Communities in Peril:

Global report on health impacts of pesticide use in agriculture

Pesticide Action Network

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Cover photo: With a pesticide container on his back, a young boy helps his father in their farm in Velingara, Senegal. September 2006. Photo credit: PAN Africa

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Foreword

Since its founding in 1982 Pesticide Action Network (PAN) has worked to replace the use of hazardous pesticides with ecologically sound and socially just alternatives. An important basis and tool of PAN's work has been monitoring the distribution, use and disposal of pesticides. The latest result of PAN monitoring initiatives is this report. It documents that pesticides still cause wide-ranging hazards, risks and poisoning in Africa, Asia and the Americas.

PAN International releases this report during unprecedented and simultaneous disruptions in the major world systems upon which we all depend: climate, ecosystems and economies. These disruptions threaten the livelihoods and lives of many people around the world, and especially those in developing countries. However, this period offers an urgent stimulus for a rethinking of the architecture of our world's fundamental systems, and for solutions that can address a global food crisis, dramatic weather events and a changing climate increasing droughts, floods and storms and collapsed economies.

This is the context for the enclosed report, which reflects how a food and agricultural system promoted by a handful of agrochemical corporations as the industrialization of agriculture, has not only failed to deliver on ending hunger and stimulating prosperity, but in fact, left a footprint of damage to health of peoples and ecosystems through the dangerous use, trade and disposal of synthetic pesticides.

Observations made throughout the world, through grassroots civil society groups and other organisations, show that chemicals, in particular pesticides, continue to have severe negative and unacceptable effects on the health of communities and the environment, especially in developing countries. According to the World Health Organisation (WHO) acute pesticide poisoning will affect three million people and account for 20,000 unintentional deaths each year. However, estimates range from one million to 41 million people affected every year. In many communities and nations, those living in poverty, women and children continue to be disproportionately exposed to pesticides, making this an issue of fairness and environmental justice. The political will has not existed to thoroughly document and expose the magnitude of the pesticide problem in individual countries, across regions, and in the world as a whole. Efforts such as these, where civil society organisations document the scientific and community evidence, are crucial. And the findings are disturbing as can be seen in this report.

Current trends show that the market for herbicides and insecticides in developing countries is growing. The amount of pesticide actually reaching the target pest is often low, and a greater part of the pesticide used ends up contaminating the environment. Moreover, according to the WHO, some 30% of pesticides marketed in developing countries for agricultural purposes or for public health use, with a market value estimated at US$900 million per year, do not meet internationally accepted quality standards.

Among the environmental problems that arise from the use or misuse of pesticides are the adverse impacts on beneficial insects and non-target organisms. Many insects, and especially bees, are responsible for pollinating one third of global food production, including probably a third of the most important food crops. Pesticides are potential contributors to the serious decline of bee populations globally.

In many developing countries, difficulties have been observed in the use of synthetic pesticides. Even the least toxic pesticides can have unintended consequences which are very serious, given the conditions of use at local level. Furthermore, pesticides cause poisonings and are linked with chronic diseases in the countries that have invested significant resources in pesticide regulatory infrastructure and enforcement. In the United States, for example, a child gets an average of five servings of pesticide residues per day on food and in water. In Europe millions of bees died by a pesticide that was tested and registered according to law. There simply is no guaranteed 'safe use'. Investments and transitions to systems that are not reliant on pesticides are urgently needed. Luckily, such systems exist. Their take-up and spread needs far greater support.

Over the past 20 years, the number of regional and international legal instruments and conventions dealing with chemicals has increased by 80%, to approximately 50 agreements. The International Code of Conduct on the Distribution and Use of Pesticides, the Strategic Approach to International Chemicals Management (SAICM), the Stockholm Convention on Persistent Organic Pollutants and the Rotterdam Convention on Prior Informed Consent, are all designed to encourage a pesticide management system which will minimize risks to health and the environment. In addition, the Food and Agriculture Organisation of the United Nations (FAO) and WHO have developed many guidelines covering risks in the management of chemicals. These approaches and methods to reduce poisonings caused by conventional pesticide-intensive agriculture have largely failed.

The facts presented in this report published by PAN International, with the support of its partners, document the lives and suffering of people who are already often the poorest communities. The facts shown here are a small fraction of the disturbing problems that exist.

Local communities around the world – facing pesticide health and ecosystem threats, along with lack of efficacy and the broken promises of industrial agriculture – are taking initiatives to organize themselves, and are learning about and using more environmentally friendly methods of protection, such as agroecology, which help to safeguard their health and their environment, while producing nourishing food for families and communities.

PAN International hopes that this report will encourage governments, international institutions, companies and other stakeholders to pass policies and standards and implement adequate measures to ensure that chemicals are used only in ways that preserve the health of communities and protect the integrity of the environment for present and future generations. PAN wants to encourage governments, international institutions, companies and donors to stimulate a transition to food and fibre production based on agroecology. *Ultimately, community control over land, resources and food systems must be fostered.*

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24 June 2010

Executive Summary

This report presents the results of a wide-ranging survey of how pesticides are used in the field by communities around the world. It shows that hazardous pesticides are routinely used in unsafe situations, and supports the call by international agencies for more assertive action on pesticide hazards. The report illustrates the urgent need for significant investment and policy support for agroecological approaches to food, feed and fibre production.

Pesticide Action Network (PAN) groups in Africa, Asia and Latin America carried out surveys in 21 areas of 13 countries, based on community monitoring strategies. PAN groups in the United States monitored the air for the presence of pesticides. The material presented from Africa, Asia and Latin America is based on interviews with 2220 women and men from farming communities, agricultural workers and rural communities affected by spray drift. Surveys identified common signs and symptoms of pesticide poisoning, and found wide-spread ill health in areas that use different pesticides on diverse crops. Where consistent results could be analysed, from 1934 respondents in Africa, Asia and Argentina, and parts of Bolivia, the survey found that around half those exposed to pesticides – between 47-59% – suffer from headaches after spraying, often severe and sometimes chronic. In Africa and Asia and parts of Bolivia 34-39% suffer from dizziness, 31% from blurred vision and 28% from excessive sweating, while in Argentina the numbers suffering from these symptoms is between 21-22%. In Bolivia consistent problems were found with dizziness, nausea and vomiting and diarrhoea. Many of those exposed to pesticides widely suffer from nausea, diarrhoea, insomnia, skin rashes, hand tremors, excessive salivation, staggering, narrowed pupils, irregular heartbeat and convulsions.

