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Demonstration Project of Alternatives to Chlordane And Mirex for Termite Control in China

Pest Management Plan

Guangdong Entomological Institute

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This document is a safeguards document prepared for the GEF project *China: Demonstration of Alternatives to Chlordane and Mirex in Termite Control*. The project is a $28 million demonstration of approaches to implement the Stockholm Convention on persistent organic pollutants (POPs) in termite control. There are three safeguards documents prepared for this project.

1. Pest Management Plan (PMP) prepared for the entire project. The PMP was developed according to the requirements of the World Bank's Operational Policy OP 4.09 on Pest Management which mandates the use of integrated pest management (IPM). The project itself is essentially a large-scale implementation of IPM in termite control, since it promotes replacement of the current chemical-based termite control methods with environmentally more sustainable IPM-based method. Majority of project funding – more than $20 million – is allocated directly to IPM activities. The PMP and the project document, therefore, are very closely related, and the principal recommendations and consideration of the PMP are an integral part of the project design.

2. Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) specific to the component 4 of the project. The component – with the budget of about $2.64 million – demonstrates a closure of a chlordane and mirex manufacturer – Liyang Guanghua Chemical Company Ltd. – in Jiangsu Province. The EIA and EMP were prepared according to Chinese environmental impact assessment regulations and the World Bank's Operational Policy OP 4.01 on Environmental Assessment.

3. Social Assessment (SA) which complements the EIA. The SA was prepared to address the social and economic impacts of the closure of the Liyang Guanghua Chemical Company, Ltd. on the plant work force. The SA was prepared as a matter of best practice, and serves as a basis for the worker compensation and retrenchment program which will be implemented under the project.

ABBREVIATIONS AND ACRONYMS

ACAC	Administration of Civil Aviation of China
CIO	Convention Implementation Office
CPMA	China Property Management Association
GAC	General Administration of Customs
GEF	Global Environment Facility
MOA	Ministry of Agriculture
MOCommu	Ministry of Communication
MOComer	Ministry of Commerce
MOCon	Ministry of Construction
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MOR	Ministry of Railroad
MOST	Ministry of Science and Technology
MOPS	Ministry of Public Security
PIP	Project Implementation Plan
PIU	Project Implementation Unit
PMO	Project Management Office
PRC	People’s Republic of China
PSG	Provincial Steering Group
SAIC	State Administration For Industry And Commerce
SDIC	State Development & Innovation Committee
SEPA	State Environmental Protection Administration
SBQTS	State Bureau of Quality and Technical Supervision
TPT	Termite Project Team

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Executive Summary

1. China is home to a diverse and extensive termite population that has caused it to become the most severely termite damaged country in the world. Because termite colonies are huge and usually remain concealed, common insecticides are not effective in completely eliminating colonies. This lack of viable options has led to the continued use of chlordane and mirex as the main pesticides for termite prevention and elimination in many places in China.

2. Historically, chlordane has been used in 18 provinces and 15 provinces have used mirex in China. The most prevalent use of chlordane has been in Zhejiang, Jiangsu and Guangdong provinces and mirex use has been highest in Jiangxi, Guangxi, Fujian, and Guandong provinces. From 1980 to 1987, almost all chlordane enterprises stopped their production. But, as serious termite problems persist in southern China and with a shortage of cheap and effective termite pesticide alternatives, some companies have begun purchasing equipment to produce chlordane. There are currently nine chlordane producers; six of these are active and the three others retain their production facilities. Production capacity for chlordane peaked in 1998 with 834.4 tons produced, dropping to a yearly production level of 479.3 tons in 2002. The building construction sector accounts for practically all of the chlordane and mirex use (more than 95%).

3. There have been seven mirex production enterprises in China and their production was temporarily stopped in 1980s (but lab production has never been discontinued). In the 1990s, some chlordane manufacturers gradually started production of mirex and five of the nine chlordane producers began production. There are three mirex producers currently operating and they are all located in Jiangsu province. The production capacity for mirex reached its highest level of 30.58 tons in 2000 and the accumulative total production of technical grade mirex has reached 140.29 tons. In China, mirex is usually used for killing termites, cockroaches, and ants.

4. China has ratified the Stockholm Convention and expressed the need to phase out these chemicals by replacing them with safer alternatives. On June 8, 2005, council of Global Environment Facility (GEF) approved “eliminating chlordane and mirex in termite control in China as a demonstration project”. One of the goals of this project is to assist China in developing an Integrated Pest Management (IPM) strategy for termite prevention and control. The ultimate goal of the strategy is to eliminate the use of chlordane, mirex and other pesticides using alternative methods based on the ecology and behavior of termites. This strategy is based on baiting termites with an Insect Growth Regulator and/or a chemical toxicant. In both chemicals will be used only where and when needed which will result in a drastic decline in pesticide use. The Project will consist of the following six components:

Component 1: Institutional Capacity Strengthening (US$1,822,000).
Component 2: Policy Framework for Elimination of Chlordane and Mirex (US$840,000).
Component 3: IPM Implementation (US$19,252,000).
Component 4: Closure of Chlordane and Mirex Manufacturer (US$2,641,000).
Component 5: Project Monitoring and Evaluation (US$137,000).
Component 6: Design of a National Replication Program (US$801,000).

5. This PMP will be developed to help ensure that the use of pesticides associated with the project will be handled properly and in accordance with World Bank Operational Policy OP4.09, Pest Management.

6. The PMP therefore makes an assessment of the current pest management and control approach in China, policy and regulatory framework, institutional capacity to implement IPM, pesticide management, monitoring and evaluation during project implementation, and identify capacity building needs. This plan addresses the following:

a. Current termite problems in demonstration area;
b. Pest management approach (including pesticide management);
c. Regulatory and Institutional Framework;
d. Strengthening national capacities; and
e. Monitoring and evaluation.

I. Current termite Problems in demonstration area

7. China is a country with the greatest diversity of termites and most severe termite damage in the world. China is home to about 482 species of termites, concentrated mostly south of the Yangtze River. While termites have an important ecological function in the ecosystem of decomposing wood, they cause massive damage to wooden structures and buildings, tree plantations, orchards, dams, embankments, bridges, power lines and other critical infrastructure in various sectors. The main economically significant termite species are *Coptotermes formosanus, Reticulitermes speratus* and *R. chinensis* which cause extensive damage in wooden structures of buildings, and *Odontotermes formosamus* and *Macrotermes barneyi* which damage the embankments and dams. As shown in the maps of Annex 17 of the PAD, termites are found in all but six Northern provinces (Heilongjiang, Jilin, Inner Mongolia, Ningxia, Qinghai, and Xinjiang) in China and affect more than 40% of the total land area in China.

8. It is estimated that the direct economic cost of termite damage is between 2 to 2.5 billion yuan per year. Indeed, south of the Yangtze River, between 30 and 90% of houses and buildings suffer termite damage. In addition to the housing sector, thousands of reservoirs, bridges, and tens of thousands of kilometers of dykes and embankments are threatened by termites. Under these circumstances, the elimination of chlordane and mirex in China faces many challenges.

Current termite problems in Zhejiang province

9. Zhejiang province is located south of Taihu lake, southeastern shore area of China with warm and humid climate and often gets monsoon rains. This type of climate and habitat provide excellent conditions for the reproduction, growth and development of several termite species. Annex 1 lists all the species and their distribution in the province. (Annex. 1, Table.1). The representative species, *Reticulitermes*, *Coptotermes*, and *Odontotermes*, can be found in 11 cities of the province, but distribution density varies from north to south.

Current termite problems in Jiangsu province

10. Jiangsu province is located north of Zheijiang province, in the confines of a rich network of water systems including the Yangzi River, the Huihe River, the Qinmu River, the Yellow Sea and the Eastern China Sea. Jiangsu province also has more than 200 lakes spreading all over the whole province such as Taihu lake, Hongze lake, Gaoyou lake, and etc. Jiangsu Province is in a subtropical zone with occasional monsoon rains providing favorable conditions for termite colonies of several species (Annex.1, Table. 2.).

11. *Reticulitermes* is dominant genus in Jiangsu province, and it is found everywhere in the whole province, the most economically important species are *Reticulitermes chinensis, Reticulitermes flaviceps, Reticulitermes aculabialis* and *Reticulitermes labralis*.

12. *Coptotermes* is the second most important genus infesting buildings and distributes widely in the south of Yangzi river in Jiangsu, and can also be found in some area close to Yangzi river in the north of Jiang Su.

