such as indicators for training, installation of bait systems, and policy aspects. The original results framework did not cover the complex and multi-layered PDOs stated in the PAD.

M&E Implementation and Utilization. The M&E reporting on the project was done by CIO and the three PIUs through the semi-annual project progress reports. As most of project indicators are output-based, the project progress reports just well recorded outputs of main project activities. Thus, the project progress reporting did not fully measure whether these activities result in the outcomes required to achieve the goals of components and the PDOs.

MIS development and utilization was supposed to be a good M&E tool to track installation, monitoring and demonstration effectiveness of bait systems during the project implementation. The project financed software development, basic hardware equipment for operating the MIS, as well as MIS training for all participating TCSs in the three provinces; however, the development of MIS was initiated late and completed, installed and functional in all participating TCSs only at the late stage of project implementation (Jiangsu, end of 2010; Anhui, September 2011; and Hunan, May 2009). This impacted negatively the implementation and the meaningful results of the MIS, which was supposed to be completed during early stages of project implementation.

To overcome the M&E design and implementation weakness, the project financed, at the project later stage, additional studies/activities including collection of data proving effectiveness of baiting systems, cost analysis of baiting systems and chemical spray, and

project implementation evaluation. Results and data from these activities were used to assess the PDO achievements in the ICR (see specifically Section 3.2).

2.4 Safeguard and Fiduciary Compliance

Safeguards

Site cleanup. The project was classified as a Category A project. The key environmental safeguards issues in the project were the site contamination and potential risks related to the permanent physical closure and dismantling of the chlordane and mirex manufacturing facilities and site cleanup under the Component 4. An open bidding process was adopted for selection of a qualified contractor and the site remediation was successfully completed; i.e. production equipment were dismantled and cleaned for recycling, buildings were cleaned and/or torn-down, contaminated soil were in-situ and/or ex-situ treated, and all the wastes were properly disposed of. Hazardous wastes were treated in an qualified incineration facility, high-risk contaminated soil was sent to cement plant for co-treatment, medium-risk contaminated soil was chemically de-contaminated and backfilled, and low-risk soil was treated and recycled as the cover soil in landfills.

Besides the originally planned closure and cleanup of one manufacturer, the project also took an overall approach to assess the other 8 chlordane and mirex manufacturers in Jiangsu under the replication component. Therefore, initial environmental impact assessment (Phase I Site Assessment equivalent) were conducted for the 8 plant sites, based on which 4 sites were selected as priority sites and a further environmental assessment was conducted for these 4 sites. This provided a solid foundation for the Liyang Xinhai site which can be quickly selected as a substitute for Liyang Guanghua site and also for selection of the second site for cleanup.

Pest Management Plan for the demonstration Provinces/Pilot Provinces. The project activities met the objectives and targets set up in the project Pest Management Plan and complied with the provisions of OP 4.09 and BP 4.01 Annex C. Pesticides used in the project demonstration provinces comply with both the national pesticide legislation and the selection criteria in OP 4.09 and their use is fully justified under an IPM approach. The pesticide used in the testing of the “monitoring-dusting” technology and the one recently registered for such technology also comply with the selection criteria in OP 4.09. The measures taken to reduce risks are adequate and consistent with education, skills, and equipment of users. The use of all pesticides is always conducted by trained personnel of the selected termite institutes who are equipped with appropriate protective gear. The participating termite stations paid keen attention to operational safety when handling pesticides and urged them to keep copies of the Material Safety Data Sheet (MSDS) for all new products used in the demonstration areas. The Bank team encouraged representatives of the three demonstration provinces (Jiangsu, Anhui and Hunan) to share some of the chemical baits with other provinces before their expiration date to avoid that they become obsolete.

Environmental and social benefits. The elimination of chlordane and mirex will reduce environmental and social impacts associated with termite control. Annex 3 of this ICR, Economic and Financial Analysis, has detailed summary of the benefits. Although difficult to quantify, the environmental and human health risks from using chlordane and mirex will be largely reduced.

Financial Management

The project had adequate project financial management system that provided, with reasonable assurance, accurate and timely information that the Grant is being used for the intended purposes. The project accounting and financial reporting were in line with the regulations issued by MOF and the requirements specified in grant agreement. However, disbursement was slower than planned at the initial stage, mainly due to unfamiliarity of the FMR-based disbursement approach. This issue was rectified in March 2008 through a comprehensive training. Thereafter the withdrawal procedure and funds flow started, but were still slow up to early 2010 due to implementation delays.

PIUs' financial management was satisfactory, partly due to standardized fund management. Special project accounts were created and financial statements and reports were prepared in line with Bank procedures. An effective internal control system through annual financial audit was maintained to ensure that project expenditures were properly authorized, supporting documents were maintained, accounts were reconciled periodically and project assets, including cash, were safeguarded.

Procurement

Yearly procurement plans were developed and shared with the Bank team for review. The updated procurement plans were disclosed publicly in time in accordance with the Bank's requirements. Procurement of all works and goods as well as selection of consultants under this project was carried out satisfactorily by following the Bank's Procurement and Consultants Guidelines. Procurement documents were found to be properly maintained by FECO and the PIUs in the three provinces during the Bank's annual post review. FECO and the PIUs in the three provinces have adequate capacity with qualified staff in carrying out procurement under the project. The grant was used for the intended purposes.

2.5 Post-completion Operation/Next Phase

At the national level, the *Management Regulation on Termite Prevention and Control in Urban Construction* revised under the project proposes to reduce the warranty period from 15 years to 10 years. This policy is expected to be issued in late 2012. The *Guidance on Replication of IPM Technologies for Termite Prevention and Control in China* drafted during the project is now under review by relevant ministries. It is expected to be issued soon to support replication of the termite IPM in the entire country. Furthermore, provisions of requesting set-up of targets for applying termite IPM nationwide have been included in the draft 12th Five Year Plan (being reviewed by MOHURD)

on termite prevention and control in China, which is a substantial step forward for IPM replication in China.

Among the three demonstration provinces, Hunan province, during the project implementation stage, issued a new price policy which increased the unit price for termite prevention from RMB 2/m² to RMB 2.5/m² for newly-constructed buildings. Although this increase was limited to cover the full cost of using bait systems which is two to three times more expensive than chemical treatment calculated based on the 15 year warranty policy, it reflected Hunan government's efforts to make changes adapting to the IPM approach. In order to sustain the project outcomes, i.e., the participating TCSs will continue to monitor bait systems installed under the project for the rest of the warranty period and the termite IPM will be replicated in broader area in the three provinces, all the three provinces were urged to consider the adoption of mechanisms to ensure the project sustainability after the project ends. The project sustainability mechanisms listed below were reflected in the project completion report prepared by each provincial PIU. The commitments in writing from all provinces were considered satisfactory, especially the needed counterpart funding as committed during the project preparation stage are reported available.

- a. *Financing guarantee.* All provinces committed sufficient funds from its provincial Finance Bureau and from the Termite Control Station's charge fee for termite prevention and control. See Annex 1 for counterpart funding amount.
- b. *Management mechanism:* The administration authority in the provincial Department of Housing and Urban - Rural Development will incorporate the post-completion operation management into its daily management work in the termite sector. The Termite Control Stations will incorporate monitoring of bait or dusting systems installed under the project implantation into their daily work on termite prevention and control. The technical operational manual and policy/regulations issued under the project will be followed. The MIS will be used to track monitoring after the project.
- c. *Staff guarantee:* All TCSs participating in the project will maintain sufficient technicians and operators to continue their responsibility of monitoring bait or dusting systems installed under the project. Technical training will be regularly provided to them as needed.
- d. *Policy and regulatory guarantee:* All provinces promised to continue follow-up on issuance of the policies and regulations promoting IPM revised under the project.
- e. *Supervision mechanism:* The provincial Termite Prevention and Control Association will incorporate regular supervision to all TCSs into its regular management and supervision work. It will also provide technical assistance as needed.
- f. *Public awareness during post-completion operation:* Public awareness activities will be continued through news media including newspapers, TV, websites, etc. and will be expanded to building developers and builders, property management companies, building owners and individual households.

During the last supervision and ICR mission in December 2011, the Bank team met all PIUs' managers and also managers from the five TCSs in the new five provinces. They all expressed strong willingness and support to sustain the IPM approach and continue monitoring of those installed bait or dusting systems, because it is realized not only by the Chinese government agencies but also by the public that spraying large amounts of toxic chemicals (POPs and non-POPs chemicals) are not sustainable for the termite sector development. The IPM approach demonstrated through the project has proved effective and very promising for replacing toxic chemical spray. All the participants were confident that China will continue to develop easy-to-use, environmentally-sound, cost-effective and domestically-produced products and tools to practice termite IPM in the future.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

Rating: Satisfactory

The PDO is deemed highly relevant to China's commitments to the POPs Stockholm Convention and the global efforts to control POPs in general and to eliminate chlordane and mirex in particular. At the national level, the government strategy of eliminating POPs pesticides and reducing risks to human health and environment from toxic chemicals through promoting the use of best environmental practices has been remained high priority. At the global level, the elimination of chlordane and mirex in China has contributed in long-range to reduce transportation of these chemicals to other countries.

The project design and implementation are also relevant to the specific National Implementation Plan for phasing out POPs in China. The features of the project components closely mirrored the development directions in the termite control sector. The project was also consistent with the Bank's Country Partnership Strategy (CPS) with China for 2006-2010, one of the five pillars (pillar 3) is to "Manage resource scarcity and environmental challenges, through reducing air pollution, conserving water resources and optimizing energy use (partly through pricing reforms), improving land administration and management, and observing international environmental conventions" and the progress report for CPS in 2011 has reported that China has made great progress within its 11th Five Year Plan period. The project was also strongly supported by the line ministry (MOHURD) as a means to replicate the termite IPM nationwide in the future.

3.2 Achievement of Global Environmental Objectives

Rating: Moderately Satisfactory

The project met its PDO (even with some delays) in three main ways: (a) environmental and health risks associated with chlordane and mirex were mitigated through complete phase-out of the production and consumption of the two POPs; (b) the IPM approach with the monitoring-baiting technology was promoted in three provinces and the monitoring-dusting technology was tested in five provinces; and (c) the national replication program for termite prevention and control in China was prepared and has

been included in the draft 12th Five Year Plan for termite prevention and control in China (which is currently under review).

IPM concept is well accepted (perception changed). Through the project implementation, the project has facilitated a change in the attitude toward termite prevention and control practice among those involved (TSCs and the public). A total of 94 training workshops on IPM concepts and techniques were held for 5,754 management staff and technicians/operators on termite prevention and control. A number of public awareness activities in different forms (including IPM demonstration site signboards, bait system installation signs, posters, brochures, news reporting in publications, public campaigns, TV shows, Videos and press conferences), as well as five research and development activities were carried out. All these activities influenced perception changes of both the termite control service providers and the public who ultimately would benefit from these improved termite control services.

Reduction in pesticide use is one of the two pillars for termite IPM (the other is to reduce termite populations by colony elimination) and it is clear that this concept has had impacts on the Chinese termite control personnel participating in the project. The representative from Hangzhou Termite Control Station has stated in his report that by using monitoring-dusting systems, the station has reduced pesticide by 900-fold (4 kg of fipronil dust vs. 3,590 kg of chlordane that would have been used in the same sites). This is a drastic change from the past when the success of termite prevention and control application was measured by the larger amount of pesticide being applied.

Policy framework for promotion of termite IPM established. During the project, a number of regulatory developments occurred at the national (6) and provincial levels (25) that provided a good enabling environment for the promotion of termite IPM. These policies, regulations and technical standards provided guidance and support to sustain and replicate termite IPM in China. In particular, an important policy measure, additionally proposed at the later stage of the project implementation, was the completion of the draft “*Guiding on Replication of Integrated Pest Management Technologies in Termite Prevention and Control*” led by FECO. This Opinion will be jointly issued by MEP and MOHURD in 2012. This further supported the achievement of the PDO (promotion of termite IPM) not only in the three provinces but also in other provinces infested by termites. This policy will also support implementation of the national replication program during the 12th five-year period.

Termite IPM (monitoring-baiting systems) proved effective⁴. The project supported the termite IPM demonstration (bait systems, see Table in Annex 2) in three provinces with all participating TCSs (Jiangsu 59; Hunan 105; and Anhui 86) involved by the end of project. Between early 2008 and summer of 2011, about 694,100 IG and 151,500 AG stations were installed at 55,354 buildings and/or sites including residential buildings,

⁴ Data used in this section are from the data collection report on bait system effectiveness, the completion reports from the PIUs, and the completion report on the other five provinces provided by the National Termite Control Center.

schools, manufacturing plants, office buildings, hospitals, commercial buildings, historical sites, parks and green areas (sidewalks and median), military facility, and other public utility (water and electric) buildings. The total buildings areas protected by IG systems reached around 166 million m², resulting in the replacement quantity of chlordane by 372 metric tons. For the current soil insecticides (chlorpyrifos, permethrin, bifenthrin, fenvalerate), the replacement amount was estimated at 260 metric tons. The application of AG systems replaced the mirex use by 163 kg. Although the amount was the total of three-year period, the bait systems were used only in approximately 15% of the termite control operation in three provinces. Among the 7,378 sites where termites consumed AG baits, the confirmed elimination rate was 77%. With the 100% acceptance rate and 90% confirmed elimination, AG performance was the best in Hunan province.