The ability of those applying pesticides in developing countries to protect themselves is extremely limited. The survey shows that none of those interviewed wore personal protective equipment that met standards in an industrialised country; and most could neither find nor afford basic protective equipment. In many instances not even long sleeved shirts and long trousers are worn. The basic precautions for using hazardous material cannot be easily implemented: safe storage is lacking; no facilities exist for returning or recycling empty pesticide containers; hazard awareness is low as information and training is unavailable.

The International Code of Conduct on the Distribution and Use of Pesticides was adopted in 1985, amended in 1989 and fully revised in 2002. The Code set standards for national laws, and most countries have legislation in place. But in spite of 25 years of action, the problems of pesticide poisoning continue. At the same time, global pesticide use is increasing, reaching record sales of over US$40 billion in 2008, and sales have grown most in developing countries of Asia and Latin America.

International action to eliminate hazardous pesticide active ingredients adopts a 'case-by-case', or 'chemical-by-chemical' approach, including incidents of specific poisoning under the scope of the Rotterdam Convention. Now, international bodies are calling for a more comprehensive strategy for pesticide *risk reduction, including the progressive ban on highly hazardous pesticides.* Through the Food and Agriculture Organisation of the United Nations (FAO), the Panel of Experts on Pesticide Management identified criteria for classifying *highly hazardous pesticides* (HHPs). However some important criteria were omitted, and PAN has developed more comprehensive criteria with a listing of HHPs. The survey shows the extent of use of HHPs: in Asia the list encompassed 82 of 150 active ingredients used by surveyed farmers, and seven of the 10 most used pesticides.

This report makes recommendations to support renewed and assertive action on pesticide hazards and hazardous pesticides. The adoption of a public health approach that eliminates pesticides on the basis of their intrinsic hazardous properties requires a major shift in national and international strategies. But the current approach of delaying action until evidence of health or environmental impacts becomes apparent places an enormous and unfair burden on pesticide users, agricultural workers and rural communities, particularly in developing countries. It causes environmental damage and has economic costs. The report calls for increased investment and policy support for agroecological approaches to food, feed and fibre production. Recommendations support a progressive ban on HHPs, together with investment in rural infrastructure and training strategies to reduce hazardous pesticide use, risks and dependence.

1. Introduction

The first international effort to address pesticide poisoning in developing countries took place 25 years ago when governments adopted the International Code of Conduct on the Distribution and Use of Pesticides (Code of Conduct) (FAO 1985). A raft of international efforts has followed, leading to the adoption of globally binding treaties and to pledges through responsible United Nations bodies. In spite of these commitments, pesticide poisonings continue. Although absolute numbers of sufferers cannot be identified with certainty, surveillance in targeted areas suggests that, despite many efforts, there has been little reduction in poisonings in rural areas of developing countries since 1985. The numbers affected may be greater now than previously thought, as pesticide use has increased during this period and rural areas lack infrastructure, access to risk reduction strategies and appropriate information and training, while poverty remains endemic. Many of the most hazardous pesticides that are banned or no longer used in industrialised countries are still commonly applied in developing countries.

The 2006 International Conference on Chemicals Management (ICCM) called for action on hazardous pesticides. FAO followed this with a renewed commitment for pesticide *risk reduction, including the progressive ban on highly hazardous pesticides* (FAO, COAG 2007). Following adoption of the international Rotterdam Convention on Prior Informed Consent (PIC) action has focused on identifying problem pesticides by documenting specific incidents and the responsible pesticide formulations. This case-by-case approach has made little progress. An effective public health programme to progressively ban highly hazardous pesticides and replace them with safe and sustainable alternative products and strategies would be a speedier and more effective way of combating the widespread health and environmental problems of pesticides in developing countries and around the world.

The Code of Conduct has called on governments to "carry out health surveillance programmes of those who are occupationally exposed to pesticides and investigate, as well as document, poisoning cases" (Article 5.1.3). In addition to the pesticide industry, the Code calls on Non-Governmental Organisations (NGOs), and all other stakeholders to assist implementation. The Pesticide Action Network (PAN) surveillance reported here has been undertaken by 24 organisations (see page iii) through community monitoring surveys in 21 areas of 13 countries in Africa, Asia and Latin America. The surveys took place in areas where pesticides are known to be widely used, but represent commonly grown crops and normal practices. The surveys paint a picture of why reliance on the use of highly hazardous pesticides remains a major global problem and of the issues that need to be tackled to make life for small scale farmers, agricultural workers and rural communities safer and more sustainable. The report presents data from 28 community monitoring actions in 11 US States which measure exposure from pesticides in the air, adding a further dimension to the understanding of pesticide exposure.

Widespread pesticide use – market trends

The pesticide market has changed dramatically since adoption of the Code of Conduct. Then, around 15 European and US multinational agrochemical companies dominated pesticide sales; following reorganisations and take-overs just six of these now control 80% of the market. Genetically engineered seeds, based on herbicide- and insect-resistant technology, make up a significant additional element in the profits of these companies. Japanese companies have a lesser share of global sales, while Chinese and Indian companies are important producers and China is expanding its pesticide exports. The market for agricultural pesticides[1] was US$17 billion at the time the Code was adopted. In the last 10 years sales have fluctuated, but reached a record US$40 billion in 2008 (see Table 1.1). Sales were expected to drop slightly in 2009.

The regional picture has changed since the mid eighties (see Figures 1.1 and 1.2). In particular sales in Asia and Latin America have grown more quickly than other regions. In considering the increased sales in developing countries, two further factors should be taken into account. First, companies price products for the market and they may be sold for less in developing countries. Secondly there is higher demand for older products in poorer regions of the world, as these tend to be cheaper. Measuring by value can mask higher volumes of sales in these countries. Another factor is that the cheaper products favoured by poorer farmers may be more hazardous, particularly in tropical areas where agriculture uses greater volumes of insecticides and these are generally more acutely toxic to humans than other categories of pesticides.

Table 1.1 Global sales of agricultural pesticides 1999-2009

Year	Sales US$m	% Change
1999	30,000	0
2000	29,200	-4.5
2001	26,780	-8
2002	25,150	-6
2003	26,710	6
2004	30,725	15
2005	31,190	1.5
2006	30,425	-2.5
2007	33,390	10
2008	40,475	21

Sources: 1999-2002 Wood MacKenzie reported in Crop Protection Association (UK) annual reviews; 2003-2008 Phillips McDougall reported on CropLife International website and in 'Facts and figures – The status of global agriculture', CropLife International 2009. www.croplife.org

1 Agricultural sales represent only a proportion of the market and exclude: forestry, leisure (e.g. golf courses), timber treatment, public health applications, migratory pest control, veterinary products, weed control on roads, pavements and railways and other non-agricultural purposes.