13. *Odontotermes* species are distributed in south of Jiangsu on both sides of Yangzi river. It attacks mostly dams of reservoirs, trees, and sometimes causes damage to wooden components in buildings.

14. *Macrotermes species are limited to parts of the* Yi Li mountain area south of Jiangsu province. Damage for this group is mainly to trees and dams of water reservoirs.

15. Every year in Jiangsu province, the loss caused by termite is over 200 million Yuan. In Nanjing, the loss caused by termite in residential apartments is over 30 million Yuan.

II. Assessment of current termite Management Approaches

16. **Summary assessment of current termite situation in demonstration area**

Zhejiang Province has 90 termite control stations at provincial, city, and county levels. The Zhejiang Provincial Institute for Termite Prevention and Control (ZPITPC) was established in 1991 as the provincial level administrative entity for termite control in Zhejiang. It operates together with the National Termite Control Center and shares some staff with the National Termite Control Center. Like NTCC, the ZPI is fully financed by the Provincial Construction Bureau. Its responsibilities include coordination of termite prevention and control work at the provincial level; promoting sound termite management; and organizing applied research on termite prevention and control. The Zhejiang Provincial Termite Prevention and Control Association (ZPTPCA, founded in 1975) has about 70 member termite control stations and research institutes (about 300 staffs in these institutes/stations). ZPITPC serves as Secretariat for the ZPTPCA. Its responsibility under the project is to carry out IPM training in the Zhejiang Province.

17. The Jiangsu province has 82 termite control stations at levels of province, city, and county. These stations are affiliated to the local government and have 98% market share of the termite control business in Jiangsu. Recently, about 10 private companies for pest control have established and share 2% termite control market of Jiangsu. The Jiangsu Provincial Termite Association founded in 1975 is an association for all termite stations and research institutes/universities in Jiangsu province. It is responsible for all training provided in Jiangsu province and for corporation between termite institutes/stations within the province. Its secretariat is located at the Nanjing Termite Prevention and Control Institute. The Association has only three full time staff but relied on staff from the Nanjing Termite Institute to perform its activities. The Association will carry out IPM related activities under this proposed project in Jiangsu Province.

Table 1. Summary assessment of current termite situation in the demonstration area

Termite Species	*Reticulitermes spp,*	*Coptotermes formosanus*	*Odontotermes* sppand *Macrotermes spp.*
How it infest buildings and houses (Colony forming..)	The colonies of *Reticulitermes* tend to be dispersed and their galleries are small. Nests tend not to have clearly formed structures, so excavating nests and dusting termiticide into galleries are not suitable for eliminating *Reticulitermes*..	*Coptotermes* has visible nest structure and larger galleries, so traditional elimination method is to excavate nest and spray persistent termiticide (Dusts) into nests. Termites will spread the termiticide dusts into nests by trophallaxis, allogrooming and cannibalism, resulting in the death of the termite colony	These species are more likely to cause damage in rural areas as they are often associated with forested habitats. Their damage is more serious in forests, dams and dykes and housing in forested areas.
How it is controlled presently	The traditional method for *Reticulitermites sp.* control is spraying liquid pesticides in and around the infestation area. The desired outcome is to kill termites present at the time of spraying and leave enough residues to kill new termite infestations, hence the popularity of chlordane (POP) and Arsenic trioxide.		Colonies of these species are presently controlled mainly by poisoned baits (Mirex, Arsenic trioxide and some Insect Growth regulators)
How the project is proposing to control it	• Clean up of construction site to eliminate conditions	Can be more expensive than the repellent treatment because the	The project is not considering Forests, dams and dykes.

	favorable to termite infestations. • In cases of termite infestation in the site, spray liquid termiticide to eliminate the infestation (there are several newer chemicals available in China as potential alternatives to chlordane and mirex). • Install baiting system to monitor and deliver toxicants when needed.	termiticide is more costly. The application is the same as the repellent treatment so labor costs are equivalent.	However, if rural buildings in the demonstration area happen to have infestations by these termite species, the same approach as the other 2 species will be adopted with some minor modification in the nature of the baits used. These species are more attracted to pine wood, corn husks/cobs, eucalyptus barks..
Treatment persistence	Under optimal conditions the liquid termiticides can last up to 5 years, depending on the selected product. Bait systems are permanent structures.	Under optimal conditions the liquid termiticides can last up to 5 years, depending on the selected product. Continuous process monitoring and timely applications of toxicants as necessary	Under optimal conditions the liquid termiticides can last up to 5 years, depending on the selected product. Continuous process monitoring and timely applications of toxicants as necessary
Advantages	Provides immediate elimination of present infestations and permanent system to monitor for new infestations. Delivery of termiticide with bait systems is need-based, localized, environmentally friendly and efficient.	Provides immediate pro-tection for the structure. Most effective treatment because it kills foraging termites.	Environmentally friendly, extremely low toxicity to humans and pets
Disadvantages	Structures are not directly	Structures are not directly	Structure not directly pro-

	protected when the liquid termiticide effects wear down. Effectiveness depends on diligent and timely monitoring	protected when the liquid termiticide effects wear down. Effectiveness depends on diligent and timely monitoring	tected. Careful selection of baits to attract termites into the monitors, actual baiting may take a long time to begin. This leaves the structures at risk.

Pesticide Use and Managment

18. **Analysis of potential pesticide-based alternatives**

a. **Chlorinated Hydrocarbons:** Most of these pesticides figure on the list of banned pesticides in many countries. Also, they figure on the list of Persistent Organic Pollutants to be phase out under the Stockholm Convention because of their bioaccumulation in the environment and their potential long term impact on human health and the environment. In this class of pesticides, dieldrin and chlordane were widely used for termite control throughout the world. In China, Chlordane was the termiticide of choice for many years.
b. **Organophosphates**: OP's are generally less persistent but more toxic to vertebrates including humans than the chlorinated hydrocarbons. The most widely used termiticide in this class is Chlorpyrifos used in chemical barriers that kill termites on contact. This chemical barrier prevents other termites from infesting building structures. This insecticide has recently been added to the list of banned pesticides in households in the U.S .
c. **Synthetic Pyrethroids**: This class of insecticides followed the discovery of Pyrethrum, a compound abundantly found in chrysanthemum that showed good insecticidal properties. Pyrethrum has low toxicity to mammals but causes very fast knockdown and rapid paralysis in the target insects. Because pyrethrum breaks down very quickly in the environment, chemists have synthesized similar, more stable compounds known as the synthetic pyrethroids used to control various pests, including termites. The most commonly used pyrethroids in termite control include *fenvalerate, permethrin*, *cypermethrin* and *deltamethrin, Bifenthrin*. To increase effectiveness, these chemicals are often mixed with an additive like piperonyl butoxide. When used against termites, synthetic pyrethroids are highly repellent. These products work because termites avoid the areas where these chemicals have been applied. Pyrethroids are very toxic to fish so precautions must be taken to prevent these chemicals from getting into streams and other surface waters.
d. **Chloronicotinyls and Phenyl pyrazoles**: These new classes of insecticides are used to control several insect pests. The Chloronicotinyls' most popular active ingredient is *imidacloprid*. In the class of Phenyl pyrazoles, *Fipronil* is used as a non-repellent termiticide. These chemicals do not repel termites, allowing them to tunnel and move around the treated area. Termites coming in contact with this

chemical stop feeding and eventually die. Imidacloprid is less toxic to mammals than organophosphates and synthetic pyrethroids

e. **Fluoroaliphatic Sulfonamides**: The fluoroaliphatic sulfonamides are relatively new, especially as termiticides. *Sulfluramid* is a slow-acting stomach poison. Products with this active ingredient are usually formulated as termite baits to suppress termite colonies.

f. **Insect Growth Regulators**: Insect growth regulators are a group of compounds that interfere with the molting process of insects including termites. These chemicals alter the growth and development of termites (chitin inhibitors) which make them ideal for use in the bait systems. They are much less toxic to humans and other nontarget organisms than the majority of termiticides. *Hexaflumuron , noviflumuron , Chlorflurazuron,* and *diflubenzuron* are some of the IGRs currently used for termite contro**l.**

g. **Inorganic compounds (Borates**): *Boric acid* and *disodium octaborate tetrahydrate* are chemical forms of boron. The borates are used to treat the surface of wood, either as a preventative or remedial treatment. These products work because the borate penetrates wood and is ingested by termites as they attempt to eat the wood. Boric acid has been known to successfully kill insects for decades, but little is known about its mechanism of activity. The most accepted hypothesis is that boron kills intestinal microorganisms that allow insects to digest their food.