Environmental and health risks associated with chlordane and mirex mitigated by complete phase-out of chlordane and mirex. The project was successful in mitigating environmental and health risks associated with the two POPs by providing crucial support to a complete phasing out in production and consumption of chlordane and mirex. By May 2009, the Chinese government needed to take a decision on whether to ban the two POPs production and consumption entirely, or to request for a registration of specific exemptions for another five years. At that time, the government was facing international and national pressures because of the spraying of large amount of toxic chemicals (POPs and non-POPs chemicals) in the termite control sector. Based on the IPM demonstration effects (including pilot use of bait systems, training provided and policy reforms initiated) produced at the early stage of project implementation, the GoC decided to completely ban the production and consumption of chlordane and mirex nationwide since May 17, 2009 (even by losing the opportunity of requesting registration of specific exemptions for the two POPs). It is certain that introduction and demonstration of the termite IPM approach by the project greatly influenced the government's decision to issue the Ban for complete phase-out. For this, the project provided an ongoing platform (already proven an effective one) to continue testing and disseminating IPM concept and technologies to expand the substitution of the two POPs in the coming years. The project definitely increased the GOC's level of comfort with this tough decision and provided assurances it was possible to maintain an effective and efficient termite control level by using newly developed IPM technologies and chemicals.

Environmental and health risks associated with the two POPs were also mitigated by cleanup of contaminated sites. China had a total of nine chlordane and mirex producers. All of them were closed by May 2009 following the issued Ban. The total production of the two POPs was reduced from 303.5 tons in 2005 to zero in 2009. The project financed environmental impact assessment of eight chlordane and mirex production sites except for the Liyang Guanghua site, for which an EIA was carried out during the project preparation stage. Two sites (i.e. Liyang Xinhai and Changshu Fengjiang) were selected for contaminated site cleanup for demonstration purpose under the project. A total of 6,946 m³ contaminated soil, 550 m² contaminated buildings inner-surface, 398 m² contaminated buildings and 6.4 tons hazardous waste were cleaned up and/or disposed. The cleanup experience will be used for cleanup of the other sites.

Locally-produced benign chemical registered. In addition to less quantity, termite IPM also requires the use of less toxic and less persistent pesticide. With this demonstration project, efforts have been put in place to register safer and less persistent pesticides for termite control. One such benign chemical, ivermectin was recently registered for termite control in China, and may be incorporated in dust or bait for future use. Ivermectin is one of the bio-pesticides, and is a fermentation product by soil actinomycete bacteria. It is highly toxic to target species such as insect pests, and less persistent than most organic pesticides. Since the Chinese termite control personnel has recognized the importance of using less toxic and less persistent insecticides, it is expected that more such benign chemicals will be sent to pipelines for registration in China.

Advanced technologies (Infrared Camera, GPS and other tools) used. Although the monitoring-controlling system uses less pesticide, it is also more labor intensive and costly than conventional methods. As part of the research and development activity of this demonstration project, Chinese expert has developed the domestic version of electronic sensing/monitoring system so as to remedy the labor cost associated with the monitoring phase. The practical application of this electronic system needs to be further tested by the market, but this is the type of innovation that is needed to sustain termite IPM in China.

Through the demonstration project, several new detection technologies such as infrared camera and acoustic emission device were introduced to Chinese termite control personnel. These new technologies allowed them to use a more targeted indoor application of pesticide such as AG baits to further promote reduced pesticide use. The introduction of these new technologies also stimulated innovations on the part of Chinese termite control expert to develop or adopt other technologies to advance their pursue of termite IPM in the daily control practice. The Nanjing Termite Control Station, for example, is testing a precision GPS device to locate IG stations that are often difficult to find when they are buried beneath vegetation or soil. Once improved and simplified, the device may save time and labor for IG application and make the baiting system more sustainable. It is also expected that the cost of IPM options will go down as more systems will enter the Chinese market (from international and local sources) and labor costs will decrease as termite institute operators gain experience in installation, monitoring and maintenance.

3.3 Efficiency

Rating: Satisfactory

A traditional cost-benefit analysis was not possible due to lack of available data and difficulties in measuring the overall environmental and health benefits. A cost-effectiveness method was used for the analysis. The significant benefits generated from the project are the environmental and health benefits resulted from phase-out of the two POPs production and consumption coupled with the use of IPM. The proxies used to evaluate the benefits clearly recognized that environmental and health benefits from phase-out of the two POPs would be greater than economic value of using the two POPs

for termite prevention and control since environmental contamination and health issues would cost huge efforts and financial resources to recover.

The cost-effectiveness analysis has shown that in order to achieve the goal of phase-out of production, consumption, import and export of chlordane and mirex in China through termite IPM, the project, compared with the “without project” scenario, has provided an efficient way to assist the Chinese government to fulfill its obligation to the Stockholm Convention with technology demonstration, policy support and technical assurance. It is significant that the project’s IPM experiences will be used in the national replication program. See more details in Annex 3.

3.4 Justification of Overall Outcome Rating

Rating: Moderate Satisfactory

The project was and remains highly relevant to GoC priorities on environment protection. As stated in Section 3.2, the project was successful in achievement of mitigating environmental and human health risks associated with the two POPs as well as other non-POPs insecticides through demonstration of the termite IPM and development of the national replication program. However, the project experienced substantial delays as mentioned in Section 2.2 to achieve these outcomes; and sustainability and replication of termite IPM remains challenging. Therefore, the overall outcome is rated as MS

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

The project, through the Chinese Government’s support and finance, addressed specific poverty impacts by assisting former chlordane and mirex production factory employees with alternative employment opportunities, training and cash support, according to their choice and after consultation. A social assessment was conducted for the chlordane and mirex producer Liyang Guanghua that disaggregated the project-affected population by gender and income and provided opportunities for stakeholder participation in developing mitigation plans to respond to the employment and income impacts of factory closure. Gender equity in relation to the mitigation of the negative impacts of factory closure was ensured by providing to both male and female employees opportunities for consultation and choice of various options.

(b) Institutional Change/Strengthening

It is commonly recognized that the institutional capacity has been strengthened through the project implementation. The project, through introducing IPM international experiences (IPM concepts and monitoring-baiting technology for this project), has assisted the national and provincial governments in China in finding environmentally-sound alternatives to toxic chemical treatment for termite prevention and control and in making policies to sustain the development of the termite control sector. The annual project review meetings and workshops strengthened the inter-provincial coordination.

The project has also assisted CIO/FECO/MEP in establishing itself as a leading agency in China providing strategic guidance and technical assistance on POPs phase-out. All the staff of CIO and PIUs has attended training in project management (e.g., filing, procurement, financial management, MIS and others). In particular the project implementation has enabled CIO/FECO to strengthen its capacity in coordination with the line ministries, the oversight ministries and the provincial government agencies, mobilization of domestic funds, project and knowledge management, and procurement and safeguards.

The IPM demonstration has strengthened technical and management capacity of the Termite Control Stations. The technical assistance through the project chief technical advisor (an international consultant) transferred international IPM knowledge to them. During project implementation, termite professionals attended several workshops to learn the concept of IPM and on the specific use of bait systems and dusting systems. Several provincial representatives participated in exchange/study visits with private termite control professionals in the United States. The improved IT system through the MIS development and use under the project will standardize their termite prevention and control practices and improve their working efficiency and effectiveness.

Chinese scientists had opportunities to network and exchange ideas with international experts in the field. The project has also enabled relevant research institutes and universities to strengthen their capacity in development of domestically-produced products and tools for termite prevention and control.

(c) Other Unintended Outcomes and Impacts

Three contaminated sites including Liyang Guanghua site were cleaned up during the project period. The successful cleanup experiences will be transferred and replicated to other potential sites. Additionally, the cleaned lands will be used for new development bringing possibilities for more job opportunities and other environmental, social and economic benefits.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

The Project Implementation Evaluation Report done by an independent consultant hired by FECO included a survey of recognizing IPM approach. The interviewees included the three PIUs, residents of the communities where the IPM approach was applied and some TCSs which demonstrated the IPM approach. The survey results showed high acceptance rates. The report is available upon request.

4. Assessment of Risk to Development Outcome

Rating: Moderate

The overall risk to the development outcome is rated moderate on the following basis. Through implementation of the project, mitigation of environmental and health risks associated with chlordane and mirex by phase-out of the two POPs was successfully

achieved nationwide. Chinese termite control personnel and the key stakeholder has recognized the importance of using less toxic and less persistent pesticides at smaller quantity for their termite control practice, and has been actively developing their own versions of needed technologies to sustain termite IPM in China. Efforts were made to revise policies and regulations so as to promote and sustain termite IPM in China. The closures of POPs manufacturing plants eliminated production of chlordane and mirex, and the adoption of bait systems in three provinces replaced substantial quantity of liquid termiticides. The public's knowledge on environmental and human health risks associated with toxic chemicals and IPM has also increased.

However, sustaining the termite IPM in China is still facing challenges: (a) IPM technologies require high operating cost during the post-completion project operation stage, especially when the warranty policy of 15 years remains unchanged; and (b) non-POPs chemicals have emerged and are being used in China.

The cost difference between IPM technologies (especially bait systems) and liquid termiticide applications is largely due to: (a) the higher cost of the imported bait systems (baits and stations, in this initial demonstration stage through the project) and (b) higher labor costs required for annual monitoring after installation. It is expected that the cost of IPM technologies will go down as more locally developed products (i.e. baits or dusting chemicals) are registered in China and labor costs will decrease as termite station operators gain more experiences in installation, monitoring and maintenance. Capacity built through the project in China will be extended to address these challenges in the termite control sector.

5. Assessment of Bank and Borrower Performance

5.1 Bank

(a) Bank Performance in Ensuring Quality at Entry

Rating: Moderately Satisfactory

During the project preparation, the Bank maintained an intense dialogue with the government (FECO and MEP) and other key stakeholders (the National Termite Control Center under MOHURD, TCSs in selected demonstration provinces, the international and national termite experts). The Bank team made full use of studies undertaken by the FECO to collect comprehensive data and information on termite control: (i) the Strategy for Phase-out of POPs Pesticides in China, funded by Italy and supervised by the United Nations Development Program (UNDP); and (ii) the Termite Study and five high-level public awareness workshops on Stockholm Convention, funded by Canada and supervised by WB. These have laid a solid base for development and adoption of the project with introduction of the IPM approach to replace the two POPs in three demonstration provinces.

The project design had weakness as mentioned in section 2.1, 2.2 and 2.3, including weakness in M&E (design of results framework and project indicators), weakness in risk

assessment, insufficient training on the disbursement mechanism, and insufficient demand analysis of bait systems. These weaknesses led to frequent adjustments in project activities and extending project closing date during implementation. Therefore, the Bank performance at Entry is rated as MS.

The key concerns raised by the Quality Assessment Group (QAG) were some issues relating to overall design (specifically measures to ensure key policy and regulatory reforms are undertaken), a lack of economic analysis and associated questions relating to sustainability of the selected IPM technology, and some weaknesses in M&E aspects and risk assessment. The QAG also raise that the PDO and indicators focused only on phasing out use of chlordane and mirex, whereas it is clear from the project design that it is equally aimed at shifting users to termite baits (and possibly other IPM-compatible technologies in future) rather than just substituting other chemicals. It was also pointed out that some alternative design options (physical barriers) were rejected, based upon advice from a workshop of experts but sufficient convincing explanations were not provided. Also, there is no explanation why baits are provided to termite control centers during project implementation for free.

(b) Quality of Supervision

Rating: Moderately Satisfactory

The Bank team provided high degree of coordination not only with the implementing agencies (FECO and PIUs), but also with the oversight agencies including MOF and MORHUD. At least thirteen supervision missions were undertaken by the Bank. A number of field visits were undertaken to ensure compliance with safeguard policies, and to verify physical progress and achievements. There was also regular, monthly and (even) biweekly follow-up reviews in many instances especially when the project was facing substantial delays and being in the process of back on track after the MTR review. The Bank's Implementation Status Reports (ISRs) realistically rated the performance of the project and provided project progress information to the GEF. There was also a very high level of inputs from the Bank's procurement, financial and safeguards staff throughout the project, both in ensuring fiduciary requirements were met, and in providing training for FECO and PIU's staff.

The significant project implementation delays were discussed with Bank management. The Bank management provided sufficient guidance for the task team to assist FECO and PIUs in addressing project issues. The Bank team closely worked with FECO and the three PIUs following the progress milestones agreed during the April 2010 mission and appropriately adjusted the project activities in order to overcome project delays and M&E weaknesses. The project implementation status was finally upgraded to satisfactory in September 2011 with the joint efforts by FECO, the PIUs and the Bank team. And the project was closed as scheduled after one-year extension.