Figure 1.1 Global pesticide sales by region, 1985

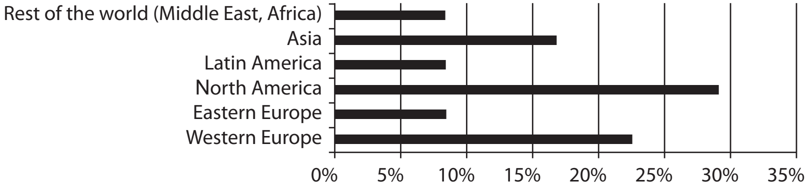
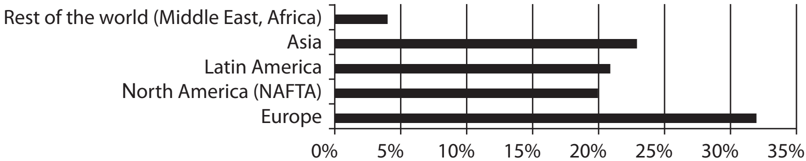


Figure 1.2 Global pesticide sales by region, 2008



Sources: 1985 Wood MacKenzie reported in Crop Protection Association (UK) annual review; 2008 Phillips McDougall in 'Facts and figures – The status of global agriculture', CropLife International 2009, p10. www.croplife.org Source: figures from Agrow journals 1986 and CropLife International www.croplife.org

Asian regulators meeting at an FAO workshop in 2005 estimated annual pesticide use in the region of around 500,000 tonnes of active ingredients. Some analysts suggest that the Asian market accounted for 43% of agrochemical revenue in 2008 (Agronews 2009), and that China is the world's biggest user, producer, and exporter of pesticides (Yang 2007). India is the second largest pesticide producer in Asia and twelfth largest globally (WHO 2009). In Latin America pesticide use has shifted dramatically from a 9% share of sales in 1985 to 21% in 2008. Some of the explanation lies in the expansion of soya bean production, which dominates parts of the sub-continent. Soya beans now cover 16.6 million ha, or 50% of the cropping area of Argentina. Pesticide application there reached 270 million litres in 2007 and in the same year in neighbouring Brazil, also a major soya bean producer, application reached 650 million litres. Soya beans are mainly exported to Europe for animal feed and to China for food uses. In Africa the trends in pesticide use are less clear, but there will be few areas where farmers now pass the year without applying pesticides (Williamson 2003). The continent accounts for less than 4% of global agrochemical use, but its farmers may face the greatest barriers in equipping themselves against pesticide hazards.

Regulating hazardous pesticides

The Code of Conduct encourages a life-cycle approach to pesticide regulation and control, recommending legislative and regulatory interventions by governments and initiatives from the pesticide industry at key points from production through distribution, use and disposal.

Most developing countries passed pesticide legislation after the Code was adopted. The Code was amended in 1989 to include the principle of Prior Informed Consent (PIC), an early warning system to governments in developing countries on pesticides banned or severely restricted in industrialised countries, and on severely hazardous pesticide formulations causing problems under conditions of use in developing countries. PIC became part of the legally binding Rotterdam Convention, which was agreed in 1998, and operated on a voluntary basis before entering into force in 2004. This prompted a review of the Code of Conduct, and the significantly revised and strengthened Code was adopted in 2002. However the Code itself is not legally binding and most legislation has not been updated in line with new recommendations. Developing countries find it difficult to fully implement their pesticide legislation, lacking sufficient scientific personnel, inspection services, infrastructure and financial resources.

Throughout the 1990s a number of international treaties were agreed that addressed hazardous pesticides (and other chemicals) and trade practices. In addition to the Rotterdam Convention, governments agreed the Stockholm Convention on Persistent Organic Pollutants (POPs), the Basel Convention on trade in hazardous waste, and the Montreal Protocol on ozone-depleting substances. The Conventions have been widely ratified in developing countries, though resource constraints mean that they are unevenly implemented.

Of the international treaties, the Rotterdam Convention most addresses the problems of hazardous pesticides in developing countries. The text of the Convention supports information exchange and a process for countries to prevent exports and imports of banned or severely restricted pesticides. In addition, it encourages identification of pesticides that cause problems to health or the environment under the conditions of use in developing countries and countries with economies in transition. However this aspect of the convention is based on documentation and notification of specific incidents and associated pesticide formulations. Five severely hazardous pesticide formulations which had been previously identified were included in the Convention when the text was adopted in 1998, but since then only one has been added by a government (Senegal) as a result of following procedures agreed in the Convention. There are clear deficiencies in the process agreed, which is failing to identify and act on pesticides that are causing poisoning incidents in developing countries.

Action on hazardous chemicals continues to be a high international priority. In 2006 governments at the ICCM endorsed a policy framework for international action on chemical hazards. The Strategic Approach to International Chemical Management (SAICM) stresses the importance of shared and multi-stakeholder responsibilities throughout chemical life-cycles' so that, by 2020, chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment.' (ICCM, SAICM 2006). This is taken up by the FAO activities for a progressive ban on HHPs.

The extent of pesticide poisoning – estimates and surveillance

Global pesticide poisoning figures are unknown, and the most enduring estimate was calculated by the World Health Organisation (WHO) in 1990. In a detailed study, WHO found that, annually, poisoning is likely to affect three million people with acute severe symptoms; account for 20,000 unintentional deaths and 20,000 deaths from self-harm; and cause 735,000 cases of specific chronic illnesses. A report for the WHO and the UN Environment Programme in 2004 found that poisoning disproportionately affects women, children and infants and that a developing foetus is particularly vulnerable (Goldmann 2004). At an Asian meeting to implement the Code of Conduct, a figure of 300,000 deaths per year was suggested for the Asia-Pacific region alone, based on studies carried out in Sri Lanka (FAO 2005).

Surveillance in rural areas in developing countries invariably uncovers a high proportion of acute pesticide poisoning incidents, with symptoms ranging from mild and transient to serious ill-health, and death. For example, a surveillance exercise in Central America revealed a 98% rate of underreporting, 76% of the incidents being work-related (Murray et al. 2002). In a South African study, a 10-fold increase of poisoning rates was found through intensive surveillance compared with routine methods; it found that occupational cases were underreported compared to suicides and the risks to women were underestimated (London, Baillie 2001). In

A woman spraying without any protection, Senegal (Photo: PAN Africa August 2008)

A woman measuring pesticide active ingredient for spraying without even minimal protection, Ross Bethio, Senegal (Photo credit: PAN Africa, August 2008)

Vietnam, a 12 month self-surveillance study of 50 farmers found that 54 moderate poisonings were reported per month, compared to only two per month treated at the local health care centre (Murphy et al 2002). A survey of 88 market gardeners in Abidjan, Côte d'Ivoire found that over half the pesticide users complained of ill health (Doumbia, Kwadjo 2009). Appendix 1 lists recent localised pesticide poisoning studies, particularly those from intensified surveillance.