h. **Biological Control (Microbial methods**) Laboratory studies have consistently indicated that biological agents such as fungi, nematodes and mites can act as pathogens to termites. However, field trials using these biological agents have given mixed results. The use of some biological agents such as nematodes and fungi (*Metarhizum anisopliae)* has never been seriously considered for subterranean termite control as it is hard to reach enough foraging termites and these biological control agents would need a long time to establish themselves in the ecosystem. *They can however be an excellent alternative in termite infested forest areas.*

Table 2. Analysis of termite management alternatives available for the demonstration area

Control Method	Repellent Liquid Termiticide	Non-repellent Liquid Termiticide	Bait Systems
How it is supposed to **control Subterranean Termites**	The termiticide is injected into the soil around the foundation of the home. The slab is drilled and the soil treated underneath. Trenches are dug around the foundation outside and within crawl spaces and filled with termiticide. The termiticide repels the termites and ideally turns them away from the structure	The structure is drilled, trenched and injected as with the repellent liquid, but the termiticide is not repellent to the termites. The termites cannot detect the non-repellent termiticide in the soil so they tunnel into it and are killed.	Wood monitoring stakes are inside stations that are placed in the ground around the structure. Monitors are inspected monthly or quarterly. If termites are found inside a station, the bait is put in. Termites consume the bait and are killed. Sentricon and Exterra baits are designed to kill the termite colony.
Termiticide Products used by Certified Pest Control Operators	Fenvalerate, Es-fenvalerate, Permethrin, Cypermethrin, Deltamethrin, Bifenthrin ***(These are all Pyrethroids that work mainly as repellents***)	Imidocloprid Fipronil **(new class of chemicals)** Chlorpyrifos is an Organophosphates that has been used for years. It has recently been banned in many countries	Sentricon (Hexaflumuron) Exterra (Difluobenzuron). These are all Insect Growth Regulators FirstLine(Sulfuramid) is a stomach poison used in combination with liquid treatment).
Relative costs	Usually the least expensive of the 3 treatments. Preparing for the injection of the liquid is labor intensive and the greatest source of the cost. Many gallons of termiticide are used in the treatment (~ 4 gallons /10 linear	Can be more expensive than the repellent treatment because the termiticide is more costly. The application is the same as the repellent treatment so labor costs are equivalent.	Sentricon is the most expensive treatment. The station installation and monthly monitoring are responsible for most of the cost. Other bait products vary, but are usually priced between barrier treatments and Sentricon.

	feet).		
Treatment longevity (persistence)	Under optimal conditions repellent termiticides can last ~ 5 years	Imidocloprid < 5 years Fipronil > 5+ years	Continuous process of monitoring with baits applied as necessary.
Advantages	Provides immediate protection for the structure. Relatively low cost and long lasting.	Provides immediate protection for the structure. Most effective treatment because it kills foraging termites.	Environmentally friendly, extremely low toxicity to humans and pets
Disadvantages	Termites are not killed, just turned away from the chemical. They often find tiny gaps in the treatment and tunnel through them to the structure.	Imidocloprid breaks down in water so it may dissipate more quickly in the soil than some repellent termiticides.	Structure not directly protected. With no means of attracting termites into the monitors, actual baiting may take a long time to begin. This leaves the structure at risk.

19. **Selection of Pesticides Authorized for Procurement under Project**: The project envisages procuring pesticides as a part of the Integrated Pest management strategy selected to phase out the use of chlordane and mirex. The list of pest control products authorized for procurement will be developed and agreed upon at project appraisal. The list will not include any Persistent Organic Pollutants (POPs) or any chemical in class I (Ia and Ib) of the World Health Organization (WHO) and will comply with the selection criteria in the World Bank Operational Policy on pest management (OP 4.09 and BP 4.01 Annex C). The final list will be recorded in the PAD.

20. **Assessment and mitigation of Risks:** The project objectives is to phase out the use of chlordane and mirex , two persistent organic pollutants with safer alternatives. The project is proposing the use of bait systems and in some cases additional sprays of liquid termiticides that would significantly reduce the impact on human health and the environment. Since these technologies will use some chemicals, there will be some potential risks associated with them too. These risks will be much lower than the use of chlordane and mirex as the proposed chemicals are much safer and delivered upon need and in localized manner. The following table (Table 3) summarizes the potential risks and associated mitigation measures to be taken.

Table 3. Potential risks and mitigation measures for the selected termite control measures

Control Method	Occupational Risks	Environmental Risks	Mitigation Measures
Liquid Repellent Termiticides Pyrethroids (Fenvalerate, Es-fenvalerate, Permethrin, Cypermethrin, Deltamethrin, Bifenthrin)	Chemicals in this class have lower toxicity to humans than organochlorines and organophosphates. However, these chemicals can be irritants to the human skin and eyes and can cause allergic reactions to people with asthma or other respiratory problems	. Pyrethroids are very toxic to fish and other insects (bees)	• Protective clothing and respiratory masks will be required of all termite control operators. • Re-entry time to the construction site will be strictly enforced according to pesticide label (24 hours in general) • Precautions must be taken to prevent these chemicals from getting into streams and other surface waters.
Liquid Non-Repellent Termiticides (Imidocloprid and Fipronil)	Imidacloprid and fipronil are less toxic to mammals than organophosphates and synthetic pyrethroids	Fipronil and Imidacloprid are highly toxic to aquatic life like fish, shrimp and crab	• Protective clothing and respiratory masks will be required of all termite control operators. • Re-entry time to the construction site will be strictly enforced according to pesticide label (24 hours in general) • Precautions must be taken to prevent these chemicals from getting into streams and other surface waters.

Insect Growth Regulators in Bait Systems (Hexaflumuron, Difluobenzuron, *noviflumuron* and *Chlorflurazuron*)	Insect Growth Regulators interfere with the development of chitin a key ingredient of the exoskeleton of insects. They are much less toxic to humans and other nontarget organisms than the majority of termiticides.	.Insect Growth regulators can interfere with the development of Shrimps and crabs (both with chitin exoskeletons)	• Protective clothing and respiratory masks will be required of all termite control operators. • IGRs will be delivered in Bait systems (localized) limiting risks of run-off. • Precautions must be taken to prevent these chemicals from getting into streams and other surface waters.
Stomach toxicants in Bait systems. (Sulfuramid)	Sulfluramid has low oral, dermal, and inhalation toxicity, and is practically non-irritating to the skin and eyes. Ingestion can produce symptoms such as diarrhea	Sulfluramid is highly toxic to birds and toxic to aquatic animals (rainbow trout)	• Sulfuramid is only applied by certified termite operators. • In case of accidental ingestion, the Poison Control Center are equipped to perform “gastric lavages” • Precautions must be taken to prevent these chemicals from getting into streams and other surface waters
• **In all cases specialized trainings on Pesticide Safe use, Pesticide Stocks and storage management will be offered as part of the project**			

Estimated costs of the proposed alternatives

21. **Cost of Baiting System (manpower cost not included):** The demonstration projects will use baiting system and supporting measures. Baiting system costs 90—95% in necessary pesticides' cost as priority measure.

22. The baseline information for the demonstration areas indicate that a total floor area of 6,002,550 sq.m. will be constructed. The ground area for the buildings ("the footprint") will need treatment for termite prevention. Based on the studies carried out, the perimeter coefficient (the ratio between total floor area and ground area of a building) is 0.28m/sq.m for wood structures for brick-wood structures and 0.20m/sq.m for bricks structures, mix structures and reinforced concrete structures. Accordingly, the perimeters for the two groups of buildings are 297,606 meter and 987,934 meter, total 1,285,540 meter. With 3 meters between the bait monitor stations the total perimeters of buildings is 1,285,540 meter and about 430,000 bait monitor stations will be required.

23. In addition, it is estimated that a total of 1,059,168 apartments with an average size of 125sq.m will be infested with termites. With an estimated 6 sets of above-ground baiting system per apartment, a total 636,000 above-ground baiting systems will be needed over the 4-year demonstration time. , at least will be needed. With an average cost per bait system of US$ 6.2/ bait system and a total of 1,066,000 sets of in-ground and above-ground baiting system, the total estimated cost will be US$ 6,609,200. Due to uncertainties and potential replacement of some bait systems it is estimated that additional 5% of baiting system will be needed at a cost of US$ 330,460. The total cost for this component will therefore be US$ 6,939,660.