However, it should be noted that the project indicators (most are output-based indicators) were not formally revised during the project implementation although this weakness was indicated in 2007 by the QAG review. Also, the slow disbursement issue was not

effectively addressed early enough (during preparation and early implementation) causing delays in levels of disbursements. Some project activities were added to better collect data for measuring achievement of PDOs, but only at the late stage of the project, which impacted negatively the complete and effective data collection to satisfactorily prove achievement of the project outcomes, especially on the termite IPM promotion. Finally, the alternation of four task team leaders during the project duration created continuity problems. Therefore, the rating is given MS on the Bank's supervision.

(c) Justification of Rating for Overall Bank Performance

Rating: Moderately Satisfactory

On the basis of the above assessment of Bank performance in ensuring quality at entry and in supervision, overall Bank performance is rated Moderately Satisfactory.

5.2 Borrower

(a) Government Performance

Rating: Satisfactory

The Government maintained its commitment to the Stockholm Convention on POPs during the project life ensuring phase-out of the two POPs. The political will and commitment to sustain the outcomes of this project ensured by developing and adopting sound framework of policies, regulations and standards on termite prevention and control at both national and provincial levels to promote the IPM approach with diversified technical options. This includes six national and 25 provincial policies, regulations and technical codes on termite control (out of which 3 national and 11 provincial were published prior to the project closing date of December 31, 2011 (see Annex 2).

On April 16, 2009, the Notification on Ban of Production, Circulation, Use and Trade of DDT, Chlordane, Mirex and HCB was promulgated as a joint effort of ten ministries and agencies led by MEP and in cooperation with NDRC, Ministry of Industry and Information Technology, MOHURD, Ministry of Agriculture, Ministry of Commerce, Ministry of Public Health, General Administration of Customs, General Administration of Quality Supervision, Inspection and Quarantine and State Administration of Work Safety. The issuance and promulgation of this national ban reflects China's engagement to honor its commitments under the Stockholm Convention.

Government funds have been provided through FECO and the provincial PIUs under the tight supervision of the Ministry of Finance. GoC's financial support to the project has been also reflected in form of mobilized counterpart funds for both the project implementation duration and over 10 years after the project life for continued monitoring of installed bait and dusting systems for termite prevention and control. The major shortcoming of MOF during project implementation was the slow pace of opening the project account, funds request and reimbursement processing, although there have been some improvements by the end of project.

(b) Implementing Agency or Agencies Performance

Rating: Satisfactory

FECO and the provincial PIUs consistently demonstrated a strong commitment to the fulfillment of the project development objectives and provided adequate internal staff and resources to ensure implementation success.

FECO established a termite project team which monitored, managed and operated the project in a satisfactory manner at the national level, although its leadership at the later stage of the project could have been stronger. The project team responded timely to Zhejiang's retrieval at the beginning of 2006. FECO remained committed to the project throughout the project implementation period despite the changes in its team members and project leaders.

To address technical problems in project implementation and assist itself in technical support and guidance, FECO recruited a Chief Technical Advisor (CTA), a National Technical Advisor (NTA) and other technical advisors in line with project requirements. As the authority of termite control in China, the National Termite Control Center (NTCC) under MOHURD provided FECO with administrative support and policy guidance at the national level, specifically in the drafting and revision of national policies and standards and promoting their promulgation. It also supported Termite Control Stations in the demonstration provinces to apply IPM. This gave FECO proactive leadership to propose adding an additional component for testing the monitoring-dusting technology in order to diversify IPM options in termite prevention and control, using different types of chemicals used in the bait system.

The PIUs performances have been consistently satisfactory mainly due to their proactive leadership at the provincial level, clear implementation structure, recruiting and retaining experienced and qualified personnel, as well as timely and quality reporting. They complied with all Bank grant covenants and discharged its fiduciary duties in a satisfactory manner. The quality of supervision support by the three PIUs' managers and technical staff was high, and their intensive efforts in following up with the termite stations and other project activity contractors was a key factor for ultimate project success.

The three provinces' representative Steering Groups, efficiently coordinated, supervised and guided project implementation, and provided administrative as well as technical support. This reduced disruption risk during project implementation.

(c) Justification of Rating for Overall Borrower Performance

Rating: Satisfactory

On the basis of the above assessments regarding Government and Implementing agencies' performance, overall Borrower performance is rated Satisfactory.

6. Lessons Learned

Capacity building with a perception-and-behavior-change approach at the both national and provincial levels guarantees project sustainability. This was a pioneering project trying to achieve change in a complex institutional environment with little practical example to follow. Capacity building in policy and regulatory framework establishment and enforcement, effective organization of public awareness raising activities, accurate and practical IPM technical knowledge education, and institutional management with improved IT technologies are crucial for making changes for this type of project. The provincial PIUs played a key role in coordinating with local government agencies and following up on project activities, which was a key factor for ultimate project success.

Undertaking in-depth needs assessment is required to ensure project is accurately designed to directly respond to local needs. Based on past ten-year termite threats in the selected provinces, the project was initially designed to procure 900,000 bait systems, of which 500,000 are above-ground and 400,000 in-ground. It was found during installation that the proportion of the two types was inappropriate, leaving a huge gap between real and designed demands. Miscalculation in project design leads to frequent component adjustment, significantly impeding implementation and lengthening project development period for one year. In addition, given that procured above-ground systems largely exceeded local demands for termite control, termite control stations in demonstration areas intentionally neglected instructions when installing these systems at an early stage so that they can finish their tasks on time.

Connecting knowledge centers with international consultants, implementing agencies, and the private sector guarantees the intensive knowledge and expertise exchange. Part of this project's success was its implementation model, which dynamically linked different PIUs with FECO with centers of expertise, researchers, and international consultants. This allowed a quick transfer of knowledge, in addition to a quick return of expertise from the sites to the research institutions. This back and forth exercise allowed the refinement of implemented IPM technology, especially the Monitoring and Dusting system which was a pilot exercise. In addition, it appeared very important to have as part of the counterpart team an international advisor who is familiar with international best practices and can expedite and facilitate the decision making process by sharing global experience and targeted advice.

Introduction of new alternative technologies always entails new challenges, which require effective and timely training and education. Installation of above-ground stations poses strict technical requirements regarding the timing (breeding and control season) and location (sites where termites are discovered alive), otherwise would not deliver expected results. In addition, their labor intensive maintenance (bi-monthly site checks) increases the cost and reduces consumer commitment. Limit knowledge of the public on how bait systems work for termite prevention and control lead to high loss rates of in-ground stations (30 to 40% in some neighborhoods) and frequent dismantlement of above-ground stations by residents. Communication and training efforts before application of bait systems, coupled with summarizing and improving experiences during the installation and maintenance periods are crucial to enhance practitioners' skills. In

addition, strengthened communication among project stakeholders, including property management agencies and residents, combined with outreach activities on IPM knowledge and related project activities are important to increase public interest with regards to IPM technologies in termite control.

Impact analysis and the integration in project design of mechanisms for generating new solutions are needed when confronted with higher operational costs derived from the application of new technologies. It was found that application of monitoring control technology is labor intensive when compared to traditional methods of chemical control. This is mainly due to long duration of the termite control engineering, specifically the high labor cost to conduct regular monitoring and maintenance. During the implementation of the Demonstration Project, such problem of incremental costs has been solved through subsidized GEF and national funds. However, this endangers the sustainability of the project. It is highly recommended in future operations to integrate in the project design a comprehensive and realistic procedure to phase-out or reduce subsidies, including policy revisions to reform the termite control pricing system and guarantee policy, and encouraging R&D to develop less labor-intensive systems as well as more effective chemicals for termite control.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

FECO raised issues in its completion report on overestimation of demand for AG bait systems, shortcoming of bait system technology in terms of longer treatment time and high labor cost, complicated procurement procedure of the Bank, project M&E weakness, inefficient funds disbursement, and frequent task team leader change. Most of these issues are agreed and considered as the key factors affecting project implementation and outcomes and rating the Bank's performance in the ICR. Regarding the issue related to the opinion that the Bank procurement procedure was long and complicated, the Bank team thinks that in order to guarantee the procurement procedure is transparent and fair, a certain procedure and standard procurement documents need to be used. The Bank has been and will continue to make efforts for simplification and flexibility to better serve our clients. The delays on procurement of bait system were mainly because implementation delays and unfamiliar with the procurement procedure, not the procurement procedure itself.

In addition, a survey in some TCSs carried out under the project implementation evaluation indicated *"the cost of communicating with the Bank is high and they don't get satisfactory feedbacks from the Bank. For instance, the TCS in one city had several unsuccessful attempts to get contact information from the World Bank experts. Difficulties in project implementation were reported repeatedly to the World Bank staff during their field inspection, but no feedback was ever given."* The Bank ICR team thinks that there may have been insufficient communications between the Bank team and some TCSs due to difficulties in language or other reasons. However, the Task Team was not

aware of the existence of this issue before (otherwise it would have been addressed properly).

(b) Cofinanciers

Not applicable.

(c) Other partners and stakeholders

Not applicable.

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD equivalent)

| Project components | Project GEF funds | | Project counterpart funds committed (at appraisal) | Actual Use of Project Funds (until Dec. 31, 2011) | | Future counterpart commitments to sustain project outcomes and scale-up activities |
|--|--|-------------------------------------|--|---|------------------------------|--|
| | Original GEF allocation (at appraisal) | Revised GEF allocation in Dec. 2010 | | Actual GEF Grant | Actual Counterpart Financing | |
| 1. Institutional Capacity Strengthening | 971,919 | 1,826,000 | 854,081 | 1,522,851.00 | 1,146,402 | 40,000 |
| 1.1. MEP | 469,223 | 563,233 | 493,467 | 569,885.89 | 525,329 | 40,000 |
| 1.2. Jiangsu | 251,343 | 321,343 | 180,307 | 310,270.67 | 158,531 | |
| 1.3. Anhui | 251,343 | 321,343 | 180,307 | 321,343.00 | 130,104 | |
| 1.4. Hunan | | 321,343 | | 321,351.44 | 332,438 | |
| 2. Policy Framework for Elimination of Chlordane and Mirex | 640,000 | 2,270,104 | 200,000 | 903,821.16 | 282,226 | |
| 2.1. MEP | 300,000 | 425,026 | 100,000 | 340,431.43 | 140,959 | |
| 2.2. Jiangsu | 170,000 | 190,000 | 50,000 | 184,165.82 | 53,793 | |
| 2.3. Anhui | 170,000 | 190,000 | 50,000 | 190,000.00 | 52,104 | |
| 2.4. Hunan | | 190,000 | | 189,223.91 | 35,370 | |
| 3. IPM Implementation | 9,677,281 | 9,310,592 | 10,267,498 | 9,448,758.69 | 2,817,168 | 9,370,402 |
| 3.1. MEP | 509,000 | 1,772,926 | 83,000 | 2,047,157.94 | 183,041 | 45,000 |
| 3.2. Jiangsu | 4,209,232 | 3,040,881 | 4,550,000 | 3,005,101.07 | 2,092,741 | 4,550,000 |
| 3.3. Anhui | 4,959,049 | 1,821,003 | 5,634,498 | 1,821,003.00 | 0 | 2,029,865 |
| 3.4. Hunan | | 2,675,782 | | 2,575,496.68 | 541,386 | 2,745,537 |
| 4. Closure of a Chlordane and Mirex manufacturer | 940,800 | 1,418,066 | 695,200 | 1,452,845.18 | 902,629 | |
| 4.1. MPE | | | 435,200 | - | 488,653 ⁵ | |
| 4.2. Jiangsu | | 1,418,066 | 260,000 | 1,452,845.18 | 413,976 ⁶ | |
| 5. Project monitoring and Evaluation | 74,000 | 193,260 | 59,000 | 151,559.42 | 55,000 | |
| 5.1 MEP | 74,000 | 193,260 | 55,000 | 151,559.42 | 55,000 | |
| 5.2 Jiangsu | 0 | 0 | 2,000 | - | | |
| 5.3 Anhui | 0 | 0 | 2,000 | - | | |
| 5.4 Hunan | | | | - | | |
| 6. Design of a National Replication Program | 748,000 | 912,794 | 53,000 | 877,164.55 | 53,000 | 35,000 |
| 7. Contingency | 1,305,000 | 0 | 1,212,878 | 0 | NA | |
| TOTAL | 14,357,000 | 14,357,000 | 13,341,657 | 14,357,000 | 5,311,425 | 9,445,402 |

⁵ Including closure compensation to 8 chlordane and mirex producers.

⁶ Including local government funds to support cleanup of the Liyang Guanghua site.