The symptoms of acute pesticide poisoning are similar to common illnesses, such as influenza, migraine and eczema, making it difficult for non-specialist medical practitioners – as well as users – to recognise health effects of pesticide exposure. This leads to an underestimate of the instances of pesticide poisoning, particularly as toxicology makes up only a small part of medical studies. Although the WHO supports a system of Poisons Information Centres to provide specialist knowledge of antidotes and treatment of suspected poisoning for health professionals, this presupposes that those whose health is affected (a) recognise the signs and symptoms of pesticide poisoning, (b) have access to local medical services, and (c) that a poison centre exists in the country. In fact, very few developing countries have a centre, with only seven in sub-Saharan Africa. Southeast Asian countries have only 15 functioning poisons information centres, with capacity to respond to a maximum of 5,000 cases per year (WHO 2009). Studies have found that acute pesticide poisoning cases are inconsistently reported and often occupational and non-intentional cases are excluded (Watts 2010 forthcoming, Thundiyil et al. 2008). Most estimates also exclude chronic poisonings and pesticide-related disease, and do not quantify the full impact of pesticides in terms of the chronic effects including systemic damage and diseases, cancer, reproductive health problems and hormonal disruption (Watts 2010 forthcoming).

Advancing a progressive ban on highly hazardous pesticides

The mechanisms for action on pesticides responsible for pesticide poisonings have worked on a case-by-case basis, tackling active ingredients one at a time. The Rotterdam Convention action for identifying 'severely hazardous pesticide formulations' based on documenting and notifying a single incident, has failed. The proposal for a progressive ban on highly hazardous pesticides (HHPs) from the FAO Council represents a public health approach with potentially far-reaching benefits. The guidance for identifying HHPs from the FAO Panel of Experts on Pesticide Management recognised that HHPs must include pesticides that cause both acute and chronic health effects, as well as adverse environmental impacts. Their criteria, however, had a number of significant omissions, and PAN has drawn up additional criteria to cover their gaps together with a list of the pesticides that meet HHP definitions (See Appendix 4). This survey and report shows the importance of swift action and lays out the basis for supporting a progressive ban on HHPs.

The methodology for the community monitoring surveys is described in chapter 2, and follows practices described in PAN's Community Pesticide Action Monitoring (CPAM) guides. In a separate monitoring initiative, PAN North America (PANNA) developed a community-based approach to measuring pesticides in the air, called the pesticide 'Drift Catcher'. Communities facing exposure to pesticide-related health impacts through inhalation use the Drift Catcher to identify the presence and levels of pesticides in the air near homes, schools, work and play. Since few US states have transparent pesticide use reporting systems or any monitoring for the presence of pesticides in the air, the Drift Catcher has been an important tool for communities. The Drift Catcher is described in chapter 2.

The symptoms recorded in the surveys document acute poisonings as it is difficult for pesticide users to link chronic health effects to current or past pesticide use. The monitors documented conditions of use in the surveyed areas to investigate whether farmers and workers who apply pesticides are able to protect themselves and surrounding communities (chapter 3). In some instances, pesticide users are able to identify specific products and/ or active ingredients that have led to ill health. In other cases it has not been possible to make a specific connection, but users indicate how often they are affected and generally the products that they use (chapter 4). The pesticide use data collected has been analysed to indicate what proportions of products can be defined as HHPs (chapter 5).

The survey contributes to important recommendations to eliminate the most hazardous pesticides which urgently need to be translated into public health actions. The enormous gap between aspirational standards in international recommendations and the reality of rural farming areas in developing countries, and those living and working near pesticide use around the world, can only be bridged by promoting safe and sustainable strategies for agricultural development.

2. Methodology – community monitoring

Pesticide users are often unaware of health and environmental impacts of the chemicals they use. Poisoning symptoms are diverse and not always easy to associate with pesticide exposure. Environmental impacts are generally unknown by users or difficult to identify. Communities, particularly in rural areas, are often exposed to pesticides through spray drift or residues in the environment. PAN has pioneered community based monitoring (CBM) strategies to provide a methodological framework for monitoring impacts of pesticides on different communities. This report focuses on two initiatives.

Community Pesticide Action Monitoring (CPAM) is a tool for community based monitoring based on participatory action research which has been developed by PAN Asia and the Pacific (PAN AP). Its training modules assist rural communities with information on pesticides, health and environmental impacts, hazard reduction and alternatives. CPAM improves awareness of pesticide hazards, impacts and unacceptable consequences. It enables communities to discuss in their own language their experience of pesticide use. This awareness can motivate farming communities to develop solutions, which may involve: taking greater precautions to reduce exposure, where possible; reducing pesticide use; looking for safer pest management strategies; or advocating local or national policy changes. The CPAM research and documentation in this report draws on extensive monitoring through surveys carried out with pesticide users and rural communities in Africa, Asia and Latin America.

In the United States, PANNA has conducted community monitoring based on measuring the levels of pesticides in the air by using a Drift Catcher and a methodology developed by its staff scientists in collaboration with communities in several States. Using the Drift Catcher, trained communities can identify how far pesticide spray and volatilization drift can contaminate the air and whether these reach levels of concern for inhalation. Its projects train communities to gather air samples and use information to improve regulation and practice, reducing their exposure.

Interview with pesticide user in Wonosobo, Central Java, Indonesia. (Photo: Gita Pertiwi, September 2008)

The results of these investigations demonstrate the level of exposure to pesticides among workers and communities. The PAN International list of HHPs is used to evaluate the concern with substances identified in the studies.

2.1 CPAM – monitoring pesticide impacts in Africa, Asia and Latin America

For this study, PAN trained CPAM monitors from local areas to conduct survey questionnaires with pesticide users, and the data gathered gains valuable insights into everyday conditions of pesticide use and common health problems. The CPAM surveys aimed to provide a picture of the situation facing pesticide users daily. It focused on conditions of current use and practice, and pesticides used within the last two years. Where incidents or concerns are raised with pesticides beyond this period the report has

Training community monitors to undertake survey in Ivirgarzama region, Bolivia. (Photo: RAPAL, January 2010) excluded the information, or made clear the timescale, recognising that some older incidents may be important if the pesticide concerned is still in use.