24. **Cost of Chlordane and Mirex to Control Termite (manpower cost not included).** Without the demonstration project, a total of 85 tons of Chlordane EC would have been needed for termite prevention in 1,062,880sq.m of wooden structures and brick-wood structures buildings, (0.08 kg of Chlordane EC per sq.m.), and 178.8 tons of Chlordane EC would have been used in 4,939,670 sq.m.of brick structures, mix structure and reinforced concrete structures (pesticides application area coefficient of 0.2). The total use of chlordane EC would have been 480.2 tons over the demonstation project with a total cost of US$ 1,767,136 (480.2 tons @US$ 3,680/tons).

25. For remediation of termite infested buildings, 3,310 kg of mirex would be needed for the estimated area of 13,239,600 sq.m, (0.25gram of mirex/m2). The total cost of mirex would be US$ 82,750 according to the price at 25 US Dollars/kg. The total cost of two pesticides chlordane and mriex would have been US$ 1,849,886.

26. **The Cost Increment of Baiting System Comparing with Chlordane and Mirex:** According to cost estimation of the pesticides and bait monitor system to be used during the implementation of the IPM strategy in the demonstration projects, and the cost of Chlordane and mirex, the incremental cost is US$ 5,089,774 for implementing IPM strategy to control termite.

27. The detailed costs of the implementation of the baiting system are outlined in Annex 1 (Cost for the implementation of PMP).

III. Policy, Regulatory and Institutional Framework

28. **Existing termite control policies.** Since 1987, MOC has established and issued a series of policies and regulations for termite control. Of which, "Regulation on Termite Prevention and Co ntrol in Urban Construction", as the MOC No. 72 regulation issued in 1999, is the most significant regulation in termite control in China. This regulation was revised and amended by the MOC No. 130 regulation in 2004. The main rules in both regulations include:

a. In termite affected area, all new buildings and renovations, expansions and decorations of old buildings must have termite prevention treatment;
b. MOC takes charge of the management of termite control in China, and the Departments of Construction of local governments take charge of the management of termite control in the corresponding provinces;
c. Termite control units must have the qualification to do termite control, and the chemicals for termite control must be registered in the Department of Pesticide Management of the Ministry of Agriculture (MOA);
d. The quality assurance term of termite control is 15 years, which starts from the date that house and buildings is transferred to users.
e. Termite control in city area should follow the "prevention as the first priority" principle, use preventive and remedial measures jointly, and implement IPM strategies in termite control as soon as possible; and
f. The government encourages to do research on the control of termites in city area, and promotes the use of new alternatives, techniques, crafts and equipments.

29. In order to strengthen the management of termite control, China has issued many technical standards for termite control in urban areas and dams and dykes, and for termite control studies. Table 4 lists standards issued by national agencies and by the Zhejiang and Jiangsu Provinces.

Table 4: National, Zhejiang and Jiangsu Termite Control Standards

Category	Issuing Agency and Year	Titles of Standards
Urban Areas	MOC, 1993	Technical Standards for Preventive Engineering of Termite Control in Houses and Buildings
	China Property Management Institute, April 2002	Technical Standards for the Preventive Engineering of Termite Control in Houses and Buildings (Draft)
	Department of Construction of Zhejiang Province, October 1986	Technical Standards for Preventive Engineering of Termite Control in New Houses and Buildings
	Construction Committee of Jiangsu Province, 1993	Operation Rules for Preventive Engineering of Termite Control in Houses and Buildings in Jiangsu Province (draft), and Rules for the Use of Chemicals for Termite Control in

		Houses and Buildings
	Department of Construction of Zhejinag Province, 1998	Detailed Rules for the Quality Management of Termite Prevention Engineering on Houses and Buildings
	Department of Construction of Zhejinag province, 1999	Measures for the management of chemical application during the termie control in house and buildings
Dams and Dykes	Ministry of Water Conservancy, August 1996	Notice on Further Strengthening Termite Control in Dams and Dykes and Ensuring the Security of Dams and Dykes
	Department of Water Conservancy of Jiangsu Province, 1990	Temporary Measures for Termite Control in Dams and Dykes in Jiangsu Province
Research	GB/T18260-2000 (issued in December 2000, effective in April 2001)	Preventive Termiticides for Wood Treatment: Experimental Methods in Laboratory for the Toxic Effects of Wood Antiseptic Against Termites
	GB2951.38-86 (issued in December 1987, effective in December 1987)	Preventive Termiticides for Cable and Electric Wire Treatment: Experimental Methods in Laboratory for the Cable and Electric Wire Against Termites
	Wuxi Institute of Termite Control, Standard Q/320201NBV101-2001 (effective in 2001)	Experimental Methods and Evaluative Criteria in Laboratory for the Effects of Termiticides against Termites

30. In order to reduce the environment pollution and to protect the human health, the Chinese government has issued many policies to eliminate or limit the production and use of chlordane and mirex. Five regulations related to the production and use of chlordane and mirex are:

a. *Regulation for Environment Management on the First Import of Chemicals and Import/Export of Toxic Chemicals* (issued by SEPA, Ministry of Foreign Trade and General Agency of Customs in 1994). This regulation aims to strengthen the monitoring and management of the first import of chemicals and the import and export of toxic chemicals included in the List of Toxic Chemicals Banned or Strictly Restricted in China. Chlordane was one of 27 chemicals included in this list. In other words, the import and export of chlordane are strictly controlled in China.

b. *Regulation for Pesticide Management* (issued by MOA in 1997 and revised in 2001). This regulation aims to strengthen the monitoring and management of the production, distribution and use of pesticides, to ensure pesticide quality, and to protect human and environmental health. The core measure of this regulation is a pesticide registration system. MOA is in charge of the registration of pesticides and provincial-level Departments of Agriculture provide assistance in pesticide

registration. Permission from the State Development Planning Commission is required for pesticide production. Pesticide dealers must apply for permits according to the national rules about hazardous chemicals. In China, the registration of chlordane as pesticides has been cancelled for its environmental and health risks. As of 2004, mirex has never got such registration in China.

c. *No. 6 Regulation "List of Obsolete Production Capability, Techniques, and Products that Need to be Eliminated* (issued by the State Economic and Trade Commission (SETC) in January 1999). This regulation stipulates that the obsolete production capability, techniques, and products included in the appendix of regulation should be shut down and eliminated within stated time limit. Effective on February 1, 1999, this regulation has listed chlordane and its production as one of obsolete products and technologies to be eliminated.

d. *No. 72 Regulation on Termite Prevention and Control in Urban Construction* (issued by MOC in October 1999). As noted earlier, this regulation requires that chemicals used for termite control be registered with the Department of Pesticide Management as pesticides. Because chlordane and mirex are not registered with the Department of Pesticide Management, legally all termite control stations cannot use chlordane to control termite in cities.

e. *Regulation for Safe Management of Hazardous Chemicals* (issued by the State Council in 1987 and revised in March, 2002). This regulation aims to strengthen the safe management of hazardous chemicals and to protect human and environmental health. The regulation has assigned responsibilities to various government agencies to supervise the production, storage, use, sales, transport, and registration of hazardous chemicals.

31. **Policies to be reviewed under the demonstration project:** Existing policies in China are problematic in helping China reduce and phase out the production and use of chlordane and mirex in termite control. Table 5 lists key problems of these policies and the objectives of the revision proposed by this demonstration project.

Table 5: Policies to be reviewed under the demonstration project

Level	Existing policies	Objectives	Key problems that require revisions
National	National Construction Code	Review relevant construction codes and develop a national model construction code incorporating termite control measures.	Current construction codes do not sufficiently promote termite control measures.

Level	Existing policies	Objectives	Key problems that require revisions
	Technical Standards for Termite Prevention in Housing Construction in China (MOC No. 166, MOC No. 130 and MOC No. 72)	Review of the existing technical standard, draft revised standard, assess regulatory impact, undertake technical consultations on the revised standard and steps towards issue and dissemination of the revised standard.	Current standard is based on the usage of chemicals for termite prevention and its technical standards are based on the usage of chlordane to control termite.
Provincial	(both provinces) Provincial Constructions Codes	Revising current provincial construction codes based on the national model construction code	Current construction codes do not sufficiently promote termite control measures.
	(Zhejiang) ZCB No. 265 and (Jiangsu) JCB No. 279 Technical Standards for Termite Prevention for New Buildings	Revision of technical standards on termite prevention for new buildings	These standards are based on chemical treatment, not IPM methods.
	(ZPB No. 422 in Zhejiang and JFB No.156 in Jiangsu) Circulars on Pricing in the Construction Sector	Issue new pricing standard in Zhejiang and Jiangsu	Regulated price is lower than the costs of IPM
	(both provinces) Manual on Budgeting Standards in the Construction Sector	Revise the manual to add pricing standards for termite prevention	No standard on termite control pricing in the Manual. This results in no budget for termite control in the construction designing
	(Zhejiang): ZCB No. 37 Quality Control Manual for Termite Prevention and Control in the Construction Sector	Revision of quality control manual on termite prevention &control in the construction sectors in Zhejiang, issue new manual in Jiangsu	Only based on chemical treatment, no IPM treatment
	(Zhejiang) Order No 86: Regulation on Termite Prevention and Control for Urban Housing (Jiangsu) New regulation	Revise the regulation for Zhejiang, and issue a new regulation in Jiangsu to include IPM elements in these regulations	IPM is not mentioned in the Zhejiang regulation. No such regulation in Jiangsu.