(b) Financing

| Source of Funds | Type of Cofinancing | Appraisal Estimate (USD millions) | Actual (USD millions) | Percentage of Appraisal |
|-----------------------------------|---------------------|-----------------------------------|-----------------------|-------------------------|
| Borrower | | 13.34 | 14.76 | 110% |
| Global Environment Facility (GEF) | | 14.36 | 14.36 | 100% |

Annex 2. Outputs by Component

Table 1: Overview of bait system installation and avoided chemical amount

| Bait systems | | Procured | Installed | Maintenance | Installed construction area (1000 m ²) | Reduced chemicals | |
|--------------|--------------------|----------|-----------|-------------|--|-------------------------------------|--------|
| Jiangsu | IG for prevention | 363,592 | 330,677 | 32,915 | 34,029.8 | Chlordane and other chemicals (ton) | 125.97 |
| | AG for remediation | 75,233 | 75,233 | NA | 916 | Mirex (kg) | 61.97 |
| Hunan | IG for prevention | 245,542 | 223,314 | 22,228 | 26,946.4 | Chlordane and other chemicals (ton) | 139.9 |
| | AG for remediation | 46,577 | 46,577 | NA | 1,553 | Mirex (kg) | 60 |
| Anhui | IG for remediation | 152,866 | 140,114 | 12,752 | 105,612 | Chlordane and other chemicals (ton) | 106.5 |
| | AG for prevention | 29,691 | 29,691 | | 1,336 | Mirex (kg) | 41.33 |
| Total | IG for remediation | 762,000 | 694,105 | 67,895 | 166,588 | Chlordane and other chemicals (ton) | 372.37 |
| | AG for prevention | 151,501 | 151,501 | NA | 3,805 | Mirex (kg) | 163.3 |

Table 2: Summary of project outputs by component

| FECO Outputs | Jiangsu Outputs | Anhui Outputs | Hunan Outputs |
|---|--|---------------|---------------|
| <ul style="list-style-type: none">Ten line ministries and agencies jointly issued the Notification on Prohibition of Production, Circulation, Use and Trade of DDT, Chlordane, Mirex and HCB. | <ul style="list-style-type: none">Submitted commitment of completely stopping use of chlordane and mirex.No use of chlordane and mirex in termite prevention and control. | | |
| Component 1 Institutional Capacity Strengthening | | | |

| FECO Outputs | Jiangsu Outputs | Anhui Outputs | Hunan Outputs |
|---|---|--|--|
| <ul style="list-style-type: none"> Established Termite Project Team. Annual project meeting organized. Two project management and two financial management trainings organized. Compiled project implementation brochure and financial brochure. | <ul style="list-style-type: none"> Established Provincial Steering Group in each of the three provinces. Established and adequately staffed PIUs in each of the three provinces for routine management. Organized project annual meeting and steering group meeting to report on this year's work progress and plan for the next year. Recruited three IPM experts (one for each Prevention and Control Station). Recruited IT experts for MIS development and maintenance. Recruited site clean-up experts for the clean-up component. | | |
| <ul style="list-style-type: none"> Three Project Inception Meetings organized. | | | |
| Component 2 Policy Framework for Elimination of Chlordane and Mirex | | | |
| <ul style="list-style-type: none"> Revised and drafted five national policies; Additional Results: Guidance on National Application of IPM Technologies in Termite Control is planned to be published by MEP and MHURD in the first half of 2012. | <ul style="list-style-type: none"> Revised and drafted seven provincial policies, regulations and standards on termite control; Report on Evaluation of Pricing of Building Termite Prevention of Jiangsu Province was finalized and submitted to competent authorities. | <ul style="list-style-type: none"> Revised and drafted seven provincial policies, regulations and standards on termite control; Report on Evaluation of Pricing of Building Termite Prevention in Anhui Province was finalized and submitted to local authorities. | <ul style="list-style-type: none"> Revised and drafted 7 provincial policies, regulations and standards; Notification on Strengthening Environment Monitoring of Termite Control issued Report on Cost Evaluation of Major Chemicals and IPM Technologies in Termite Control was finalized. |
| Component 3 IPM Implementation | | | |

| FECO Outputs | Jiangsu Outputs | Anhui Outputs | Hunan Outputs |
|---|--|--|--|
| <ul style="list-style-type: none"> • 4000 manuals disseminated of Building Termite Integrated Management in China and Manuals on Operation of Bait System in Building Termite Control. • 35 Management personnel of PIUs trained in the selected provinces was organized. • 135 personnel attended the Trainings of trainers • Researchers' training organized with 163 participants. • The training on monitoring-dusting technologies was attended by 60 participants. • Two trainings of management personnel and technicians of termite control stations in China were organized with 229 participants. | <ul style="list-style-type: none"> • Two trainings of management personnel. • 2 rounds of ten trainings on IPM operation with 1043 participants. • Two MIS trainings with 118 participants. | <ul style="list-style-type: none"> • 17 classes of 8 trainings on IPM, attended by 735 management personnel and technicians. • 2 senior trainings attended by 434 officials from municipal and county agencies of real estate management in this province. • 1 training of bait system installation was organized, attended by 46 property management officials and staff. • 251 participants attended two trainings on bait system installation and maintenance management • 37 participants in training on financial management. • 67 participants attended training on documentation management. • 84 participants in a training on termite control of historic architecture. • Three trainings on MIS with 254 trainees. • Two trainings on policy with 236 trainees. | <ul style="list-style-type: none"> • Eighteen trainings of management personnel and technicians with 706 participants. • Five trainings of management personnel with 180 participants. • Two trainings on financial management with 45 participants. • Eight trainings on IPM with 294 participants. • Eight trainings on MIS with 461 participants. |
| <ul style="list-style-type: none"> • Publicity brochures of the project compiled. • 10,000 IPM manuals disseminated. • Videos on the project and IPM shot and 500 copies manufactured. | <ul style="list-style-type: none"> • A webpage for the project was set up. http://www.jshj.org/jspops • Couples of reports in publications at provincial level and above. • Press conferences and large publicity campaigns at public squares on Stockholm Convention and elimination of chlordane, mirex and other POPs organized with 700 recycled bags, 3000 bookmarks and 1000 stamp albums disseminated. • Four thematic TV clips finalized. • Four hundred warning signs set up. | <ul style="list-style-type: none"> • A webpage for the project was set up http://www.ahjst.gov.cn/ahjst/ztlm/043012/ • Technical information of the project and IPM was published by the PIU and termite control stations on local media. • 260 large signs, 2500 placards for monitoring facility, 2000 project posters and 30,000 publicity brochures were produced and disseminated. • A Commitment Ceremony on Implementation of Stockholm Convention was held attended by more than 100 officials from 17 provincial and municipal termite control stations. | <ul style="list-style-type: none"> • A webpage for the project was set up http://www.hunanjs.gov.cn/z/zfc/zzfc.asp?ntype=byfz • 21 TV coverage and 62 reports in publications. • 3000 project brochures and 20,000 sheets disseminated. • 650 warning signs set up in neighborhoods where bait systems were installed. • 3000 promotion material disseminated to the public such as calendars, bags and cups. |

| FECO Outputs | Jiangsu Outputs | Anhui Outputs | Hunan Outputs |
|--|--|--|--|
| | <ul style="list-style-type: none"> Surveys conducted with 1000 questionnaires disseminated. | | |
| <ul style="list-style-type: none"> The first 32,300 in-ground and 3000 above-ground small-scale bait systems and the first 100,000 in-ground and 147,001 above-ground 30% bait systems procured. | <ul style="list-style-type: none"> 330,677 in-ground bait systems installed covering a construction area of 34.0298 million m². 75,233 above-ground bait systems for residential buildings were installed for remedial treatment, covering a construction area of 916,000 m². 125.97 MT of chlordane and other pesticides and 61.97 MT of mirex are eliminated. | <ul style="list-style-type: none"> 128,114 in-ground bait systems were installed covering a construction area of 16.261 million m². 28,191 above-ground bait systems for residential buildings were installed for remedial treatment, covering a construction area of 1.336 million m². 12,000 in-ground and 1,500 above-ground bait systems were installed for preventive and remedial treatment of historic architecture covering a construction area of 89,351.6 m². 106.5 MT of chlordane and other pesticides and 41.33MT of mirex are eliminated. | <ul style="list-style-type: none"> 223,314 in-ground bait systems were installed covering a construction area of 26.9464 million m². 46,577 above-ground bait systems for residential buildings were installed for remedial treatment, covering a construction area of 1.553 million m². 139.9 MT of chlordane and other pesticides and 60kg of mirex are eliminated. |
| | <ul style="list-style-type: none"> MIS for Jiangsu demonstration (http://www.jsby.org) developed. 59 termite control stations equipped with MIS. | <ul style="list-style-type: none"> MIS for Anhui demonstration was developed. 86 termite control stations have been equipped with MIS. | <ul style="list-style-type: none"> MIS for Hunan demonstration was developed. 105 termite control stations equipped with MIS. |
| <ul style="list-style-type: none"> 9 infrared cameras procured, 3 for each selected province for routine termite monitoring. In total, 250 termite control stations at municipal and county levels are equipped with one computer and one printing machine for MIS. Operation Manual on Monitoring-dusting Technologies developed; 45,375 termite monitoring equipment were procured for the selected five cities, 41,250 of which was installed during project implementation for preventive treatment and 4125 for maintenance after the project is over. The treatment covers a construction area of 3.365 million m². Specialized agencies were recruited to evaluate the effects of monitored and spray technologies to verify its effectiveness; | | | |
| Component 4 Closure of Chlordane and Mirex Manufacturers | | | |
| <ul style="list-style-type: none"> Reduction of 303.5 MT of chlordane and mirex production in Jiangsu Province Clean-up of Liyang Xinhai Chemical Plant. Altogether 3,133 m³ of contaminated soil, of which 648 m³ is of high risk, 891 m³ of medium risk and 1,594 m³ of low risk, 230 m² of contaminated building inner-surfaces, 276 m² of contaminated building and 4 MT of hazardous waste were restored, cleaned and properly disposed as planned. In Changshu clean-up site, 3,813 m³ of contaminated soil, of which 1,819 m³ is of low risk and 1,994 m³ of high risk, 320 m² of contaminated building surfaces, 122 m² of contaminated building and 450 liter of waste were restored, cleaned and properly disposed. Technical advisors, engineering project supervisors as well as independent monitoring and inspection agencies recruited for the clean-up. Altogether USD 405,550 of compensation fees provided to 8 closed chlordane and mirex manufacturers | | | |
| Component 5 Monitoring and Evaluation | | | |

| FECO Outputs | Jiangsu Outputs | Anhui Outputs | Hunan Outputs |
|---|-----------------|---------------|---------------|
| <ul style="list-style-type: none"> • Annual Evaluation and monitoring workshop organized • Project mid-term review was conducted in 2009. • Installation of IPM bait systems in selected provinces was examined by experts. • Implementation of IPM monitoring-dusting systems in five selected cities was examined and reviewed. All five cities have in principle passed the review and would make adjustment in line with the opinions of the Review Expert Team in time. • Five annual implementation review meetings organized, attended by MOP, MHURD, NTCC, agencies from demonstration areas and other stakeholders, discussing implementation progress and work plan for the next year. • MIS is established at FECO. • Reports on evaluation of bait systems in selected provinces finalized. • Report on cost analysis of bait systems and chemical technologies in termite control finalized. • Report on post project assessment finalized. | | | |
| Component 6 National Replication Program for Elimination of Chlordane and Mirex in China | | | |
| <ul style="list-style-type: none"> • Zhejiang Termite Control Center recruited to provide technical support; • A workshop on development of the national replication program organized, and attended by more than 30 experts and officials • The consulting service contract to develop the national replication program was signed with Zhejiang Termite Control Center. The program is incorporated into the Twelfth Five-Year-Plan for National Termite Control. • EIAs of the 8 chlordane and mirex manufacturers are conducted, identifying local contaminated areas. | | | |

Table 3: Policy revisions at national level

| Policy title | Objective | Status |
|--|---|---|
| 1. Regulations for quality management methods on termite prevention and control in urban buildings | To include IPM provisions | Under listing |
| 2. Technical standards for termite prevention in urban buildings (JGJ/T 245-2011) | To include IPM provisions | Issued |
| 3. Management regulations for termite prevention and control in Urban Buildings (a Revised Draft of No. 130 Instruction of MOHURD) | To review the warranty period of termite prevention and control and to promote IPM concepts and techniques | Under listing |
| 4. Notification on Ban of Production, Circulation, Use and Trade of DDT, Chlordane, Mirex and HCB | To eliminate chlordane and mirex in China | Issued |
| 5. Assessment of termite prevention and control chemical effectiveness testing methods - Registration of IPM compatible termite control products | To improve the efficiency and speed of registering IPM-compatible insecticides in China by reviewing the existing system for termiticide registration | Issued for trial |
| 6. Guidance on replication of IPM technologies for termite prevention and control in China | To promote IPM practices for termite control | To be jointly issued by MEP and MOURH in 2012 |