PAN groups in Africa, Asia and Latin America carried out field surveys using a structured questionnaire (Appendix 2) to assess conditions of use, health impacts, and where possible the pesticides used. The questionnaire is based on PAN's experience; developed initially with medical assistance, it was modified in consultation with local organisations and communities. Critically, the questionnaire was translated so that, as far as possible, interviews were in the appropriate local language. Organisations participated in PAN CPAM-workshops and were trained in survey techniques and interview ethics; some of those trained became 'community monitors', and others trained local monitors in their own countries. Comments from these training sessions led to some modifications of the questionnaire. In particular the focus was narrowed and some questions omitted in recognition that farmers or workers had limited time to participate.

In total, 2220 people were interviewed in the Africa (three countries), Asia (eight countries) and Latin America (two countries) (Table 2.1; see also Tables 3.1, 3.4, 3.8). The consultations were predominantly with farmers or farming families or with agricultural workers. The exception was Argentina where the participants were drawn from communities living in heavily sprayed areas subject to spray drift. Data was gathered on health effects experienced, as evidenced by self-reported symptoms and incidents. Where possible further

2.1 Total number of pesticide users interviewed with CPAM survey methodology

Region	Total pesticide users interviewed	Countries where CPAM surveys were carried out
Africa	420	Mali, Senegal (two areas), Tanzania
Asia	1304	Cambodia, China, India (three areas), Indonesia, Malaysia (two areas), Philippines, Sri Lanka, Vietnam (two areas)
Latin America	496	Argentina, Bolivia (four areas)
Total	**2220**	

Source: Original reports from PAN Regions are available at www.pan-international.org in-depth interviews took place with some of those who had suffered from a poisoning incident.

Preparation and studies in Africa

PAN Africa organised two regional workshops to promote the CPAM approach. National training workshops took place in Senegal, Mali, Tunisia for NGOs and authorities in charge of chemical and pesticide management. In Tanzania a workshop for English-speaking countries engaged participants from Tanzania, Ethiopia, Nigeria and South Africa. The community monitoring surveys took place between February 2007 and July 2009, and were conducted by five organisations in Mali, Senegal and Tanzania. In Tanzania the CPAM approach was adapted for the participating NGO and the pesticide authorities to investigate the use of the form developed by the Rotterdam Convention on Prior Informed Consent (PIC) for reporting human health incidents that occur under conditions of use in developing countries (www.pic.int). In total 420 people (see Table 3.1) and 35 pesticides stores and shops (Table 3.12) were interviewed for this study.

Preparation and studies in Asia

Preparation began with a regional training session for facilitators from 11 organisations in eight countries held in Penang, Malaysia, in July 2008, and one training of facilitators held in Bintulu, Malaysia for facilitators of the one Sarawak-based organisation (Sarawak Dayak Iban Association). In addition to the CPAM training and interviewing techniques, the participants developed local and regional action plans. Each organisation trained community monitors to carry out interviews. The community monitoring took place from August to November 2008. Partners consulted with communities where pesticides are used either at work or elsewhere, and interviewed approximately 100 respondents in each community. In total, 1,304 respondents were interviewed (see Table 3.4). A further 69 detailed interviews with individuals who had suffered from pesticide poisoning were partly but not entirely drawn from the survey respondents. The survey in this region collected significant data on the identity of pesticides, frequency of use, and the percentage which highly hazardous pesticides comprised of total pesticides used.[2] Some participating NGOs interviewed retail stores;

2 With the exception of the data from Wonosobo community (Indonesia), undertaken by Gita Pertiwi: the data entry and analysis was done by Gita Pertiwi, Java. Questionnaires were sent to PAN AP for data entry and analysis, carried out with standard statistical software modified for this survey. The programme used for data entry was EPI Info version 6, a DOS based program used by US based Centre for Disease Control (http://www.cdc.gov/epiinfo/epi6/ei6.htm). A Microsoft Access database was used to record information on the pesticides identity and related details.

the results were difficult to analyse but revealed interesting insights (see section 3.4 and Table 3.12).

Preparation and studies in Latin America

Community monitoring in Latin America took place in Argentina and Bolivia (Table 3.8). The study in Argentina focuses on communities affected by spray drift rather than impacts on pesticide users. Each country held training workshops for those facilitating and carrying out the field work. The community monitors all attended these workshops and were aware of the purpose of the survey in relation to health impacts associated with pesticide exposure; environmental issues such as deforestation to expand agricultural production; choice of pesticides; and methods of application, including aerial spraying.

Methodological limitations to CPAM studies

The surveys drew on experiences over a wide area on a limited budget, and no control samples were established. The study areas were those where pesticides were known to be widely used. Although the interviewees were selected at random, they are largely, but not entirely, pesticide users. The largest number not using pesticides was in the Pucarani area of Bolivia where 44% of participants have converted to ecological farming. The information documented is presented on this basis and can neither draw conclusions about percentages of overall numbers affected nor be extrapolated to the whole country. However the experiences are likely to be typical rather than exceptional.

Where possible, it has named pesticides (active ingredient and/or product) commonly cited as causing problems, particularly those associated with poisoning incidents, but this was not possible in all the surveys. A significant concern in developing countries is the level of adulterated or mis-labelled pesticides available, and the results have assumed that the pesticide product contains the active ingredient specified on the label.

The use of local languages in conducting the surveys aimed to minimise misunderstandings in interviews. However all material has been translated into English, in some cases through intermediate languages, and some errors may have occurred.

In spite of these limitations, the survey evokes a picture of normal – and certainly widespread – conditions of pesticide use and of the problems encountered by both pesticide users and others exposed to pesticides.

2.2 Community-based monitoring in North America

Methodology for building evidence and power for strategic action

PANNA's monitoring programme is based on a combination of community-based monitoring (CBM) and participatory action research principles and methodology. PANNA and community-based organisations use these principles and methods to strengthen community relationships and power, to sharpen campaign analyses and plans for action, and to make scientifically explicit the burden of pesticide exposure. Outcomes of the programme include bolstered community power to take action against hazardous pesticides in their environment and more robust analysis. The scientifically-sound data assists communities in campaigns to change pesticide policy, provides an increasingly strong body of evidence of pesticide contamination in the US and internationally, and increases visibility of the problem of pesticide exposure as a public health issue.

PANNA links community-based organisations with its staff scientists to investigate levels of pesticides in the air, water and in people's bodies. PANNA collaborates with the organisations on research design, and community members are primary researchers. Laboratory analysis of the data is conducted by staff scientists and/or independent laboratories and results are discussed and synthesized by the staff scientists and community participants, together. The scientific data is used to understand localized details of pesticide threats and to strengthen local-to-international campaigns for change.

