



**MAKING ADVANCES IN CHINA ON
REDUCTIONS IN THE USE OF THE
PERSISTENT ORGANIC
POLLUTANTS CHLORDANE AND
MIREX FOR TERMITE CONTROL:
A PILOT STUDY**



**ROYAL ROADS
UNIVERSITY**

**Final Report
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**Report to:
Foreign Economic Cooperation Office
State Environmental Protection
Administration**

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INTRODUCTION

This letter provides a synopsis of the activities conducted by Royal Roads University (RRU) under the Sino-Canadian Case Study on POPS Alternatives for Termite Control in China. It forms deliverable “i. Final completion report of the case study” of Contract Number F/I/S/04/031 between the Foreign Economic Cooperation Office, State Environmental Protection Administration (SEPA), Beijing, China and Royal Roads University.

The primary goal 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 the reduction of the use of chlordane and other pesticides using a variety of alternative methods in an integrated manner, in support of the National Implementation Project for the phase-out of persistent organic pollutants (POPs) under the Stockholm Convention.

INCEPTION WORKSHOP AND SITE VISITS (JANUARY 11 – 20, 2004)

The project was initiated with the participation of Drs. Matt Dodd and Bill Dushenko, in an Inception Termite Expert Workshop held in Beijing from January 12-14, 2004. Experts and delegates were present from a number of agencies with a stake in termite control and its alternatives including SEPA, World Bank, Ministry of Agriculture, Ministry of Construction and the National Termite Control Centre (Hángzhōu), International Department, National Termite Prevention Industry Association, Urban Entomology Research Centre (Zhèjiāng University), Centre of Environmental Studies (Peking University), Běijīng University, Wúxī Termite Control Institute (Jiāngsū Province), China Pesticide Industry Association, Termite Prevention Academy, Guǎngdōng Insect Institute (in Guǎngzhōu), Nánjīng Institute of Termite Control (Jiāngsū) and Qīngdǎo Termite Control Station (Shāndōng province).

Our primary involvement was to provide a perspective on alternatives and Integrated Pest Management (IPM) approaches being used internationally for termite prevention and control. We provided a presentation that examined the chemical alternatives to termite control and integrated pest management (IPM) strategies investigated and used in countries such as the United States, Australia, Brazil, Germany, Kenya, Egypt, and

Chile, as well as China. A copy of our presentation was made available to SEPA. A Preliminary status report, *Use of Alternatives and IPM Practices* was also submitted to SEPA prior to the workshop by Dr. Doug Bright.

Presentations by the Chinese Termite Experts indicated that research on IPM had been conducted by various institutes in China with some promising results. Discussions on the first day of the workshop indicated that the operational approach being taken by China which is occurring in a three-stage strategy [(i) awareness, inventory and exploration of alternatives; (ii) demonstration project and IPM; and (iii) program for overall elimination of chlordane and mirex] is a complex, ambitious, but innovative task, involving both internal and global partnerships. Canada was also recognized as one of the global leaders in addressing POPs, and an example to be followed.

During the second day of the workshop, delegates discussed and selected the criteria and work plan to be used for the selection of 1) one province to host the demonstration project for alternatives to chlordane and mirex and 2) two pilot test sites (cities) as part of a case study for the assessment of alternatives to termite control. The workshop concluded with the delegates indicating they would return to discuss the criteria and work plan with their agencies and others, and notify FECO/SEPA of their intentions soon.

Drs. Matt Dodd and Bill Dushenko also visited two potential pilot case study sites in Hángzhōu (National Termite Prevention Centre) and Wúxī (Termite Control Institute) from January 14 to 16, 2004. These tours indicated that considerable capacity existed in China for developing effective alternatives to mirex and chlordane use, and that a significant amount of preliminary work in IPM had already begun.