Table 4: Policy revisions in the three demonstration provinces

| Level | No. | Policy | Objective | State |
|------------------|-----|---|--|----------------------------|
| Jiangsu Province | 1 | Opinions on Implementation and Promotion of China Demonstration of Alternatives to Chlordane and Mirex in Termite Control Project in Jiangsu Province | To support project sustainability after the project life | Issued |
| | 2 | Management Methods of Termite Control in Urban and Rural Areas | To include provisions for IPM | Issued after consolidation |

| Level | No. | Policy | Objective | State |
|----------------|-----|--|---|--|
| | 3 | Institutional administrative provision for termite prevention and control institutions | To include provisions for IPM | Issued after consolidation |
| | 4 | Technical standards and provisions for termite prevention in buildings | To include provisions for IPM | |
| | 5 | Design Codes on Termite Prevention and Control in buildings | To include provisions for IPM | |
| | 6 | Quality control manual for termite prevention and control in buildings | To include quality control guidance for IPM options | Applying for registration |
| | 7 | Budgeting manual for termite prevention and control in buildings | To include provisions for mandatory termite-prevention design and to encourage integration of termite prevention measures into construction process | Applying for registration |
| | 8 | Report on Cost Assessment of Major Pesticides and Bait Systems in Termite Prevention and Control | To review the fee schedule, related economic and financial analysis, and to design new fee schedule for termite control applications | Finalized |
| Anhui Province | 9 | Notification on Complete Elimination of Chlordane and Mirex in Termite Control and Implementation of China Demonstration of Alternatives to Chlordane and Mirex in Termite Control Project (Wan Jian Fang [2011] No. 73) | To ban use of chlordane and mirex and promote and sustain IPM | Issued |
| | 10 | Management Methods of Termite Control in Urban and Rural Areas | To include provisions for IPM | Issued |
| | 11 | Budgeting manual for termite prevention and control in buildings | To include provisions for mandatory termite-prevention design and to encourage integration of termite prevention measures into construction process | Issued |
| | 12 | Technical standards and provisions for termite prevention in buildings | To include provisions for IPM | To be issued in the first half of 2012 |
| | 13 | Institutional administrative provision for termite prevention and control institutions | To include provisions for IPM | |
| | 14 | Quality control manual for termite prevention and control in buildings | To include quality control guidance for IPM options | |
| | 15 | Pricing standard on termite prevention and control | To review the fee schedule, related economic and financial analysis, and to design new fee schedule for termite control applications | |
| | 16 | Report on Cost Assessment of Major Pesticides and Bait Systems in Construction Termite Control | | Finalized |
| Hunan Province | 17 | Notification of the General Office of Human Provincial People's Government on Elimination of Chlordane and Mirex in Termite Control (Xiang Zheng Ban Han [2007] No. 39) | To ban use of chlordane and mirex | Issued |

| Level | No. | Policy | Objective | State |
|-------|-----|---|---|--|
| | 18 | Pricing standard on termite prevention and control | To review the fee schedule, related economic and financial analysis, and to design new fee schedule for termite control applications | Issued |
| | 19 | Notification on Strengthening Environment Monitoring in Termite Prevention and Control (Xiang Jian Fang [2009] No. 421) | To promote IPM | Issued |
| | 20 | Technical standards and provisions for termite prevention in buildings | To include provisions for IPM | To be issued in the first half of 2012 |
| | 21 | Management Methods of Termite Control in Urban and Rural Areas | To include provisions for IPM | Applying for registration |
| | 22 | Institutional administrative provision for termite prevention and control institutions | To include provisions for IPM | Applying for registration |
| | 23 | Quality control manual for termite prevention and control in buildings | To include quality control guidance for IPM options | Applying for registration |
| | 24 | Budgeting manual for termite prevention and control in buildings | To include provisions for mandatory termite-prevention design and to encourage integration of termite prevention measures into construction process | Applying for registration |
| | 25 | Report on Cost Assessment of Major Pesticides and Bait Systems in Construction Termite Control | | Finalized |

Annex 3. Economic and Financial Analysis

Introduction

The Project Development Objective (PDO) is to mitigate environmental and health risks associated with chlordane and mirex in termite control by (a) demonstrating the elimination of their use through the introduction of integrated pest management (IPM) in selected area, and (b) preparing a national replication program for complete phase-out of chlordane and mirex in China.

During project preparation, due to lack of data and information readily available in China and inherent difficulties in measuring the effect of these pollutants, it was impractical to carry-out traditional cost-benefit analysis, therefore the economic analysis was based on qualitative analysis. The economic and financial analysis intended to assess the introduction of IPM approach for termite control in buildings requires information on the total number of buildings exposed to termite damage, present number of infestations, detailed information on the building age, when and how it was last treated, cost of damage per case etc. Unfortunately, such information was not available then; the analysis was not able to be done. Alternatively, the cost analysis between chemicals presently used and potential alternatives including non-POPs chemicals and IPM technology (bait system) was conducted. The unit price (per kg and per M²) information was from WHO (World Health Organization) and the information on costs by different sized structure was estimated from the past termite prevention and control practices. The cost comparison results showed that chlordane was the most economical approach and the IPM was the most expensive approach in terms of operational costs. However, the analysis was not able to assess the potential health and environmental impact of the use of chlordane and substitute chemicals.

At ICR stage, the analysis still faces similar difficulties in carrying-out quantified analysis since relevant information and data are still not available. This is mainly due to the lack of specific scientific research on the environmental impact and human health risk from the use of chlordane and mirex in China. Fortunately, such research has been done internationally in the late 1990s, and the evidences and results will be used for this analysis as references. The focus of this analysis is on assessing the economic benefits and costs based on a number of assumptions and scenarios. .

Methodology Applied

The traditional cost-benefit evaluation that estimate internal rate of return (IRR) and net present value (NPV) derived from cash flow calculations is not applied since it is difficult to quantify the environmental and social impacts and benefits in monetary terms. Therefore, the approach of *cost-effectiveness* approach is applied in this analysis.

The analysis following focuses on evaluating economic impacts on environment not financial benefits to the project entities since financial costs of the integrated pest

management (IPM) are higher than the costs of existing traditional approaches of chemical block for termite prevention and control.

Main Assumptions and Proposed Scenarios

Main Assumptions

IPM will reach its expected effects: The IPM (bait system) approach for termite prevention and control was introduced for the first time to China. Due to its technical requirements and the short period of implementation, full effects were not properly reported. However, this IPM approach has been implemented in other countries (US, Australia, Pakistan etc.) and is a mature technology. Its effects have been fully revealed. In the different project provinces and cities, despite some problems related to the technical installation, initial effects have been visible and recorded through a rigorous monitoring and inspection, and relevant assessment was undertaken. It is assumed that the IPM (bait system) has reached its expected effects, and will be viable for replication in China.

Public awareness and acceptance of IPM: Since the public was used to the traditional approach (application of chlordane and mirex) for termite prevention and control due to its low cost and long-period efficiency, coupled with a lack of scientific publications related to its environmental contamination and its impacts on human health (e.g., cancer occurrence), they would be reluctant to accept high-cost termite treatment and frequent visit for monitoring. The public awareness campaigns under the project tended to increase awareness regarding the negative environmental impacts as well as the risks to human health due to the exposure to chlordane and mirex and the advantage of IPM technologies. Furthermore, the Project Implementation Evaluation Report included a survey of recognizing IPM approach. The interviewees included residents of communities where the IPM approach was applied and the Termite Control Station workers, who implemented the IPM approach. The high acceptance rates have been reported in the survey result. Therefore, an assumption of the public's willingness to pay the incremental cost to utilize bait systems is made.

International research results are applied in China: As mentioned above, China does not have specific scientific research data that can be used for this analysis on evaluating impacts of using POPs, particularly the impacts of chlordane and mirex on the environment and on human health and data on benefits of gradually terminating the production, use, export and import of these two POPs. This type of research was conducted internationally in the late 1990s when developed countries (e.g., US, Japan) issued a ban on using these chemicals.

- i. One Japanese study showed six times higher chlordane concentration in mother's milk in houses treated with chlordane for termite control and another Japanese study showed strong correlation between chlordane in blood and operators who applied chlordane for termite control.

- ii. A recently published American study showed that 20 years after the ban of chlordane, high chlordane in fishes near the areas frequently treated with chlordane for termite control is still detected.

Those studies have not shown any adverse effects on human health, nevertheless the US study clearly indicates the persistency of chlordane and thus its bio-accumulation in our ecosystem. If these POPs continued to be used, they will eventually affect human health since we lie on the top of the food chain.

Although there is no scientific proof of correlation between the exposure to chlordane and the occurrence of cancer, the ICR mission learned from Termite Stations some existing evidences that cancer occurrence among workers of termite control stations was 40 percent higher than the national public average. But official or scientific data proving this is not available.

In addition, assessment of the environmental hazard from chlordane and mirex use is cited from Stockholm Convention website under “Listing POPs in the Stockholm Convention”, which summarized the research results from international society:

“Chlordane remains in the soil for a long time and has a reported half-life of one year. The lethal effects of chlordane on fish and birds vary according to the species, but tests have shown that it can kill mallard ducks, bobwhite quail, and pink shrimp. Chlordane may affect the human immune system and is classified as a possible human carcinogen. It is believed that human exposure occurs mainly through the air, and chlordane has been detected in the indoor air of residences in the US and Japan.”

“Direct exposure to mirex does not appear to cause injury to humans, but studies on laboratory animals have caused it to be classified as a possible human carcinogen. In studies mirex proved toxic to several plant species and to fish and crustaceans. It is considered to be one of the most stable and persistent pesticides, with a half life of up to 10 years. The main route of human exposure to mirex is through food, particularly meat, fish, and wild game.”

We would take these research results as references to evaluate potential adverse environmental impacts.

Proposed Scenarios

Based on the incremental cost analysis prepared during project preparation, the following two scenarios, without project and with project, which are consistent with the baseline and GEF alternatives, are used for cost-effectiveness analysis. The below cost-effectiveness analysis will be based on these two scenarios.

- i. The scenario of “without project”: China as the Stockholm Convention member is obligated to find alternative environmental friendly approach for replacing existing practice of using chlordane and mirex for termite control. However,

since the CIO and SEPA and termite control stations have no experience and capacity on IPM for termite control, as well the existing policies, regulations and standards and operational procedures were all promoting and indirectly mandating the use of chlordane and mirex for termite control, it would take a lot of effort and much time to introduce and implement IPM method and potential problems in policy support, technical constraints and public acceptance would appear. Before IPM approach is fully introduced and functioned well in China, the Government might request for another five-year exemption after the first exemption was expired in 2009. The consequence would be: (i) more areas would be contaminated and more financial resource would be needed for cleaning up the contaminated soil and water system; and (ii) more costly and time consuming for introducing IPM approach for termite control and establishing necessary policy and regulatory framework and developing technical standard for implementing IPM.

- ii. The scenario of “with project”: The IPM (bait system and dusting system) technologies through the project have been implemented within three demonstration provinces and five pilot cities, representing a high potential for replication in the termite prevention and control sector in China. Although the IPM approach’s positive advantages with regards to the environment and to human health and long-term effectiveness have not fully revealed, plus its higher costs (equipment and labor) and technical requirement might slow down the national replication progress, the project objectives have successfully achieved, the policy and regulatory framework for supporting IPM implementation has been established, the institutional capacity has been strengthened and the technical standard has been developed and technical experience for implementing IPM has been gained.

Assessment of Economic Benefits

The project did not directly generate any economic revenue or financial return. The significant benefits generated by the project would be its positive environmental impact resulted from the reduction of soil and water contamination associated with chlordane and mirex as well as other non-POPs chemicals, and the positive social impact via reducing the risk to human health. As it is impossible to quantify the negative impact of using chlordane and mirex, the analysis has to use some proxies for evaluating these benefits, such as *savings* from the remediation costs of chlordane and mirex contaminated sites (such as chlordane and mirex production factories), and the medical expenditure on treating cancer. As mentioned above that no direct evidence of the correlation between closely contacting the chlordane and mirex (termite controls station workers) and the cancer occurrence has been found as research has not been conducted yet. But there have been incidence that the cancer occurrence rate among Termite Control Station workers is much higher than national average.

The higher cancer occurrence among termite station workers has two economic effects: medical expenses and labor productivity loss (reduce economic income). With IPM

technologies used in this project, the workers are less exposed to toxic chemicals; at least the possibility of cancer occurrence among termite control station workers would be reduced considerably.

There is no specific report of cancer occurrence within exposed residents in termite treated areas with chlordane and mirex. The US report indicated that the potential risks to human health existed, and no one could project what would happen with the infants who had mother milk with the chlordane contamination in the future. The most significant concern is that the contamination of POPs will remain for long periods and will not decompose naturally, thus hard to clean up.

Under the project, the cost of cleaning the site of Liyang Xinhai Chlordane factory was almost 6 million yuan (RMB, roughly equivalent to \$900,000), which was a small-scale collective enterprise. Although it will not be possible to estimate the accurate cost for cleaning all the contaminated areas, it would be with no doubt tremendous. With the introduction of IPM, these tremendous cleaning costs would be *saved*. As IPM replication progress would not be rapid due to its high costs and technical requirements, it is suggested to carry out a specific study to measure the environmental costs of cleaning the contamination.

Additional economic losses related to chlordane production and use would be:

- i. Loss of economic value of land due to contamination. For example, the site of Liyang Xinhai Chemical Factory, which produced chlordane, had been idle for more than five years after closure, and it would be very cautious to use after cleanup;
- ii. In contaminated water body, fishery industry is affected as the US research report indicated that chlordane was still found in fishes near the areas of termite treatment after 20 years after terminating the use of chlordane. The income loss due to affected fishery would be hard to estimate; and
- iii. Potential loss of crop production value if the crop was planted in contaminated soil.