32. **Policies and regulations related to the ban of chlordane and mirex:** In addition to above efforts, China was strongly committed to the development and implementation of the Stockholm Convention. China took apart in all preparatory meetings and was one of the counties who initially signed the Stockholm Convention on May 23, 2001. On August 13, 2004, China officially ratified the Stockholm Convention and became a Party to the Convention. China has also advanced substantially in meeting the Convention requirement that Parties to the Convention submit a NIP to the Conference of Parties within two years after the Convention enters into force for that country. So far, China has already started to develop and nearly finished the national strategic framework for the reduction and phase-out of pesticidal POPs through a Sino-Italian program.

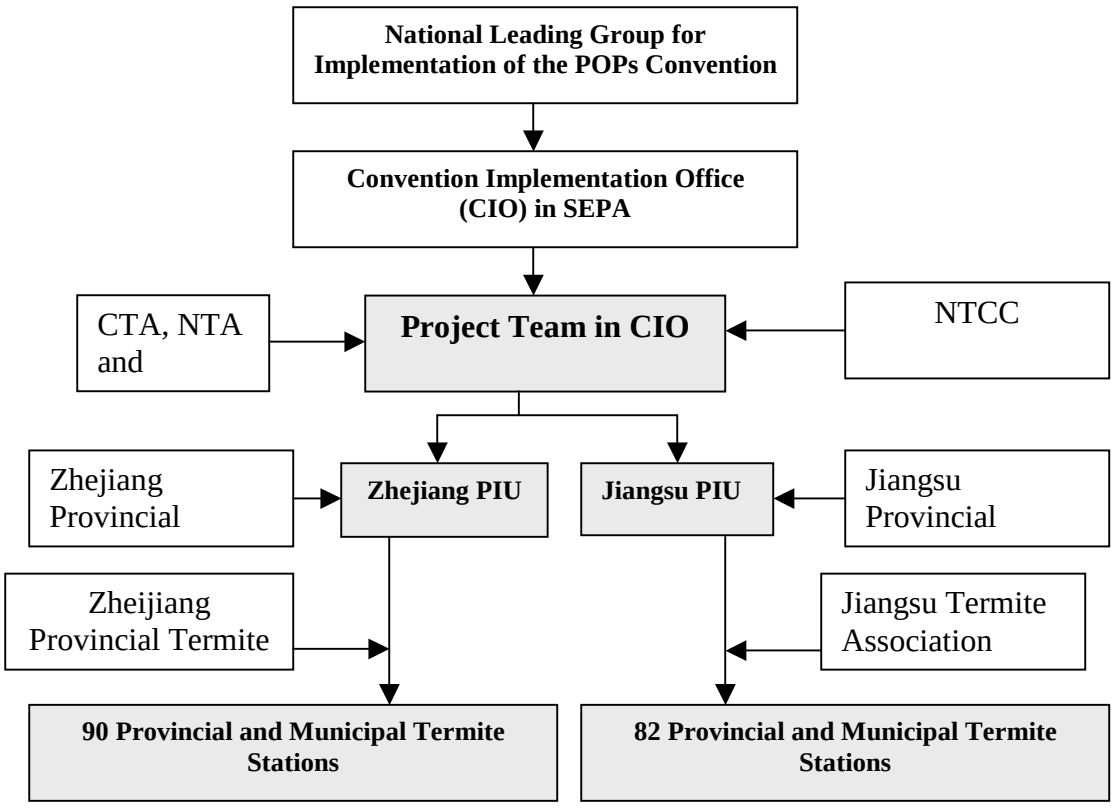
33. **Potential bottle necks for the phase-out of chlordane and mirex:** The present policies and regulations for termite prevention in China are heavily relied on chemical approaches. The 15 years quality guarantee term of termite control intends to use chemicals like chlordane. Meanwhile, the pricing standard of termite control is set by the government and always is quite low. The lack of both effective and economic chemical alternatives to chlordane and mirex and the limited practice on IPM approaches have prevented the termite control stations from adopting IPM approaches but continued the use of chlordane and mirex. In addition, because China has yet to develop technical principles and operational standards for IPM techniques, local termite control stations usually don't know what and how to do IPM practices and how to evaluate the effectiveness of an IPM practice. Furthermore, existing regulations are yet to restrict and eliminate of the use of chlordane and mirex in termite control. Although the SETC Order No. 6 bans the production of chlordane and mirex, producers of these two chemicals are yet to stop their production. To eliminate the use of chlordane and mirex in China, monitoring and enforcement of regulations must be strengthened.

34. **Policies and regulations related to pesticide management:** The Government of China has several laws and regulations related to the management of pesticides (import, export, production, sale, distribution, transport and storage). These laws and regulations are under the mandate of a number of ministries, agencies or institutes (see table in Annex Table 4). The most important ones are the Pesticides registration, under the Ministry of Agriculture (ICAMA) and the main *Pesticide management Regulation in China* is under the State Department. It was issues May 8, 1997 and amended Nov 29, 2001 to reflect the requirements to join the World Trade Organization (Intellectual Property Rights) and the International Code of Conduct on Pesticide Distribution and Use

(see Annex Table.5 comparing Chinese laws and those outlined in the codes of conduct on Labeling, packaging, storage and disposal of pesticide).

35. **Institutional Framework for Implementing IPM and managint pesticides:** The PAD describes in details the institutional arrangements for the implementation of the project, including the implementation of IPM practices as alternatives to chlordane and mirex (see figure 1)

Figure 1. Project Institutional Arrangements



a. **The National Termite Control Center (NTCC):** The NTCC will have the following tasks under the demonstration project:
   i. Taking lead under the auspices of SEPA and Ministry of Construction in the development of national termite prevention and control policies and regulations.
   ii. Development and periodic updating of an operating and training manual for IPM implementation in Zhejiang and Jiangsu provinces.
   iii. Reviewing and updating the certification system for operators in termite

prevention and control.

b. **Provincial Steering Group.** In each project province, key stakeholders will form a steering group to provide advice to provincial PIU on technical, policy, management and other aspects of project implementation. The Steering Group will meet quarterly or as needed to consider project progress, provide technical guidance, consult on political issues, and ensure that the project receives adequate and broad support from provincial authorities. The Steering Group in each province will include representatives of the Construction Bureau, Environmental Bureau, Pricing Bureau, Financial Bureau, Agricultural Bureau, Water Conservation Bureau and Forest Bureau. In Zhejiang, the group will be chaired by a representative of the Construction Bureau. In Jiangsu, the group will be chaired by a representative of the provincial environmental protection bureau (EPB). The project will provide logistical support to the meetings of the Steering Group.

c. **Local Project Implementation Units in Zhejiang and Jiangsu (local PIUs).** Zhejiang and Jiangsu provinces will establish project implementation units (PIUs) to conduct day-to-day project management and coordination of provincial level activities in their respective provinces. The PIU's location, size and specific functions will be clearly defined in a TOR prepared by CIO in SEPA. The PIUs will include staff from the provincial institutions such as EPBs, Construction Bureaus, and termite institutions. Its responsibilities will include (i) coordinating/organizing local training and seminars; (ii) overseeing operation of termite management and IPM implementation for termite control in Zhejiang and Jiangsu; (iii) contributing to advocacy and policy dialogue; and (iv) collecting information and preparing progress reports. As the production of chlordane and mirex is located in Jiangsu province, the PIU in Jiangsu will have additional responsibility on (v) monitoring chlordane and mirex production, (vi) closure of the Liyang Quanghua production facility, and (vii) cleanup and disposal of chlordane and mirex contaminated wastes after the closure.

d. **The Zhejiang Provincial Institute for Termite Prevention and Control (ZPITPC):** The Institute is presently responsible for all training provided to termite stations and termite staff in Zhejiang province and for corporation between termite institutes/stations within the province. In order to maintain and utilize the present system, the Institute will be contracted to conduct IPM training in the province.

e. **The Jiangsu Provincial Termite Association.** The Association will maintain its present role in the Province. Under the project, it will be responsible for all IPM training to be provided to staff employed by the termite stations in the province. It will continue cooperation between termite institutes and stations within the province.

f. **Termite stations in Jiangsu and Zhejiang Provinces.** The professional termite stations will receive IPM training and implement integrated termite management using bait systems instead of chlordane and mirex. As of 2004, Zhejiang has 90 and Jiangsu has 82 provincial and municipal termite stations, all of which will be involved in this project.

g. **Other involved parties.** The implementation of the proposed demonstration project will involve **Suppliers of chemicals and bait systems.** Contracts to supply chemicals and bait systems will be awarded based on World Bank procurement procedures about six month after the start of the project to allow domestic and international suppliers to register their products with MOA. Bait system will be procured periodically during implementation period in order to ensure most cost effective supply of bait systems.