The Drift Catcher is the air monitoring device used in this community–monitoring programme (see Box 1) (PANNA 2005a). It is an important tool for use in intensively sprayed areas and areas of spraying near people's homes, workplaces and schools – places where children live, work and play. It captures pesticide spray and volatilization drift which have travelled from the point of application and can affect nearby communities. PANNA scientists, together with community-based organisations and independent scientists, developed and launched the Drift Catcher in 2003. PANNA provides training for community-based groups in the technical aspects of using the Drift Catcher, and offers a certification programme for Drift Catcher operators, who follow protocols recognised by the state of California and US EPA as scientifically robust. An organising manual helps facilitate the development of an effective local campaign for social change (PANNA 2005b). The projects link community-based organisations with state, national and international campaigns for pesticides policy change and enforcement.

Drift Catching has proven an important tool that strengthens community organising efforts, raises the profile of pesticide issues in the media, and offers critical data as part of strategies toward winning important policy changes. Since its 2003 launch, Drift Catchers have been deployed for 27 projects in ten US states by trained volunteers and community leaders. Descriptions of Drift Catcher findings are listed in 5.6, and results from projects carried out from 2003-2009 are detailed in Appendix 5.

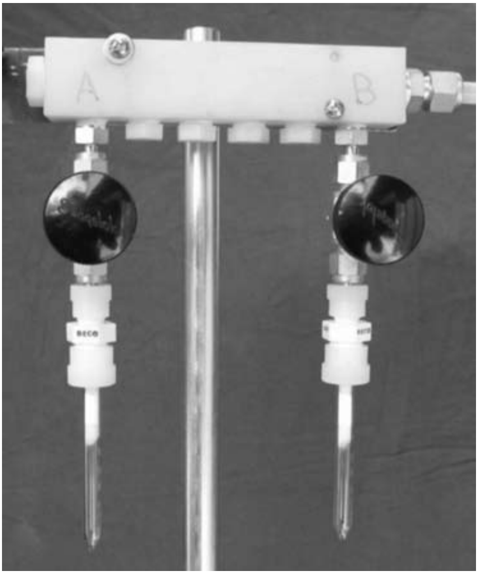
The Drift Catcher could play a role in other parts of the world where communities are affected by spray and volatilization drift from monoculture production, but cannot get information from the plantations or companies which control the spraying.

Box 1. Measuring exposure by capturing sprayed pesticides – the Drift Catcher

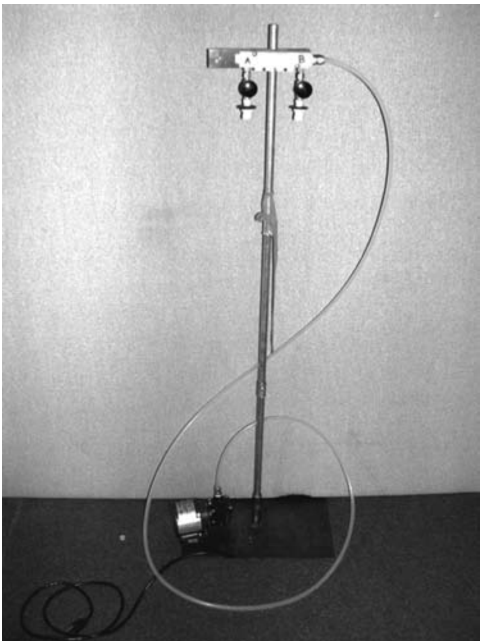
Many rural communities are exposed to pesticides as a result of spray and volatilization drift, largely via inhalation. In most areas in the US there is no policy or regulation that requires applicators to tell people what they will be, or have been, exposed to. These communities cannot identify the pesticides sprayed, and indeed may be unaware of exposure. The Drift Catcher is a simple air sampling system that can be used by the layperson to measure levels of pesticides in the air. It operates on principles for air sampling equipment and protocols used by the State of California and it has been reviewed by a scientific advisory committee comprised of researchers with expertise in air monitoring drawn from the US EPA, California Department of Pesticide Regulation, the US Geological Survey and other agencies.

The Drift Catcher works like a vacuum cleaner, sucking air through sample tubes that are packed with an adsorbent resin. As pesticide-contaminated air is drawn through the tubes, pesticides stick to the resin and are filtered out of the air. All Drift Catcher operators receive hands-on training in workshops led by PANNA scientists, and are certified in a one-on-one testing session. Only certified operators are allowed to collect samples. After about 24 hours of sampling, the tubes are removed and stored in freezer. When sufficient sample tubes are collected they are sent to a laboratory for analysis, to identify the pesticides captured, and calculate the level of pesticides for each sampling period. Drift Catcher sampling follows methods developed by the National Institute for Occupational Safety and Health (NIOSH), the California Air Resources Board, or the US EPA. Along with technical aspects, the drift catcher training includes participatory, campaign planning that involves community leaders in developing a plan of action for change in pesticide policies and practices.

As a result of the information collected and analysed in laboratories, communities and individuals can find out exactly what they have been exposed to. This has helped them to take action for reducing their exposure. In some cases their evidence has contributed to a ban of a pesticide (for example molinate) in the state. In other cases it has led to an increased ‘free zone’ between the sprayed area and residential areas, schools, health centres and other public places.



Close up of manifold of Drift Catcher air sampling device with sample tubes attached. (Photo: PANNA)



Drift Catcher air sampling device. A pair of sample tubes are inserted into the manifold at the top of the metal stand, and the pump (blue, sitting on stand base) draws air through the tubes at 2 liters per minute. (Photo: PANNA)

3. Results – poverty and conditions of pesticide use

This section looks at the conditions of pesticide use found in the CPAM surveys. It provides a brief description of the general conditions facing rural communities in the 21 areas of 13 countries that participated in the survey, and describes the results. The questionnaire focused on the ability to purchase and wear personal protective equipment (PPE), and knowledge of principles of application – for example disposal of empty containers, storage of unused pesticides, and taking account of wind when spraying. In Tanzania the survey addressed whether farmers read the label and follow label instructions. In the Asia region the focus was PPE, spraying methods, and pesticide disposal and storage. In Argentina the survey focused on communities affected by spray drift rather than the pesticide applicators.

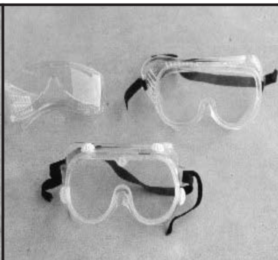
The International Code of Conduct on the Distribution and Use of Pesticides defines PPE as:

> **Personal protective equipment** means any clothes, materials or devices that provide protection from pesticide exposure during handling and application. In the context of this Code, it includes both specifically designed protective equipment and clothing reserved for pesticide application and handling.