We found the experts workshop and site tours to be extremely valuable in better understanding the achievements and challenges of the Chinese in meeting their commitment to phasing out chlordane and mirex as part of the NIP. A "Mission Report on Termite Experts Workshop and Site Field Visit" which documented our observations and contributions to the workshop was subsequently submitted to SEPA in March 2004 (Contract Item C).

STATUS REPORT: USE OF ALTERNATES AND IPM PRACTICES

Following our return to Victoria, the Preliminary Status Report on the Use of Alternatives and IPM was updated to incorporate information gathered during our visit to China as well as discussions we had with SEPA and the Chinese Termite Experts. The revised report included additional information on the general properties, production and uses of chlordane and mirex and their effects on humans and the environment. A general discussion on IPM was also presented followed by an in-depth look at IPM practices in Australia and the USA, specifically Hawaii, California, Florida and Mid-America. The case studies revealed that IPM strategies consisted of a variety of different approaches used in various combinations depending on specific conditions and circumstances under which termites occur. It was concluded that some of the best opportunities for developing IPM strategies in China to manage termites included the following components:

- Building codes, chemical registration, pricing, warranty and training (policy and legislation)
- Understanding termite biology and ecology, and employing cultural controls and education/extension (monitoring/prevention);
- Design and construction, including physical barriers, (prevention);
- Bait system monitoring of colony establishment for prevention of infestation (monitoring); and
- Bait systems with chemical toxicants for early control, targeted growth regulator chemicals, and limited use of other chemicals to handle heavy infestations (control).

Some challenges to the implementation of IPM in China were also noted and presented in the report submitted to SEPA in October, 2004 (Contract Item B).

FIELD VISIT FOR DEMONSTRATION PROJECT (JUNE 9 – 20, 2004)

Drs. Bill Dushenko and Matt Dodd participated as the RRU representatives in the June Mission for the Sino-Canadian Termite Management Project held with the World Bank, SEPA/CIO and Chinese termite control experts from Jiangsu and Zhejiang Provinces. RRU's portion of the mission took place in Nanjing, Wuxi, Hangzhou, and Beijing from June 9 to 20, 2004. The meeting in Nanjing outlined strategies for the phase-out of persistent organic pollutants (POPs) including DDT, HCB, chlordane and mirex in a presentation provided by Peking University. A presentation was also given on baseline information available for Hangzhou City and Zhejiang province as a potential

demonstration project area for IPM and termite management alternatives. The need to provide technical support on analytical methods for collecting baseline information was identified and RRU was tasked with drafting an analytical and sampling plan. A technical report "Sampling and Analytical Methods for Chlordane and Mirex" was subsequently prepared and submitted to SEPA in July 2004 (Contract Item G).

A tour of a chlordane production factory in Liyang was conducted on June 11, 2004. This plant, which started production in 1997, employs over 50 workers with activities occurring at two different sites. The buildings at both sites were in a state of disrepair. There were plans to decommission the sites and; based on visual observations on site conditions, strong odour of chemicals in stained areas, miscellaneous debris, and wastewater discharge site cleanup; would be required. There are currently no cleanup standards or protocols for chlordane and mirex in China and SEPA would need to initiate this work.

Our mission continued with meetings in Wuxi on June 12 and 13, 2004. Discussions on *policy and institutional strengthening* by the National Termite Control Centre in Hangzhou on were conducted on the morning of June 12. A presentation on the IPM components for the demo project was provided by Zhejiang University on the afternoon of June 12. The institutions anticipated to be involved with the demo project include the National Termite Control Centre, Professional Termite Control Association, termite control stations in each municipality and county within the demo area(s), and other administrative departments and bureaus of the government (e.g. Construction, Environment and Finance ministries, Railway Bureau, and others). The roles and objectives of the Sino-Canadian component of the project, within what was proposed, was discussed and it was suggested that it's primary contribution might be to determine which alternatives should be used and where in each area; such as buildings, dams and dykes, agriculture, and forestry. Lengthy discussions of presented costs for the demo project ensued, with the largest component being the implementation costs. One concern out of the information presented was the lack of an integrated framework in which to develop an IPM strategy that could be both tailored to a specific province (demo area) and scaled up to other areas in China. There also appeared to be some confusion in reaching consensus on what is meant by IPM among the Chinese delegates.