Another non-valued benefit is the institutional capacity building through the project expedited the access of IPM technologies to China. The government officials' capacity to review and revise IPM related policies was strengthened through the project implementation as all the targeted policy and regulatory reforms at national and provincial levels were reached. Technical trainings and technical assistance were provided under the project to improve workers' technical skills to install and monitor IPM stations.

Cost-effectiveness Analysis

Based on the scenarios proposed above, the following analysis will specifically evaluate the efficiency of the project approach in assisting the Chinese government to fulfill its

obligation to the Stockholm Convention for achieving the goal of eliminating chlordane and mirex.

Introduction of IPM technique: The IPM approach for termite prevention and control was for the first time to be introduced into China through the project. Implementing IPM method requires a lot of knowledge and technique. The international successful experiences and lessons in implementing IPM method have been taken into consideration in the project design, which included developing IPM training manual and materials, providing training to all existing staff at termite stations, research institutes, chemical suppliers and officials. The results of project implementation have demonstrated its efficiency of the approach for implementing IPM. In the three demonstration provinces more than 694,000 in-ground bait systems covering more than 77 million M2 were installed and more than 165,000 above-ground system covering almost 4 million M2 construction areas were installed. The IPM technique has been successfully applied in the archaeological and historical sites to avoid huge loss. More than 5,754 technical staff and project management personnel have been trained. The international technical advisor also provided technical assistance to resolve the problems confronted during implementation and provided a lot of suggestions for improving implementation. In addition, the experience of implementing IPM and the project-supported/promoted scientific research in evaluating IPM effects provided guidance for developing the national replication program, which would save time and avoid lacking of knowledge for dealing with technical constraints.

Policy and regulatory reform: As indicated in the proposed scenario above, there were no policy and regulatory framework to support IPM implementation in China prior to the project, therefore without any experience and assistance, it was a challenge for the Chinese government to issue policies and regulation before the first exemption expired in 2009. The government would take much longer time and inputs to issue policy and regulation to support IPM implementation. Under the project technical assistance, the process of the policy and regulatory reform in reviewing and revising policies and regulations was speeded up and the project also promoted the government's approval process. By end of the project six national policies and regulations and 25 provincial policies and regulations have been drafted or revised, of which three at national level and 11 at provincial level have been issued and the rests are under approval process.

Public awareness education: The Chinese government signed the Stockholm Convention to terminate POPs, but the public had not realized the environmental damage and risk to human health from application of chlordane and mirex due inadequate information dissemination to the public. The higher costs of implementing IPM for termite control would make the public reluctant to accept IPM even under the project. It would be difficult to implement IPM without the public support. The project public awareness education was fully used various measures including the media and press (newspaper, TV and radio broadcast) and social activities (e.g., city fair) to disseminate IPM information. In the project demonstration areas, there are thousands large signs with IPM information, more than forty thousands of brochures and placards were disseminated to the public, and cooperation relationship with communities was established. The

webpage for recording and disseminating all the information on IPM has created, which provided the government a tool to manage and monitor the termite control work. The public awareness education was greatly changed the traditional concept for termite control and the public in the demonstration areas voluntarily accept IPM. The public survey results showed the public awareness education has reached its expected effect and made a great contribution to IPM successfully implementation. The approaches of public awareness education would be applied in the national replication program.

Capacity building in project management: As CIO and SEPA as well as the termite control stations lacked experience of IPM for termite control, it would take time for them to learn the related knowledge and management experience. The project provided a relatively efficient way to strengthen the institutional capacity of the government agencies. Under the project, three demonstration provinces and five demonstration cities have established effective training system and exchange mechanism for the project management staff. The management capacity of the CIO and PIUs' staff and local government officials and management staff of in-line administration agencies has increased significantly and the inter and intra provinces exchange mechanism has been strengthened. The establishment of MIS not only changed the information management approach, but also provided a permanent electronic database for bait system monitoring and maintenance. This MIS provided a platform for the government to monitor the termite prevention and control progress status, and for recording daily activity for IPM implementation, which would improve work quality. This MIS as a sample would be taken into consideration in designing the national replication program.

Due to lacking information, it would be hard for us to estimate how long it would take and how much would cost the Chinese government to eliminate chlordane and mirex and implement IPM for replacement without the project assistance. The above analysis has demonstrated the efficiency of the project in introducing IPM method and strengthens the capacity to fulfill the obligation to the Stockholm Convention.

Operational Costs Comparison

During project preparation, a cost comparison had been carried out and five examples had been used for the analysis. However, since then, IPM has not introduced to China some of data were based on estimation. In the end of project, actual operation costs of implementing IPM have come out, and the following comparison has confirmed the estimation that operation cost of IPM is higher than that of traditional chemical block approach.

During project implementation CIO and provincial PIUs carried out a cost evaluation analysis based on a detailed calculation with actual data collected in the project areas. The costs comparison between IPM approach and traditional chemical block approach provided guidance for making technical regulations and pricing in IPM implementation, which was new to all the project pilot demonstration provinces and cities as well for future replication in other areas. The operation costs include: (i) equipment and chemicals for installing Bait systems; (ii) labor and transportation costs; (iii) monitoring

and inspection costs; as well as (iv) other indirect costs (management costs, social insurance, public housing funds etc.).

The table below is the result of a detailed calculation of unit costs of different approaches. This calculation was based on termite control for a six-floors building (total 3,600 M²) including all auxiliary facilities (well, stairs etc.):

| | Bait System | | | Chemical Spray | |
|-------------------------------|-----------------------------|------------|------------|-----------------------|-------------|
| | Installation of bait system | Supplement | Adjustment | Initial cost spraying | Retreatment |
| Ground area (M ²) | 600 | 600 | 600 | 600 | 600 |
| Floor area (M ²) | 3,600 | 3,600 | 3,600 | 3,600 | 3,600 |
| Number of Floors | 6 | 6 | 6 | 6 | 6 |
| Labor (RMB) | 1,231 | 1,876 | 202 | 851 | 1,908 |
| Bait station | 1,680 | | 2,520 | | |
| Chemicals (RMB) | | 7,183 | | 5,717 | |
| Transportation (RMB) | 729 | 1,120 | 121 | 503 | |
| Equipment (RMB) | 61 | | 92 | 50 | |
| Other dir. costs (RMB) | 59 | 165 | 50 | 285 | |
| Management fee (RMB) | 1,708 | | | 740 | |
| Engineering fee (RMB) | 1,841 | | | 798 | |
| Social insurance | 392 | | | 170 | |
| Housing common funds | 70 | | | 30 | |
| Total costs | 21,100 | | | 11,052 | |
| Unit cost (Y/M ²) | 5.86 | | | 3.07 | |

It is obvious that the operation costs of IPM (bait system) are higher than the costs of chemical block system. But this might not be the case if we factor the major environmental and health hazards caused by chemical contamination.

In three project demonstration provinces the cost comparison varies as shown in the table below. Among them, Jiangsu's has highest ratio between IPM and chemical, while Hunan has the lowest one. This is because Jiangsu has the highest unit cost of implementing IPM and lowest unit cost of chemical spray, while Hunan has lowest cost of IPM, which implicated that it would be relatively easy for replication in the entire province.

| | Chemical Spray | IPM (Bait System) | Ratio of IPM/Chemical |
|----------------|-----------------------|--------------------------|------------------------------|
| Average | 3.07 | 5.86 | 1.91 |
| Jiangsu | 2.37 | 7.81 | 3.29 |
| Hunan | 2.97 | 4.13 | 1.39 |
| Anhui | 3.19 | 7.53 | 2.36 |

Another comparison is to decompose the costs of 10 M² as follows:

| Item | Labor (yuan) | Materials | Transportation (yuan) | Equipment | Other costs | Total Costs (yuan/10m²) |
|--------------------|-------------------------|------------------|----------------------------------|------------------|--------------------|---|
| Chemical | 2.363 | 15.88 | 1.40 | 0.14 | 0.791 | 20.57 |
| Percentage | 11.5% | 77.22% | 6.8% | 0.68% | 3.8% | |
| Monitoring-control | 9.19 | 31.62 | 5.47 | 0.423 | 0.76 | 47.463 |
| Percentage | 19.4% | 66.6% | 11.5% | 0.9% | 1.6% | |

In the table above, among various costs the materials are weighted the highest in both approaches. The bait system requires more labor input and transportation and this is the main factor of high costs of implementing this IPM approach.

The cost comparison analysis confirmed the hypothesis of high operational cost of IPM method. However, comparing to the cost of cleaning the contaminated environment, for long term, IPM method would be the lowest cost for termite control.

Conclusions and Recommendations

Based on the analysis above, the proxies used to evaluate the benefits clearly recognized that environmental and social benefits from terminating use of POPs would be greater than economic value of using chlordane and mirex for termite prevention and control since environmental contamination, pollution and damage would cost huge efforts and financial resources to recover.

Ban of production, use, import and export of chlordane and mirex was issued in 2009 during the project implementation stage; however, replication of IPM is still a long-term task, as the operational costs of IPM are higher than the traditional practice of chemical block. IPM sustainability needs the government policy support and technical regulation for implementing IPM, especially for the national replication program.

The cost-effectiveness analysis has shown that for reaching the goal of terminating production, consumption, import and export of chlordane and mirex in China and replacing by IPM for termite prevention and control, the project has provided an efficient approach to assist the Chinese government to fulfill its obligation to the Stockholm Convention with policy support and technical assurance. The significance is that the project successful experience would be applied in the national replication program.

As mentioned above that due to lack of data, it was not able to carry out a quantified analysis. It is therefore recommended that the relevant research and studies should be carried out to evaluate the adverse environmental impacts caused by chlordane and mirex and the benefits from implementing the termite IPM as well as its cost reduction approaches.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

| Names | Title | Unit | Responsibility/ Specialty |
|--------------------------|-------------------------------------|-----------|------------------------------|
| Lending | | | |
| Helen Chan | Consultant | EASCS | |
| Yi Dong | Sr. Financial Management Specialist | EAPFM | |
| Feng Ji | Environmental Specialist | EASCS | |
| Agustinus S. Kaber | Program Assistant | EASEN-HIS | |
| Xiaoping Li | Senior Procurement Specialist | AFTPC | |
| Robert Leonard O'Leary | Senior Finance Officer | CTRFC | |
| Erik Pedersen | Consultant | EASER | |
| Margaret Png | Lead Counsel | LEGEM | |
| Yan Wang | Program Assistant | EACCF | |
| Peishen Wang | Consultant | EASCS | |
| Qing Wang | Environmental Specialist | EASER | |
| Chaohua Zhang | Lead Social Development Specialist | SASDS | |
| Supervision/ICR | | | |
| Evelyn Bautista-Laguidao | Senior Executive Assistant | EAPVP | |
| Martin Fodor | Senior Environmental Specialist | AFTEN | |
| Yi Geng | Sr. Financial Management Specialist | EAPFM | |
| Laurent Granier | Sr. Environmental Spec. | ENVGC | |
| Xiaowei Guo | Senior Procurement Specialist | EAPPR | |
| Feng Ji | Environmental Specialist | EASCS | |
| Abdelaziz Lagnaoui | Sr. Environmental Spec. | ENV | |
| Erik Pedersen | Consultant | EASER | |
| Sukanya Venkataraman | Customer Service Representative | GSDTR | |
| Yan Wang | Program Assistant | EACCF | |
| Peishen Wang | Consultant | EASCS | |
| Qing Wang | Sr. Environmental Specialist | EASER | |
| Ning Yang | Environmental Specialist | EASCS | |
| Guoping Yu | Procurement Specialist | EAPPR | |
| Fang Zhang | Financial Management Specialist | EAPFM | |

(b) Staff Time and Cost

| Stage of Project Cycle | Staff Time and Cost (Bank Budget Only) | |
|------------------------|--|--|
| | No. of staff weeks | USD Thousands (including travel and consultant costs) |
| Lending | | |
| FY04 | | 142.51 |
| FY05 | | 142.63 |
| FY06 | | 147.57 |
| Trust Funds | | 98.00 |
| Sub-Total: | | 530.71 |
| Supervision/ICR | | |
| FY07 | | 82.9 |
| FY08 | | 52.6 |
| FY09 | | 53.9 |
| FY10 | | 84.3 |
| FY11 | | 66.7 + 20 additional supervision support cost |
| FY12 | | 68.4 |
| Sub-Total: | | 428.8 |
| Total: | | 959.5 |

Annex 5. Beneficiary Survey Results

The Project Implementation Evaluation Report done by an independent consultant hired by FECO included a survey of recognizing IPM approach. The interviewees included the three PIUs, residents of the communities where the IPM approach was applied and some Termite Control Stations, who demonstrated the IPM approach. The survey results showed high acceptance rates. The report is available upon request.

Annex 6. Stakeholder Workshop Report and Results
(if any)

Not Applicable.