The Code further says that:

> **3.5** Pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available should be avoided, especially in the case of small-scale users in tropical climates. Preference should be given to pesticides that require inexpensive personal protective and application equipment and to procedures appropriate to the conditions under which the pesticides are to be handled and used.
>
> Government and industry should cooperate in further reducing risks by:
> **5.3.1** promoting the use of proper and affordable personal protective equipment (5);

Consideration of recommended PPE shows the difficulty of expecting farmers and agricultural workers to protect themselves. Pesticide users are advised to wear an overall, or at least long trousers and long shirt sleeves, hat, gloves, eye protection, a mask or a respirator. Good quality boots made of rubber (not porous materials) should be worn with socks. Trousers should not be tucked in, but placed over the boots to prevent any liquid dripping into the boot. Clothing should be laundered after it is worn for spraying – an

		
Rubber or chemical resistant gloves	Goggles should have covered vents on the sides for protection	Respirators prevent inhalation of dusts, powders, vapours and spray droplets

Photos: Rankin GO and Velentovic, MA, Chemical Spray Safety activity that can expose others and leave residues in water that is also used for washing other clothes, or even in drinking water. A wide-brimmed hat is important to stop spray being absorbed into the body through the scalp, and the brim will help protect the face and eyes. Gloves must be made of rubber or a chemical resistant material, and should be replaced immediately at any sign of leaking. Goggles provide more protection than glasses, and should be shielded around the lens to prevent entry of particles from any angle. A mask will absorb spray and should be replaced regularly. A properly fitted respirator prevents inhalation of dusts, powders, vapours or spray droplets. Respirators filter air with a cartridge or canister (more heavy duty) which will need to be replaced regularly – preferably every eight hours.

Those applying pesticides need to be aware of neighbours, nearby crops, and ideal environmental conditions to protect themselves and others. It is important to avoid walking through 'just sprayed' vegetation, and avoid contamination if the wind is blowing spray into the applicator. An ideal wind is steady at 3-15 km/h. Sprayers should be aware of spray drift risks to bystanders, crops, animals and water.

3.1 The African surveys – conditions of use

African farmers, and particularly women, form the backbone of the economies of many countries in the region. In spite of the small share of global pesticide trade (4%), pesticide use is widespread in rural areas and few farmers will pass a year without applying some form of chemical pesticides (Williamson 2003). The use of pesticides on subsistence crops as well as on export crops represents a significant risk for farmers and populations in sub-Saharan Africa. Many crops, such as cotton and vegetables, are treated several times before harvest. African farmers are possibly the least equipped to protect themselves and their community against the hazards of pesticide use, in terms of literacy, education, access to information and poverty. Thus, while overall pesticide use appears lower than in other parts of the world the rural population and the environment are likely to suffer significant exposure. The CPAM survey of 420 farmers took place in Mali, Senegal and Tanzania (Table 3.1).

The 13 million population of Mali is predominantly dependent on agriculture, with 70%-80% living in rural areas. As many as 20% of the population are dependent on cotton production, the crop where pesticide use is greatest.

Table 3.1 Surveys in Africa carried out between February 2007 and July 2009

Country	Area	No. interviewed	Crops
Mali	Sikasso	100	Cotton
Senegal	Velingara, South	100	Cotton
Senegal	Ross Bethio, North, in the Senegal River Valley	100	Rice
Tanzania	Ngarenanyuki	120	Horticulture

Interviews took place with 100 farmers in the fertile and rain-rich Sikasso area, the major cotton-producing zone and the focus of agricultural development efforts. Paradoxically, Sikasso is the poorest region and cotton producers are on average poorer than other farmers (Delarus J et al. 2009). Ninety percent of the farmers interviewed used pesticides themselves, mainly in the fields (82%) but also in homes (5%).

Agriculture is central to the livelihood of approximately 70% of the 12.17 million population of Senegal according to Senegalese Economy and Financial Ministry in 2010. The survey interviewed 100 farmers in the predominantly cotton-growing area of Velingara in the South, and 100 rice growing farmers at Ross Bethio, Senegal River Valley, in the North. In Velingara 90% of those interviewed used pesticides and 95% in Ross Bethio. In addition to agricultural use, farmers use pesticides in their homes against ticks, cockroaches and other pests.

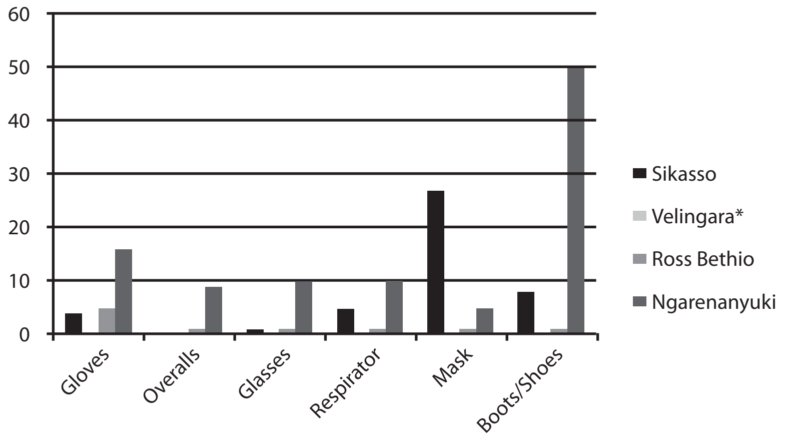
Tanzania has a population of around 40 million, with approximately 75% living in rural areas, where agriculture is the mainstay of their livelihood. The study area of Ngarenanyuki is made up of five villages at the foot of Mount Meru in the north of the country. Farmers grow vegetables to supply local and regional markets. Recent projects have raised awareness of pesticide hazards, but 95% of the 120 farmers interviewed use pesticides and most believe they are essential for horticultural production. The methodology in Tanzania varied in some respects from other CPAM surveys, but is sufficiently similar to allow a comparison.