A presentation on *defining IPM and the elements of an IPM strategy* was therefore presented by RRU on the morning of June 14 in Hangzhou, highlighting the major output of the Sino-Canadian Project. This included the goal of IPM, which is to minimize the impact of pests (in this case, termites) by using a *variety* of control procedures (not just chemical alternatives to chlordane) and an attempt to *decrease* the overall chemical input into the environment. This includes focusing on the ecology of the termite as the basis for the prevention of problems (e.g., providing habitat conditions that are unfavourable to termites), more so than the chemical characteristics of the toxicants used to control them. It was emphasized that IPM represents a philosophy rather than a specific control measure. A copy of the presentation was provided to SEPA at the meeting.

In the discussions that followed, the importance of collecting accurate baseline information on the Sino-Canadian project was emphasized. This has been problematic in the past given the range of different activities and agencies involved in termite management. It was decided, therefore, that RRU provide a list of questions (24 in total) to SEPA on baseline information from the demo area(s) that could be used to develop the general framework and generate an IPM strategy.

The group toured the Green City Residential Development Demo Project on the morning of June 15, 2004. This new construction project incorporated the use of pine-baited boxes and provided a good starting example of IPM use in China. Based on presentations by RRU, the Wuxi City Termite Control Unit presented their interpretation of an IPM strategy for the demo area(s), with particular reference to Jiangsu province and Hangzhou City. This consisted of six components: IPM technologies, promotion, an application manual, study tours to see IPM in other countries, cost variations in implementation, and functioning of the demo project. The meetings in Hangzhou concluded on the morning of June 17 with a presentation by the National Termite Control Centre on the *institutional capacity of the demo area(s)*. Policy evaluation and strengthening was addressed in terms of the demonstration area(s) including revising the following to satisfy the demands of the IPM strategy: termite management methods and technical regulations for controls, quality management methods for termite control and construction projects, fee collection standards, and a price manual for construction projects.

Our mission concluded with meetings in Beijing on June 18 at the SEPA offices; among representatives from SEPA/CIO, the World Bank, the Sino-Canadian Termite Team and the Sino-Italian PCB Team; on the framework of the project briefs for the PCB and Termite Demonstration Projects. Considerable discussion was conducted during the June mission in providing the Chinese authorities with an understanding of IPM that goes beyond simply replacing one chemical alternative for another. The consensus was for the development of a “toolbox” for termite management in the demo province(s) that would need to consist of the following elements:

- *Policies*, e.g., construction codes, chemical registration, pricing, warranty and training;
- *Monitoring*, e.g., biology/ecology, bait boxes, computer based monitoring, inspection and visual monitoring, locating nests, education and training;
- *Prevention*, e.g., structural design, treatment of wood, physical barriers, chemical barriers, and education and training (cultural control); and
- *(Damage or remedial) Control*, e.g., chemical treatment, biological control (research and development), physical measures (e.g., nest digging), and education and training.

The toolbox would be specific to the demo area and used within the general framework to formulate an IPM strategy. This general framework will be adaptive and a key element in developing future IPM strategies (scaling up) for other provinces. The toolbox would incorporate answers to the series of baseline questions submitted to SEPA to be addressed by the various termite control experts in the demo area. It was anticipated that a complete first draft of the IPM strategy for the demo area(s) would be developed through iterative consultation with the Chinese authorities and be available by the end of August 2004. An expert workshop in IPM strategies was also planned by SEPA for October 2004 and would likely include IPM experts from the US, Australia/New Zealand, and the World Bank. This would provide the opportunity to conduct an external expert review of the draft IPM strategy for the demo area(s).