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

I. Summary of FECO's ICR (provided by FECO)

Context

1. Termiticides chlordane and mirex are among the twelve persistent organic pollutants (POPs) identified for elimination by the Stockholm Convention due to increasing evidence of their toxicity to people and the environment, their tendency to accumulate in the food chain, and their ability to travel long distances through global ecosystems and persist in the environment. As a country strongly committed to the Stockholm Convention, China participated in all preparatory meetings and was one of the original signatories of the Stockholm Convention (signed on May 23, 2001). On August 13, 2004, China ratified the Stockholm Convention and became a Party to the Convention.

2. China has one of the most diverse termite population and most severe termite damage in the world. It is estimated the direct economic loss caused by termites in China is about 2 to 2.5 billion Yuan annually. China's explosive growth in new residential construction and general infrastructure development has substantially increased the demand for termite control.

3. Since the introduction of chlordane and mirex to China in 1964 and 1979 respectively, they had become the principal instruments for termite prevention and control. Their effectiveness, persistence, low cost and ease of application have led to their widespread use and contributed to the fact that termite management in China heavily relies on chemical methods. From 2000 to 2003, China produced 450-820 tons of chlordane and 9-31 tons of mirex annually, which mainly used in termite control in residential and other buildings. The use of both termiticides poses significant local and global risks to human health and the environment.

4. Demonstration of Alternatives to Chlordane and Mirex in Termite Control Project, a self-standing, full-size GEF project (GEF Grant TF056588) had been designed to lay a foundation for a national replication program for the phase-out of chlordane and mirex in China. The project Grant Agreement was signed by People's Republic of China and the World Bank in 2006, with the GEF grant of US\$ 14,357,000 plus a local contribution of US\$ 13,341,000.

5. Foreign Economic Cooperation Office (FECO) in the Chinese Ministry of Environmental Protection, worked as the national implementing agency for the project. Jiangsu, Anhui and Hunan Provinces were selected as the demonstration provinces. Three PIUs were set up for local project implementation.

6. The original project implementation period is from mid-2006 to the end of 2010. Due to project implementation delays, the project was extended for one year.

7. The project's development objective is to mitigate environmental and health risks

associated with chlordane and mirex in termite control by (a) demonstrating the elimination of their use through the introduction of integrated pest management in selected areas, and (b) preparing a national replication program for complete phase-out of chlordane and mirex in China.

8. Consistent with this objective, the key project outputs included (a) elimination of 150 MT of chlordane and mirex use in the building construction sector of the demonstration area; (b) comprehensive policy, regulatory and institutional reforms at the national and provincial level to replace termiticide-based termite management with integrated termite management; (c) closure and clean-up one of the chlordane and mirex facilities and a permanent reduction of 150 MT in the national chlordane and mirex production; and (d) development of a national replication program for phase-out of chlordane and mirex in the rest of China. But in December 2010 when the project was restructured, additional project activities were added. More detailed outputs are summarized in Annex 2.

9. The project had six components:

10. **Component 1: Institutional capacity strengthening.** The objective of this component is to mobilize institutional capacity for project management, technical and advisory capacity for project implementation, and capacity of key stakeholders to support the shift from pesticide-based termite control to IPM-based termite prevention and control. It has three subcomponents:

- a. Project management and technical implementation.
- b. Technical and advisory capacity for project implementation.
- c. Inception activities and mobilization of key stakeholders.

11. **Component 2: Policy framework for elimination of chlordane and mirex.** The objective of this component is to improve policies, regulations and standards so they facilitate elimination of chlordane and mirex and promote IPM for termite control. It has two subcomponents:

- a. National policy and regulatory study.
- b. Provincial policy and regulatory reform.

12. **Component 3: IPM implementation.** The objective of this component is to replace the existing chlordane and mirex-based termite control in the building construction sector of the demonstration area with an IPM-based bait system and complementary IPM measures. It has five subcomponents:

- a. IPM operating and training manual.
- b. IPM training program.
- c. Public awareness and information dissemination.
- d. IPM implementation.
- e. Research and development (R&D).

13. **Component 4: Closure of chlordane and mirex manufacturer.** The plant closure is a critical activity for phase-out of chlordane and mirex, and an important complement of IPM implementation. It has two subcomponents:

- a. Permanent physical closure and dismantling of the chlordane and mirex manufacturing facilities.
- b. Clean up one of the facility's chlordane and mirex contaminated sites and disposal of chlordane and mirex waste.

14. **Component 5: Monitoring and evaluation.** The objective of this component is to evaluate the overall performance of the project, facilitate IPM learning, and capture the knowledge necessary for the preparation of the national replication program. The component would fund monitoring and evaluation workshops, annual review meetings, and a computerized management information system (MIS) necessary to track and evaluate project implementation progress.

15. **Component 6: National replication program for elimination of chlordane and mirex in China.** The objective of this component is to develop a national program for elimination of chlordane and mirex in termite control based on the experiences gleaned from this demonstration project. The component would fund workshops and consulting services for preparation and dissemination of the replication program, drafting of the national replication program document, stakeholder consultations and supporting activities. It would also fund preparation of baseline information feeding into preparation of environmental impact assessments (EIAs) for closure of the remaining eight chlordane and mirex manufacturers.

Project Achievements

16. By the end of 2011, the project objectives have been all achieved as summarized below.

- a) *Establishing high-qualified project management and implementation team.* To ensure high-efficient project management and implementation at both the national and provincial level, under the supervision by the National Leading Group for Convention Implementation consisted of thirteen national ministries, FECO established a termite project team to manage and coordinate the project and to coordinate with relevant international agencies. The three demonstration provinces established multi-department steering group at the provincial level and the project implementation units (PIUs) to manage and support project daily work at the provincial level. In addition, FECO, worked with the World Bank, and its consultants prepared manuals on IPM operation, financial management, procurement and auditing, and organized a series of professional training workshops for managers, financial and technical staff. 612 people in total participated eight training workshops. Based on these trainings, the three provinces continued to organize technical and management trainings in each province to ensure enough qualified staff to be engaged in the project.

- b) *Preliminary development of termite control policy framework.* A sound framework of policies, regulations and standards on termite control by using IPM approach is preliminarily established at the national level and in demonstration provinces, providing institutional support to project implementation, sustainability and national replication in the future. There are six national policies and 25 provincial policies drafted or revised under the project. Most important, on April 16, 2009, the Ban on Production, Use, Sales and Trade of DDT, Chlordane, Mirex and HCB was issued as a joint effort of ten ministries and agencies led by MEP, which stated that, since May 17, 2009, production, use, sale and trade DDT, Chlordane, Mirex and HCB in China will be banned. In addition, Guidance on National Replication of IPM in Termite Control, which was drafted under coordination of FECO, is planned to be issued in mid 2012 by MEP and MOHURD. The issuance of the ban has enabled China to honor its commitments under the Stockholm Convention and has found a solid base for national replication of IPM in termite control during the twelfth Five-Year-Plan period.
- c) *Complete elimination of production and use of chlordane and mirex.* The project promoted closure of all chlordane and mirex production lines in Jiangsu Province which was not anticipated, completely eliminating production, use and circulation of these two POPs in China. Furthermore, to ensure all related provinces in China fulfill the claim by the Ban, FECO organized a one-month signing and commitment campaign in whole China for the elimination of chlordane and mirex from Apr.17-May 17, 2010, which covered over 15 provinces and municipalities affected by termite damage, and over 10,000 people signed the commitment.
- d) *Introduction of Environment-Friendly Alternative in Termite Control and Green Upgrading.* IPM is a comprehensive approach for termite control that focuses on monitoring, complemented by biological, physical and chemical barrier technologies. Compared with traditional measures of spraying pesticides, IPM reduces chemical consumption by 99%. As the most important part of the project, FECO organized application of bait systems in three provinces by providing 762,000 in-ground and 151,500 above-ground bait systems through the project. By end of 2011, three provinces had installed 694,100 in-ground and 151,500 above-ground bait systems with preventive treatment covering 77.24 million m² and remedial treatment 3.8 million m²; the remaining 67,900 IG will be used for bait system maintenance for next 10-years. Compared with traditional extensive use of chlordane and mirex, application of bait systems reduces chlordane and other chemicals by 372.37 MT and mirex by 163.3 kg. It effectively protects environment and human health from POPs pesticides, generates sound environmental and social benefits and promotes green development of termite control.

Besides, regarding the high cost of bait system resulting in the potential risk of its sustainability in China, FECO organized monitoring-dusting (MD) applications in Hangzhou, Nanchang, Nanning, Guangzhou and Chengdu, five provincial capitals, as a supplement pilot operation of IPM under the project. FECO procured 45,375 monitoring stations for five cities, and 41,250 sets were installed by end of 2011, the

remaining will be used for future maintenance. To promote MD implementation in the five cities and expand IPM influence, in December 2011, FECO procured another 15,600 monitoring stations, which will support replication of IPM and its extensive implementation in China after the project is closed.

For termite prevention, all the IG bait systems and MD systems were installed in 17,086 residential buildings, 1,137 office/commercial/manufacturing buildings, 52 historic sites, 274 hospitals and schools, and 471 other buildings. For termite control, all AG were installed in 12,782 residential buildings, 1,229 office/commercial/manufacturing buildings, 72 historic sites, 458 hospitals and schools, and 269 other buildings.

- e) *Clean-up demonstration of contaminated sites for chlordane and mirex production facility.* With approval of FECO and World Bank, Liyang Xinhai Chemical Plant and Shanghai Fengjiang Termite Control Material Co. in Jiangsu Provinces were selected for contaminated site clean-up. The project cleaned up 6,946 m³ of contaminated soil, 550 m² contaminated buildings inner-surface and dismantled 398 m² contaminated buildings, and disposed 6.4 MT of hazardous waste and 450 liter of residue, effectively addressing leakage and movement of POPs pesticides. And Liyang Guanghua Chemical Plant was cleaned with the local counterpart funding of Liyang government. These provided experience for proper clean-up of other POPs contaminated sites in China.
- f) *Training, Publicity and Raised IPM Awareness.* To spread IPM knowledge and application results, FECO and PIUs organized 92 training workshops for 5729 managers and technicians. In addition, public campaigns were carried out in demonstration areas to raise public awareness of IPM concept and technologies. Over 10,000 copies of IPM operation manuals, brochures, posters, CDs and other propaganda materials for publicity were produced. FECO also worked with CCTV to make TV show for the purpose of replicating termite IPM. Anhui PIU disseminated 260 signs and 30,000 promotion brochures and set up 2,500 placards and 2,000 posters for IPM implementation. Hunan PIU, worked through media, produced 21 TV coverages and 62 reports in publications, disseminated 3,000 IPM brochures and 200,000 promotion sheets. Jiangsu PIU organized innovative activities, such as press conferences on implementation of multilateral environment conventions, large-scale publicity campaigns in public squares and opening ceremonies for clean-up of contaminated sites and hazardous waste, with 5,000 promotion material disseminated.

Main factors affecting project implementation

17. One of the main reasons for one-year project extension was overestimation of bait system demand in project design, which led to frequent procurement adjustment and funding reallocation. This significantly impeded implementation progress.

18. Bait systems need longer time than chlordane and mirex in termite prevention and control. It also requires frequent inspection resulted in high labor cost. And damage and

loss of the bait stations caused additional work for inspection and new installation and also affected the control results.

19. The project funding availability and procurement did not match well the physiological season of termite control. In some provinces or cities, 3 to 6 months were lost, which caused delays on IPM demonstration.

20. Due to the deflation policy on China's real estate these years, many housing construction plan had been dropped. The counterpart bait-system installation plan was not able to be implemented accordingly. New buildings had to be identified for bait system installation. Human province suffered this difficulty the most among three demonstration provinces.

21. Complicated procurement procedure and longer procurement period was also a main difficulty for project implementation. Especially, the bait system procurement and supplier selection resulted in the postponement of goods arrival and installation.

Performance evaluation of Bank and borrower

22. Bank performance-Satisfactory. The Bank team played an active and effective role in the supervision and quality control of the project during the whole implementation progress, and proactively provided support to address implementation problems as they arose, including procurement and disbursement issues, technical support for IPM demonstration etc. At least two supervision missions were undertaken each year by the Bank for project implementation supervision and problem solving. A number of field visits were undertaken to ensure compliance with safeguards, and to verify physical progress and achievements.

23. Chinese government performance-Satisfactory. The national implementing agency, FECO played an active and effective role during the whole project management and implementation; and provided administrative and technical support for the national policy framework establishment, institutional capacity building, IPM demonstration, eliminating the use and production of chlordane and mirex, disposal for closure of chlordane and mirex production facility and contaminated site clean-up, project monitoring and evaluation, the whole-process quality control. In addition, FECO's wide experience in collaborating effectively with numerous intergovernmental departments, bilateral donors and enterprises helped harmonize interests and standpoints of different agencies for project implementation.

24. Local PIUs performance-Satisfactory. Three demonstrative provinces demonstrated a strong commitment to meet the project development objectives and provided adequate staff and inter-departments cooperation, which ensured the success of project implementation. In addition, all provinces provided strong support for project implementation and provided counterpart financial support.