IV. Strengthening National Capacity

36. **Institutional Strengthening (Details in Component 1 of Annex 4 in the PAD).** To ensure success of the Project, it is necessary to mobilize (a) institutional capacity for project management, (b) technical and advisory capacity for project implementation, and (c) capacity of the key stakeholders to support the to shift from pesticide-based termite control to IPM-based termite prevention and control. These will be achieved through activities focused on (a) mobilizing the lead termite institutions and individuals at national and provincial levels, training of the Convention Implementation Office (CIO) at SEPA and the Project Implementation Units (PIUs) in Jiangsu and Zhejiang in project management and evaluation, and (b) providing programmatic support to key organizations involved in project implementation. Roles and responsibilities of different players are as follows:

37. **Termite Project Team in CIO**. A project team will be established in CIO to be responsible for the centralized management, coordination and supervision of the project. It will (i) prepare TORs for activities under the project, (ii) review project progress reports submitted by the local PIUs, (iii) supervise project procurement and financial resources according to the Bank's procedures, (iv) organize and convene project coordination meetings among stakeholders, and (v) review project outputs. The project team will be part of CIO and will consist of one full-time project staff from CIO and one from the Ministry of Construction.

38. **Provincial Steering Group.** In each project province, key stakeholders will form a steering group to provide advice to the PIU on technical, policy, management and other aspects of project implementation. The Steering Group will meet periodically to review project progress, provide technical guidance, consult on political issues, and ensure that the project receives adequate and broad support from provincial authorities. The Steering Group in each province will include the representatives of the Construction Bureau, Environmental Bureau, Pricing Bureau, Financial Bureau, National Termite Control Center, Agricultural Bureau, Water Conservation Bureau and Forestry Bureau. In Zhejiang, the group will be chaired by a representative of the Zhejiang Construction Bureau. In Jiangsu, the group will be chaired by a representative of the provincial environmental protection bureau (EPB).

39. **Provincial Project Implementation Units (PIU)**. The project will set up two provincial PIUs in the demonstration provinces – one in Hangzhou, Zhejiang, and one in Nanjing, Jiangsu – to manage provincial project activities. The PIUs will report to the

Project Team in CIO. The detailed description of the composition, location and functions of the PIUs is discussed in Annex 6 of the Project Appraisal Document.

40. **Technical and advisory capacity**. In addition to the above, the Project will also recruit a Chief technical advisor (expected to be an international expert), a National Technical advisor, and technical experts to advise the Project team in CIO and the PIUs on technical aspects of project implementation.

41. **Project training program to enhance national capacity (Details in Component 1 and 3 in Annex 4 of the PAD).** All project staff in the Termite Project team in CIO and in PIUs in the two demonstration provinces will be trained for project management. In addition, 516 termite station managers, 72 trainers, 120 researchers, and 1,920 termite control operators from 170 termite stations will be trained in IPM technology with the OPM Operating and Training Manual developed in the Project. Training will be concentrated on POPs characteristics and health & environmental risks, IPM technology and practice, baiting system, and pesticide management. Specific training programs include the following:

a. **Project management training.** This training will equip individuals and units involved in project implementation with (1) project management skills and (2) understanding of key issues related to elimination of chlordane and mirex in termite control through introduction of IPM. The management training will target the Project Team, PIU staff and other individuals involved in project management and monitoring. It will be concentrated early in the project period and will focus on financial management and procurement, reporting and record keeping requirements, monitoring and evaluation procedures, report drafting, application of the procedures outlined in the project implementation manual, sensitization to safeguard and disclosure requirements, use of the project MIS and other areas. The training will also provide general overview of key issues related to management of POPs, elimination of chlordane and mirex in termite control, IPM, disposal of hazardous wastes, policy and institutional reform, public awareness and other issues which staff of the project team and PIUs needs to understand in order to effectively manage technical experts working on these issues in detail.

b. **IPM training program.** The design and delivery of the training will be specific to different groups of people in termite control, but in all cases it will include general introduction to risks associated with the use of chlordane and mirex, concept of IPM and applied training in skills necessary for introduction of the bait system and complimentary measures.

    i. **Training of termite station managers.** This training will target the management personnel of termite control stations. The training will introduce them to the demonstration project, concept of IPM, good management practices for running an IPM-based termite control teams, and related skills. The training course will be delivered in conjunction with the project launch workshop in each province in the demonstration provinces. Three persons from each station, totaling 516, will take the training which will be delivered through six geographically distributed courses.

ii. **Training for researchers.** This training will target the research and technical staff undertaking applied research at the termite stations. The training will address the conceptual and practical issues associated with IPM, and focus on those aspects of bait systems and other measures that will need to be integrated in the ongoing research agenda. In total, about 120 trainees, primarily from the city-level termite stations with significant research programs, will participate in the training which will be delivered centrally through one three-day training course.

iii. **Training of trainers.** This training will prepare qualified trainers to satisfy future IPM training needs in the two demonstration provinces. The trainers will be selected from among the senior termite station staff to receive advanced technical and pedagogical skills necessary for organizing and delivering training to termite personnel in their geographic areas. In total, 72 trainees, three from each of the 24 city-level stations will be trained at one week-long workshop by international and national experts. Establishing the training of trainers will be an important element of IPM sustainability in the two demonstration provinces.

iv. **Training of termite control operators.** This training will target termite control operators installing and monitoring the bait stations, and implementing complementary termite control measures. This training will be offered to temporary workers directly involved in application of preventive and remedial termite treatment. The training will focus on practical application of bait system as well as introduction to IPM and health and environmental risks from using chlordane and mirex. About 80 personnel from each of the 24 city stations (a total of 1,920) will attend the training. The training will be delivered through one, 3 day course in each major city in the demonstration provinces. Altogether, more than one thousand staff will receive this basic IPM training.

42. **Public awareness and information dissemination (Details in Component 3 in Annex 4 of the PAD).** Successful IPM implementation requires that the consumer public – occupants and developers of the buildings – are aware of the risks associated with chlordane and mirex and informed about the benefits of IPM. Informed public sensitized to the dangers of persistent pesticides will be a vital element in creating a social and economic environment enabling wide-spread and permanent adoption of IPM. This sub-component, will therefore, promote public awareness and information dissemination in the demonstration provinces.

a. **Public awareness activities.** The sub-component will support public awareness activities targeted at groups that have a stake in elimination of chlordane and mirex and implementation of IPM. It will include public awareness through TV, radio and print media.

b. **Termite IPM website building on existing website.** Importantly, the component will support development of content for an information website which will be a part of the existing POPs website. The website will serve the information needs of general public as well as those with research or

professional interest in termite control. The general part of the website will contain strategic messages and information for the use of general public and serve as one of the channels for the overall public information campaign. The technical part of the website will contain the training and operating manual, literature references, contacts for termite stations and other organizations involved in project implementation, various training materials and research reports disseminating lessons from the project, key regulations and similar content. The website will be professionally designed and managed by a contracted consulting firm under the auspices of Project Team and PIUs, and will be updated throughout project implementation period.

V. Monitoring and Evaluation

43. **Focus.** Successful implementation of the PMP requires regular monitoring and evaluation of activities undertaken in the demonstration area. The focus of monitoring and evaluation will be to assess: (a) the built up of IPM capacity in the Zhejiang and Jiangsu provinces, (b) the extent to which IPM techniques based on baiting termites with an Insect Growth Regulator and/or a safe chemical toxicant are being adopted in termite control, (c) the extent of policy reforms, and (d) the environment benefits that end-users derive by adopting IPM.