The IPM Toolbox was developed and the report “*Preliminary Report on the Development of a Toolbox for Integrated Pest Management (IPM) Strategy*” was submitted to SEPA in

October 2004 (Contract Items E and F). The main elements of the toolbox consisted of the following basic elements:

- *Policies* – including institutional arrangements among stakeholders at different levels, and mandates that support and encourage the adoption of a range of alternatives;
- *Monitoring* – systems in place to assess the nature and progress of termite infestation, direct the selection of management actions, and evaluate their efficacy (e.g., biology/ecology, bait boxes, computer based monitoring, inspection and visual monitoring, locating nests, education and training);
- *Prevention* – proactive alternative approaches that minimize or mitigate the risk of potential termite infestations (e.g., structural design, treatment of wood, physical barriers, chemical barriers, cultural control, and education and training); and
- *(Damage or Remedial) Control* – prescriptive alternative measures designed to mitigate existing termite infestations in structures [e.g., chemical treatment, biological control (research and development), physical measures (e.g., nest digging), and education and training].

All of these basic elements were incorporated into a decision-making framework for an IPM strategy that was presented in a flow chart. The four elements of the Toolbox (Policy, Monitoring, Prevention and Control) were discussed in detail and an inventory of toolbox elements currently existing in China, as well as information gaps and areas of uncertainty that needed to be addressed to implement an IPM strategy for a given area more effectively were given.

EXPERT WORKSHOP ON IPM STRATEGY (14 – 16 OCTOBER 2004)

SEPA organized an international expert workshop on IPM from October 14 – 16, 2004 in Beijing to evaluate and improve the technical strategy and the IPM implementation plan proposed by the local experts. Participants at this workshop included Dr Aziz Lagnaoui (The World Bank), Dr Nan-Yao Su (University of Florida), Dr Michael Lenz (CSIRO, Australia), Dr Matt Dodd (RRU) and Chinese experts from The National termite Association, University of Peking, Nanjing Termite Control Institute, Wuxi Termite Control Institute and National Termite Control Center.

Dr. A. Lagnaoui gave a presentation on The World Bank Safeguard Policy on Pesticide and Pest Management. He outlined the need for safeguards and outlined the key policy provisions. The main objectives of the policy were to minimize environmental and health

hazards arising from pesticide use, ensure all activities follow an IPM approach and develop a national capacity. The need for an Environmental Assessment and a Pest Management Plan prior to the implementation of any chemical alternatives was also stressed. This was followed by a talk by Dr M. Lenz (CSIRO) on IPM in termite control in Australia. Elements of IPM in Australia included “Building out Termites” using physical barriers, government inspections, monitoring and baiting, ecology and economic and social benefits. Elements of the IPM toolbox developed by RRU formed the basis of the next presentation by Dr M. Dodd (RRU). A copy of the presentation was made available to SEPA and all participants at the meeting. This was followed by discussions during which Dr Su noted that the IPM strategy developed by the Chinese Experts was in line with the toolbox elements.

A summary of the baseline information for the demonstration area was presented by the Chinese Experts and a strategy for the implementation of the POPs Convention was also given. China’s strategy is to reduce POPs use by 2014. This will include the phase out of chlordane in different regions starting with the demo provinces and replication in other areas in subsequent years. Incremental cost and capacity building required to achieve this was then discussed. The key activities for reaching the objectives were: introduction of alternatives; monitoring; and replication.

The criteria for the selection of the demo area was also discussed and included

1. Representative and extent termite damage in the demo area.
2. Termite control and research and development experience
3. Co-financing and administrative support by local government
4. Large consumption of chlordane and mirex.