Lessons learned

25. *Inadequate investigation and information collection in early design stage.* Preliminary research for project design, especially the feasibility study, was inadequate, causing frequent component adjustment during implementation and extension of project implementation period at a later stage. Especially regarding the number of bait system, its overestimation resulted in twice adjustments. In addition, the unused baits are another issue as most of them have been expired. So, adequate research and consideration for potential risks of project implementation should be paid more attention in the early design stage for future new projects.

26. *Inadequate support from project participants.* Good coordination and support by local government is highly necessary for project implementation. Withdrawal of Zhengjiang Province during the project preparation stage and Liyang Guanghua Chemical CO. as the contaminated site for clean-up during the project implementation stage highly impeded the project implementation progress and added additional workload. Therefore, sufficient communication at the project preparation stage is quite important among all stakeholders.

27. *Frequent change of management personnel.* Both in the Bank and FECO, frequent change of project management staff led to continuity problems of project management. During the five-year project period, the position of project manager on Bank side has been undertaken by four staff in turn and over ten people in FECO participated in the project management. Instability of international and national management personnel impacted on project implementation and working efficiency.

28. *Inadequate consideration of project evaluation.* Project evaluation was inadequately considered in the project design. Some project indicators were designed without sufficient research and consideration. In addition, collection of some key data lacked comprehensive planning and some important data were not collected, which affected the accuracy of evaluation results.

Project sustainability

29. *Finance support.* In the project implementation agreements signed between MEP and the three selected provinces, the three provinces promised co-financing for the post-project period to support continued monitoring of installed baiting systems. The three provinces have assigned human resources as well as committed co-financing in kind and in cash. To secure project sustainability, the provincial Departments of Housing and Urban-rural Development, Environmental Protection and Financial Bureaus have issued documents requiring all termite control stations involved to set aside co-financing from the termite control fees each year according to the fund needs for post-stage project operation.

30. *Institutional support.* Project management for post-project period will be incorporated into the routine sector administration function of the provincial authorities, which are responsible for guiding and managing follow-up operation of the project. Maintenance of installed bait systems or dusting systems will be included in routine daily

work of the termite control stations involved in the project.

31. *Policy support.* The Guidance on National Replication of IPM in Termite Control, as a joint effort of MEP and MOHURD, is planned to be officially issued in mid 2012. The Guidance will greatly promote replication of IPM concept and technologies in China and accelerate green transformation and upgrading of termite control in the 12th Five-Year-Plan period.

32. *Technical support.* Termite control stations in each demonstration area is required to maintain a stable technical team for monitoring and maintenance of installed bait or dusting systems and provide training for technicians regularly for the next ten years after the project. Workshops for experience exchange among these technicians will also be organized to maintain technical capacity in order to replicate termite IPM.

II. Comments on Bank's ICR

33. The ICR reflects objectively the achievements and deficiencies of the project, showcases the real workload and efforts performed by all stakeholders, and points out lessons learnt pertinently. We fully agree on the findings and conclusions in the ICR.

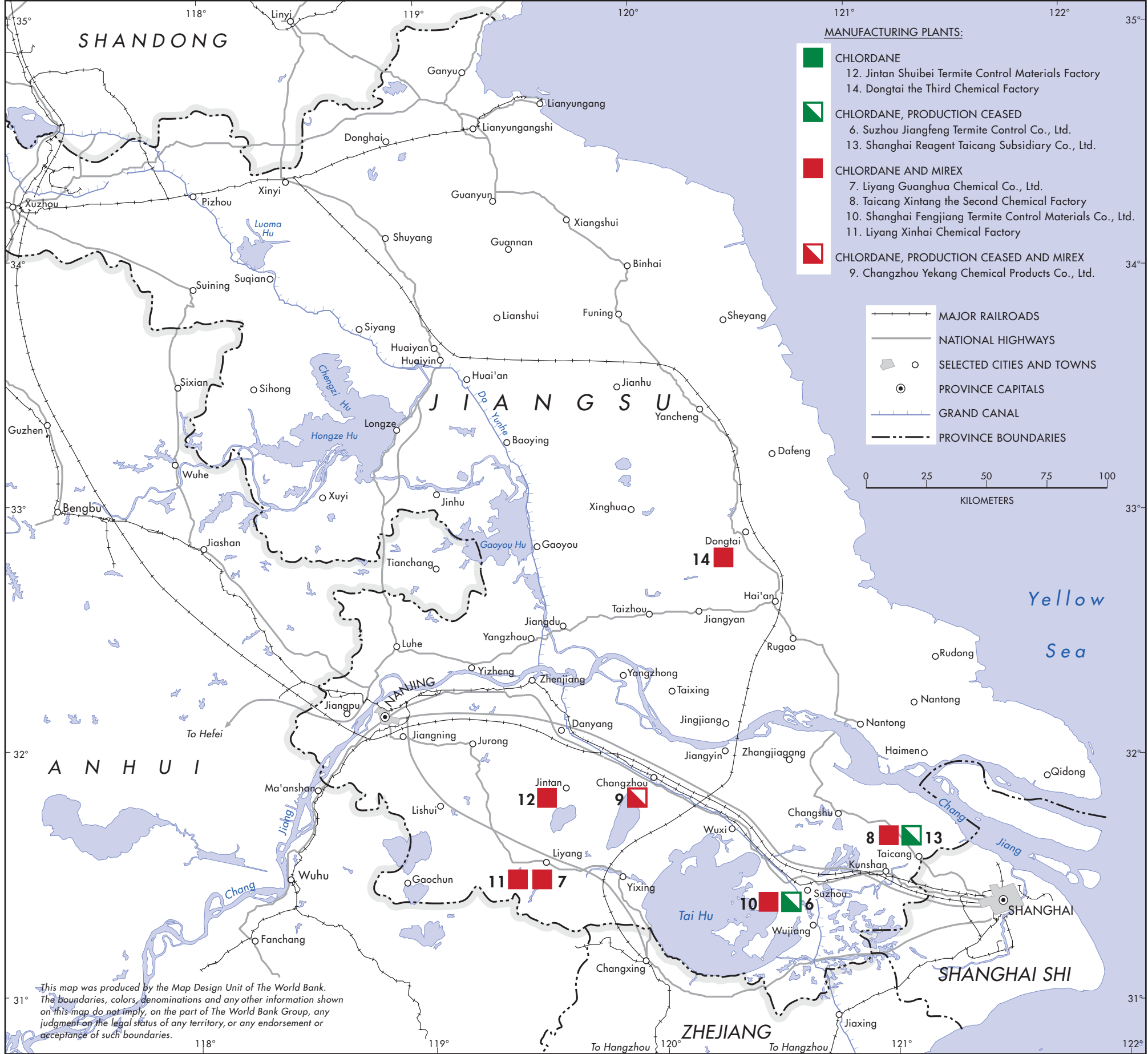
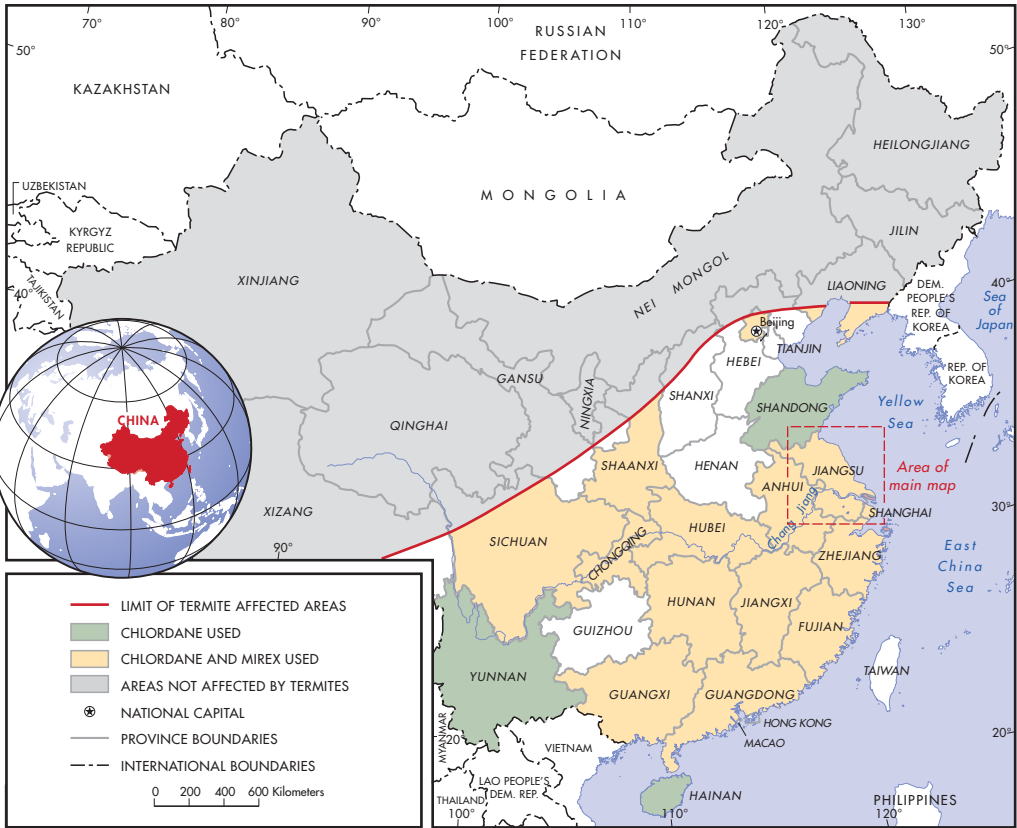
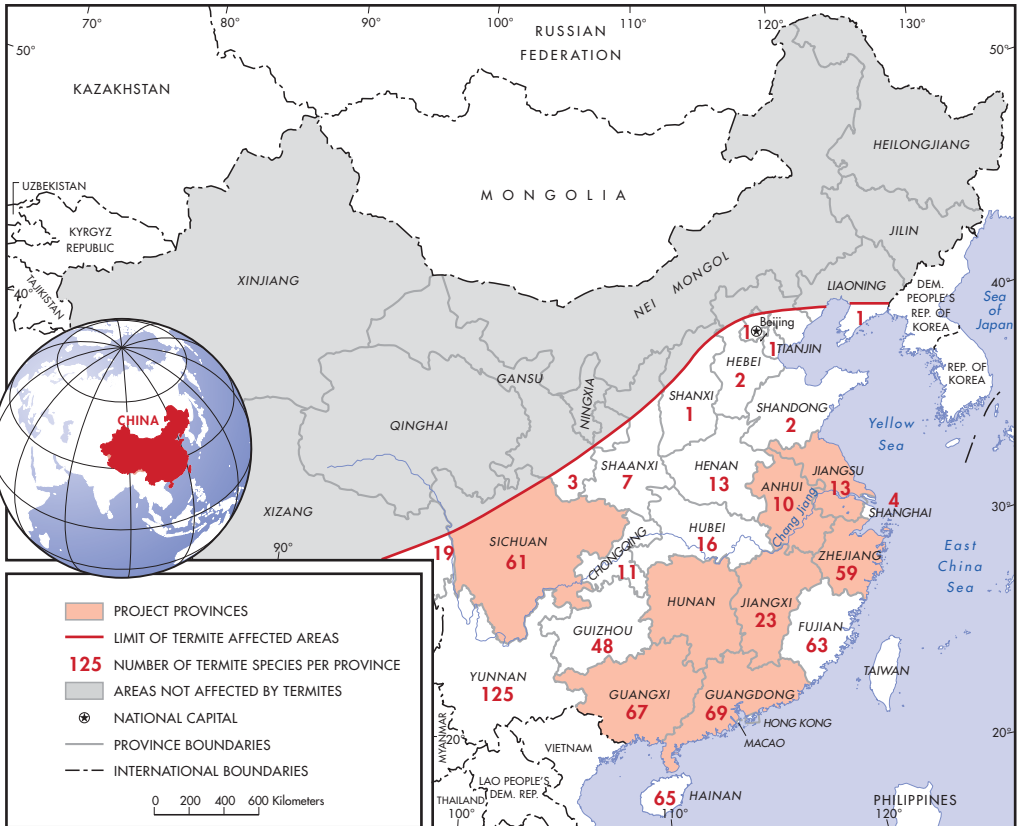
Annex 8. Comments of Co-financiers and Other Partners/Stakeholders

Not Applicable.

Annex 9. List of Supporting Documents

1. Project Concept Note
2. Project Appraisal Document, June 2006
3. Project Appraisal Reports for Anhui and Hunan
4. QAG Review Report, July 2007
5. Mid-Term Review Report, February 2010
6. Aide Memoires for Preparation and Supervision Missions from September 2003
7. Implementation Status Reports (ISR) from May 2007
8. Country Partnership Strategy (CPS) for China 2006-2010, May 2006
9. National Implementation Plan on POPs, Government of China, April 2008
10. Project Restructuring Package
11. FECO's Project Implementation Evaluation Report
12. FECO's Cost Analysis of Chemical Spray and Bait Systems
13. FECO and three PIUs' Completion Reports
14. FECO's completion workshop, May 2012, summary of proceedings/discussions and list of participants

CHINA ALTERNATIVES TO CHLORDANE AND MIREX IN TERMITE CONTROL PROJECT



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