44. **Outcome and Performance Indicators.** By the At the end of project, Over 600,000 bait systems will be installed in newly constructed buildings of the demonstration area. This will result in the phasing out of over 150 MT of chlordane and mirex being presently produced for termite control. In this case the key outcome indicators will be the final number of bait systems installed and the quantities of chlordane and mirex phased out. The key performance indicators will be related to technical, regulatory and capacity building aspects.

Table 6. Performance indicators

Performance Indicators	Description
Technical Indicators	• Number of buildings that adopted baiting systems • Number of Baiting systems used • Quantities of liquid pesticides used • level of reduction or increase of pesticide purchase • Quantities of chlordane and mirex produced • Quantities of chlordane and mirex used
Regulatory Indicators	• laws, regulations, and policies amended, reformed, or introduced

Capacity Building Indicators	• Number of training courses held. • Numbers of managers, researchers, trainers, and termite control operators trained in IPM technology, • Number of termite control operators certified. • numbers of pamphlets booklets and training manuals produced and distributed

45. **Principal instruments.** The principal monitoring instrument will be (a) regular field visits by the PIUs, CIO's termite project team, and the World Bank, and (b) to be supplemented by regular periodic progress reports and annual review meetings. Project management, information collection, monitoring and evaluation will be the responsibility of the termite project team in CIO and the provincial PIUs. The monitoring procedures, standard progress reports, and responsibilities for monitoring will be described in detail in the Project Implementation Manual, which will be finalized prior to launching of the project. Regular reports will track key activities of individual project components in a standard format and will allow easy aggregation and evaluation of information, and provide basis of monitoring indicators detailed in Annex 3 of the PAD.

a. **Proposed regular reporting format (Annex 6).** These tables are to be filled out by the termite stations in the demonstration provinces for monthly submission to provincial PIUs for aggregation and provincial progress reports to be submitted by PIUs to Termite project team in CIO every quarter.

46. **Key activities for Monitoring and evaluation.** They are as follows:

a. **Monitoring and evaluation workshop.** At the start of the project, a monitoring and evaluation workshop will be held between the Termite team in CIO, PIUs, termite stations, and other stakeholders to review and refine monitoring indicators noted in Annex 3 of the PAD.

b. **Annual review meetings.** This will be held annually to review and evaluate project implementation, assess achievement of project performance indicators, and provide recommendation on project implementation for subsequent years.

c. **Management Information System and regular progress reports.** The project will establish a computerized MIS to track progress of the project and facilitate its evaluation, particularly in respect to bait system implementation. Each termite station will provide monthly information to the provincial PIUs on their bait system implementation in its area of service. The PIUs will consolidate data and enter them into the MIS and generate regular progress reports for the Termite

Team in CIO who will provide semi-annual progress reports to the Bank. The MIS will also track implementation of other project activities.

d. **Field visits.** All management units, including PIUs, Project team, and the Bank, will visit project sites regularly.

Annex

Annex 1-1. Zhejiang Termite Catalogue

Family	Genus	Species
Ⅰ Hodotermitidae	1.*Hodotermopsisl*	(1) *H. sjostedti* Holmgren
Ⅱ Kalotermitidae	2.*Cryptotermes*	(2) *C. declivis* Tsai et Chen (3) *C. Pingyangensis* He et Xia
	3.*Incisitermes*	(4) *I . minor* (Hagen)
Ⅲ Rhinotermitidae	4.*Coptotermes*	(5) *C. formosanus Shiraki* (6) *C. longistriatus* Li et Huang (7) *C. changtaiensis* Xia et He (8) *C. shanghaiensis* Xia et He (9) *C. grandis* Li et Huang (10) *C. suzhouensis* Xia et He
	5.*Reticulitermes*	(11) *R. Chinensis*(snyder) (12) *R. citrinus* Ping et Li (13) *R. parvus* Li (14) *R .labralis* Hsia et Fan (15) *R .leptomandibularis* Hsia et Fan (16) *R. affinis* Hsia et Fan (17) *R. flaviceps* (Oshima) (18) *R .fukienensis* Light (19) *R. speratus* (Kolbe) (20) *R. curvatus* Xia et Fan (21) *R. qingjiangensis* Gao et Wang (22) *R. yizhangensis* Huang et Tonsg (23) *R. aculabialis* Tsai et Hwang (24) *R. hunanensis* Tsai et Peng (25) *R luofuicus* Zhu, Ma et Li
	6.*Odontotermes*	(26) *O. formosanus* (Shiraki) (27) *O. fuyangensis* Gao et Zhu (28) *O. pujiangensis* Fan (29) *O. guizhouensis* Ping et Xu (30) *O. fontanellus* Kemner
	7.*Macrotermes*	(31) *M. barneyi* Light (32) *M. luokengsis* Lin et Shi (33) *M. zhejiangensis* Ping et Dong
	8.*Euhamitermes*	(34) *E. zhejiangensis* He et Xia
	9.*Sinocapritermes*	(35) *S. mushae* (Oshima et Maki) (36) *S. tianmuensis* Gao
	10.*Pericapritermes*	(37) *P. jangtsekiangensis* (Kemner) (38) *P. nitobei* (Shiraki) (39) *P. tetraphilus* (Silvestri) (40) *P. gutianensis* Li et Ma
	11.*Xiaitermes*	(41) *X. tiantaiensis* Gao et He (42) *X. yinxianensis* Gao et He
	12.*Nasutitermes*	(43) *N. gardneri* Snyder (44) *N. grandinasus* Tsai et Chen (45) *N. parvonasutus* (Shiraki) (46) *N. qingjiensis* Li (47) *N. tiantonsgensis* Zhou et Xu (48) *N. anjiensis* Gao et Guo
	13.*Sinonasutitermes*	(49) *S. xiai* Ping et Xu
		(50) *M. heterodon* Gao et He

Annex 1-2. Jiangsu Termite Catalogue

Family	Genus	Species
Ⅰ Kalotermitidae	1.*Incisitermes*	（1）*Incisitermes minor* (Hagen)
Ⅱ Rhinotermitidae	2.*Coptotermes*	□2）*Coptotermes crassatus* Ping （3）*Coptotermes communis* Xia *et* He （4）*Coptotermes grandis* Li *et* Huang （5）*Coptotermes jiaxingensis* Xia *et* He （6）*Coptotermes shanghaiensis* Xia *et* He （7）*Coptotermes suzhouensis* Xia *et* He
	3.*Reticulitermes*	（8）*Reticulitermes affinis* Hsia *et* Fan （9）*Reticulitermes dantuensis* Gao *et* Zhu （10）*Reticulitermes flaviceps* (Oshima) （11）*Reticulitermes fukienensis* Light （12）*Reticulitermes fulvimarginalis* Wang *et* Li （13）*Reticulitermes speratus* (Kolbe) （14）*Reticulitermes aculabialis* Tsai *et* Huang （15）蚁*Reticulitermes chinensis* Snyder （16）*Reticulitermes labralis* Hsia *et* Fan （17）*Reticulitermes leptomandibularis* Hsia *et* Fan （18）*Reticulitermes perilabralis* Ping *et* Xu （19）*Reticulitermes qingjiangensis* Gao *et* Wang
Ⅲ Termitidae	4.*Macrotermes*	（20）*Macrotermes barneyi* Light
	5.*Odontotermes*	（21）*Odontotermes fontanellus* Kemner （22）*Odontotermes Pujianensis* Fan
	6. *Pericapritermes*	(23) *Pericapritermes jangtsekiangensis* Kemner

Annex 3. Cost for the implementation of PMP

Activities	GEF (US $)	Local (US $)	Foreign (US $)	Total (US $)
Institutional Capacity Strengthening	**1,000,200**	**821,800**		**1,822,000**
a. Project Management and Technical Capacity	743,200	568,800		1,312,000
b. Technical and Advisory Capacity for Project Implementation	177,000	176,000		353,000
c. Inception Activities and Mobilization of Key Stakeholders	80,000	77,000		157,000
Policy Framework for Elimination of Chlordane and Mirex	**640,000**	**200,000**		**840,000**
a. National Policy and Regulatory Framework	300,000	100,000		400,000
b. Provincial Policy and Regulatory Framework	340,000	100,000		440,000
IMP Implementation	**9,645,000**	**9,607,000**		**19,252,000**
a. IPM Operating and Training Manual	88,000	8,000		96,000
b. IPM Training Program	845,000	0		845,000
c. Consumer Awareness and Public Information Dissemination	50,000	0		50,000
d. IPM Implementation	8,387,000	9,524,000		17,911,000
e. Research and Development	275,000	75,000		350,000
Monitoring and Evaluation	**78,000**	**59,000**		**137,000**
a. Monitoring and Evaluation Workshop	0	14,000		14,000
b. Annual Review Meetings	60,000	27,000		87,000
c. Management Information System	18,000	18,000		36,000
Total	**11,363,200**	**10,687,800**		**22,051,000**