The demonstration area selected on the basis of the above were

1. Jiangsu Province
2. Zhejiang Province
3. Guangzhou City (as a pilot city).

The preliminary IPM Strategy for the Demonstration Project and key risk and obstacles to its implementation was presented by Director Li, Wuxi Termite Control Institute. The basic requirements of the IPM strategy, economic and injury thresholds, stakeholders

involved and cost benefits were presented. He continued his presentation by describing termites and their economic importance in the demo areas as well as the use of chlordane and mirex for their control. After a synopsis of the available termite control technologies and their advantages and disadvantages as applicable to the situation in China, Director Li discussed the criteria for the selection of control tools and presented the main component of the IPM strategy for the demo area. He suggested the core technology of IPM strategy should be the monitor-controlling system and provided nine reasons to support this. Other assistant technologies to be considered included local chemical treatment, physical barrier, building design, preservative-treated wood, and nest-excavation that may be used selectively to supplement core technology. The steps to the IPM implementation and incremental cost were also given. A copy of the presentation and the report was submitted to SEPA and all the participants at the meeting.

Director Li's presentation was followed by a discussion of the strategy after which Drs. N-Y Su, M Lenz and M Dodd were tasked by SEPA to review and provide comments on the feasibility of the developed IPM strategy. M Dodd (RRU) was also tasked with ensuring that elements of the toolbox developed by RRU had been incorporated into the IPM strategy. The three researchers met on October 16 and 17 to work on the IPM plan. It was evident that more time was needed to complete the review and, as such, the document was divided into three sections as follows: N-Y Su (Sections 1 &2), M Dodd (Sections 3 & 4) and M. Lenz (Section 5 and Appendices). The edited sections from M Lenz and M Dodd were submitted to Dr Su who merged the documents, provided the final edits and submitted the final version to SEPA on October 26, 2004. The finalized IPM strategy report formed part of documents submitted by SEPA to the World Bank (Contract Items F and H).

TECHNICAL SUPPORT TO TESTING OF DIFFERENT ALTERNATIVES

The objective of this task was to provide technical support to the local Chinese consulting firm for testing alternatives to chlordane and mirex for termite control including the provision of alternate samples if not available locally in China. The local consulting firm identified the required chemical as Agenda 2.5 EC as requested through email from SEPA on August 17, 2004. The active ingredient was identified as Fipronil, a low-dosage, fast-acting, non-repellant spray termiticides. We attempted to obtain samples

for SEPA. Upon investigation the active ingredient (Fipronil) is not registered in Canada so obtaining these samples was not possible. We informed SEPA of this by email on November 29, 2004 and requested feedback on whether information was required regarding the testing protocols.

CURRENT STATUS OF PROJECT AND CONCLUSION

SEPA has noted that the Sino-Canadian project and contributions from RRU have been extremely valuable in preparing a PAD, in support of the demonstration project, to the Global Environmental Fund (GEF) entitled "Demonstration of Alternatives to Chlordane and Mirex in Termite Control in China. This includes the completion of baseline information in the two demonstration provinces: Jiangsu and Zhejiang; testing of chemical alternatives and IPM methods for the demonstration project; and studies on institution capacity, policy and construction codes. It is planned that this PAD document will be submitted to the GEF for approval in May, 2005. The Canadian POP Trust Fund with the World Bank has been extended to June 2006, with the China POPs case studies (TF 051540) anticipated to be finished by February 2006.

The next phase of the demonstration project is to develop the appropriate safeguards required for funding by the GEF, including Environmental Impact Assessments (EIAs), focused on the decommissioning of chlordane & mirex production plants; Pest Management Plans (PMPs), focused on the potential risks associated with changing current chemicals used in termite control; and Social Assessments (SAs) on the incorporation of IPM by communities within the demonstration area(s). Terms of Reference have been developed by SEPA for each of these safeguard components. The University looks forward to its continuing involvement in the on-going demonstration project.

In closing, RRU would like to thank SEPA, the People's Republic of China and the World Bank for involving the expertise of its researchers in the POPs Program to date, as well as for their hospitality and collegiality. We look forward to a continuous and prosperous relationship in the future.