Annex 4. Government departments and their responsibilities in Pesticide management

Ministry/department	Import	Export	Production	Storage	Transportation	Business	Use	Disposal
SEPA	□	□	□	□			□	□
MOH	□		□			□	□	
MOA	□	□	□	□	□	□	□	□
SDIC	□		□	□	□	□	□	□
MOCommer	□	□		□		□		
MOCommu				□	□			
MOR				□	□			
ACAC				□	□			
MOPS			□	□	□	□	□	□
SBQTS			□			□		
GAC	□	□						
SAIC			□			□		

Annex 5. Comparing Chinese laws with International Code of Conduct on pesticides labeling, packaging, storage and disposal

The laws, codes and policies of China	Code of Conduct - 2001 revised version
Implementation Measure of Pesticides Administration Regulation The 5th item implement authentication system to experiment unit of pesticides registration. Ministry of agriculture is in charge of organizing authentication of pharmic effectiveness experiment unit of pesticides registration, pesticide remnant experiment unit of pesticides registration, toxicology experiment unit of pesticides registration, environmental impact unit of pesticides registration, and issuing authentication certificate. Authorized experiment units of pesticides registration should accept supervision of agriculture administrations above province administration class. ***Pesticides Management Regulation*** Packaging of pesticide must be labeled and attached introduction. Labels should be clung or print on packaging. Label and introduction must give clear indication of name of the pesticide, name of the enterprise, serial number of the products, registration number of pesticides products or production license No., the pesticide's content, formulation, effective ingredient, weight, performance, toxicity, purpose, usage, practical technology, release date, period of validity, important notes, and so on; packaging factory's name should be indicated if pesticide need to be packaged in another factory. ***Guideline on labels of pesticide products*** 5. Essential content which should be indicated: 5.1 Name of the product, content and formulation 5.2 License No. of the product 5.3 Application range, dosage, and usage	**10.1** All pesticide containers should be clearly labelled in accordance with applicable guidelines, at least in line with the FAO guidelines on good labelling practice. **10.2** Industry should use labels that: **10.2.1** comply with registration requirements and include recommendations consistent with those of the recognized research and advisory agencies in the country of sale; **10.2.2** include appropriate symbols and pictograms whenever possible, in addition to written instructions, warnings and precautions in the appropriate language or languages (3); **10.2.3** comply with national or international labelling requirements for dangerous goods in international trade and, if appropriate, clearly show the appropriate WHO hazard classification of the contents; **10.2.4** include, in the appropriate language or languages, a warning against the reuse of containers and instructions for the safe disposal or decontamination of used containers; **10.2.5** identify each lot or batch of the product in numbers or

5.4 Net content 5.5 Quality warranty period 5.6 Sign of toxicity 5.7 Attention items 5.8 Storage and transportation methods 5.9 Name and address of manufacturer 5.9.1 The name of manufacturer, detail address, postcode, contact phone numbers must be noted consistent with business license. Color coding that characterizes of type of pesticide (toxicity) 6. Other requirements of labeling 6.5 Pesticide's label should use formal simplified Chinese characters, minority areas could use characters in their language at the same time. **Comment: Average users don't know how to get the MSDS of pesticide.**	letters that can be understood without the need for additional code references; **10.2.6** clearly show the release date (month and year) of the lot or batch and contain relevant information on the storage stability of the product
The 21st term of ***pesticides management regulation*** prescribes that pesticide management unit must store pesticides well according to relevant official prescription. Storage system and regulation should be set up to guarantee quality and safety of pesticides. ***Guideline on packaging of pesticide products*** 1 packaging 1.1 Packaging of pesticide should be consistent with requirements of its storage, transportation, sales and use. 1.2 Packaging materials of pesticide shouldn't be broken in storage and transportation, and comply with relevant standards. 1.3 Outer packaging material of pesticide should be infrangible and bearable to guarantee the content inside won't be destroyed. The adoptable outer packaging material are: wood, metal, prefabricated material, compound material, cardboard or paper with dampproof layer, hemp textile, and other packaging material agreed by transportation administration and customers. 1.4 Inner packaging material of pesticide should be infrangible and bearable, and not cause chemical reaction with pesticide, not swelling, not leak, not impact quality of products	**10.3** Pesticide industry, in cooperation with government, should ensure that: **10.3.1** packaging, storage and disposal of pesticides conform in principle to the relevant FAO, UNEP, WHO guidelines or regulations (27,28, 37, 39, 40) or to other international guidelines where applicable; **10.3.2** packaging or repackaging is carried out only on licensed premises where the responsible authority is satisfied that staff are adequately protected against toxic hazards, that the resulting product will be properly packaged and labelled, and that the content will conform to the relevant quality standards. **10.4** Governments should take the necessary regulatory measures to prohibit the repackaging or decanting of any pesticide into

Adoptable inner packaging material are glass, plastic, metal, prefabricated material, thick papers and so on. 1.5 Pesticide should be packaged according to its formulation, usage, toxicity, physical and chemical characteristic. Net weight of each trunk of liquid pesticide preparation shouldn't exceed 15kg. Net weight of each bag of solid pesticide preparation shouldn't exceed 25kg. Net weight of each piece of liquid pesticide technical product shouldn't exceed 250kg. Net weight of each piece of solid pesticide technical product shouldn't exceed 100kg. 1.6 A container of bottled liquid pesticide should have suitable inner stopper and outer lid. The lid of barreled liquid pesticide technical product should have gasket, and screw down completely to avoid leakage. 1.7 Glass or plastic bottles loaded with liquid pesticide should be stuffed with quakeproof material to load in outer container for avoidance of leakage caused by collision. 1.8 If pesticide is loaded in small packaging, the small packaging should be cased in outer container which is appropriate for storage and transportation. 1.9 There must be a qualified license and an introduction inside an outer container. ***Pesticides Management Regulation*** The 39th item The disposal of fake pesticide, pesticide of low quality, expired pesticide, forbidden pesticide, waste packaging of pesticide, and other waste containing with pesticide should strictly abide by the environment-protection laws and codes for environmental pollution avoidance. ***Poison defense regulation of pesticides' transportation, sale, and use*** 8 disposal of waste pesticide 8.1 The outdated, invalid and disabled pesticide confirmed by authorized technical agents should be destroyed.	food or beverage containers and rigidly enforce punitive measures that effectively deter such practices. **10.5** Governments, with the help of pesticide industry and with multilateral cooperation, should inventory obsolete or unusable stocks of pesticides and used containers, establish and implement an action plan for their disposal, or remediation in the case of contaminated sites (41), and record these activities **10.6** Pesticide industry should be encouraged, with multilateral cooperation, to assist in disposing of any banned or obsolete pesticides and of used containers, in an environmentally sound manner, including reuse with minimal risk where approved and appropriate. **10.7** Governments, pesticide industry, international organizations and the agricultural community should implement policies and practices to prevent the accumulation of obsolete pesticides and used containers (37).

8.1.1 Pesticide with high toxicity should be buried in grooves with leak-proof structure after chemical process. The burying place should be away from dwelling houses and water source, and set a sign with “poisonous”. 8.1.2 Low and middle toxicity pesticide should be buried in deep holes away from dwelling houses and water source. 8.1.3 Pesticide’s burning and destroying must be processed in special stoves. 8.2 Appropriately dispose pesticide left in non-application site. 8.2.1 Utilize saw, dry dust or fine adsorbent to clean liquid pesticide; refer to 8.1.1 to dispose high toxicity and huge quantity pesticide. 8.2.2 Solid pesticide should be put at safe place and clean on time. 8.3 Packaging of pesticide should be prohibited for other use. They mustn’t put aside randomly, and must have appropriate disposal; packaging in good condition can be recycled by sales agents or manufacturers. refer to 8.1.1 to dispose broken packaging of high toxicity pesticide. 8.4 Measures for huge quantity of waste pesticide must be approved by labor and environment administrations and reported to higher government departments. 8.5 Protection implements must be wore during disposal process. **Comment: There’s no compelling pesticide packaging recycle system in China.**	