Use of PPE

The proportion of farmers using PPE was tiny and none wore sufficient protection (Figure 3.1). In Sikasso, Mali, although only nine farmers were

Pesticide leaking from equipment onto a producer spraying without wearing any protection, Tanzania (Photo: AGENDA, May 2006)

Figure 3.1 Number of farmers wearing PPE in surveys in Mali (n=100), Senegal (n=100 in Velingara; n=100 Ross Bethio), Tanzania (tn=120) (%)



See text for notes on regular clothing worn

* *Only five farmers in Velingara indicated they wore any form of PPE*

The container for refilling spray equipment is left in the drum, Tanzania (Photo: AGENDA, October 2007)

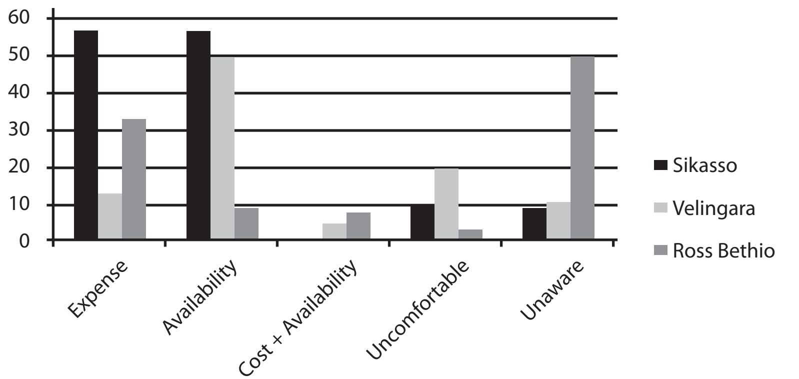
unaware of the need to protect themselves less than half (48) wear any form of protection. The most common form of PPE was a mask (27), eight indicated they wore shoes or boots, five said that they used a respirator and four wore gloves. No farmers owned overalls dedicated to use when spraying pesticides, however almost half (48) said they wore long-sleeved shirts and trousers to cover arms and legs. In Senegal just five of the Velingara farmers used any PPE, although only 11 said they did not know that it was needed. In the Ross Bethio area half the farmers did not know that PPE was necessary, and only 10 used at least one item: gloves (5) and one each of overalls, glasses, respirator, mask, and boots or shoes. In Tanzania the majority of farmers revealed that they do not own, and never wear, PPE when working with pesticides (55%); of those who wear PPE boots are the most common protection, worn by 50%, followed by gloves 16%, respirators 10%, glasses 10%, overalls 9% and masks 5% (Table 3.2). In none of the three country studies did farmers possess complete sets of equipment or wear complete protection.

Interestingly, in Mali and Senegal farmers indicated that lack of availability and cost are more important reasons for not using PPE than comfort

Table 3.2 Protective gear worn and its condition in Ngarenanyuki, Tanzania (survey December 2006 – March 2007) (%) (n=120)

Wear PPE	Never	Sometimes	Every time
	55	13	9
Details of PPE	**Don't have**	**Use / poor condition**	**Use / good condition**
Gloves	68	-	4
Boots	28	7	42
Respirator	72		
Mask	69		
Glasses	72		
Overall	63	6	#8

Figure 3.2. Reasons for not wearing PPE in Mali (n=100) and Senegal (n=100) (%)

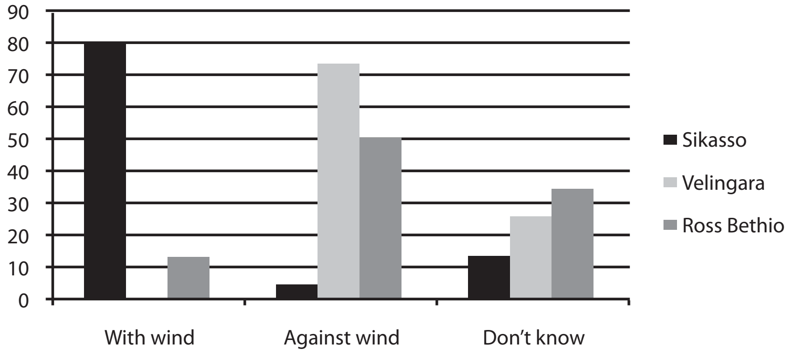


(Figure 3.2). In Tanzania the main reasons cited for not wearing PPE are non-availability, cost and lack of information. It is possible that in all areas the reason of comfort did not arise is mainly because it was rarely worn. In Tanzania, many farmers were very keen on having PPE and some said they would buy items at any cost.

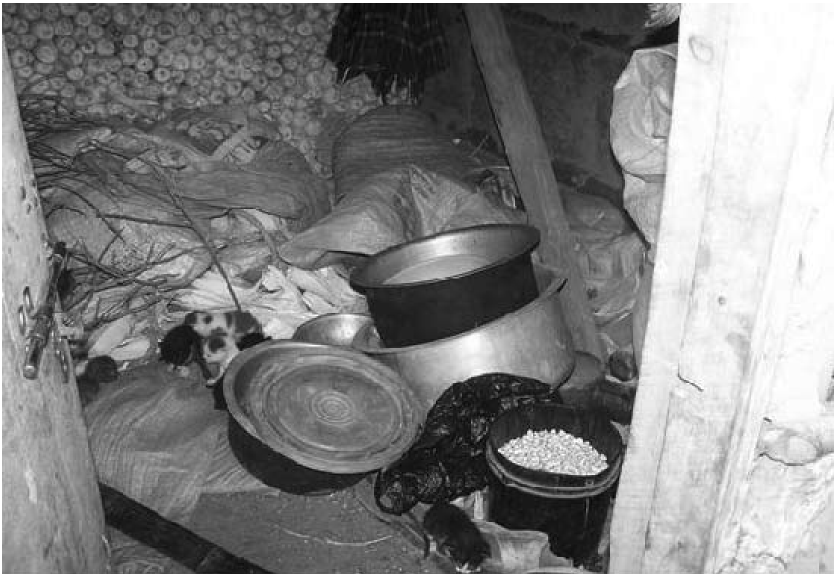
Spraying in the wind

Knowledge of spraying with or against the wind is an indicator of farmer awareness of safety during application. In Mali the majority of farmers (81) were aware that they should spray in the direction of the wind, however 14 did not know this and five sprayed against the wind. In Senegal farmers in both areas showed considerable confusion about the direction to spray, with those spraying against the wind numbering 74 in Velingara and 51 in the Ross Bethio (Figure 3.3).

Figure 3.3 Knowledge of spraying and wind direction



Spraying is carried out in a haphazard manner, Tanzania (Photo: AGENDA, May 2007)



Pesticides are stored in the home along with food and cooking pots (and kittens), Ngarenanyuki Tanzania (Photo: AGENDA, October 2007)

Storage of PPE in Ngarenanyuki, Tanzania (Photo: AGENDA, October 2007)

Figure 3.4 Disposal of empty pesticide containers

Disposal of empty containers

When asked how they disposed of empty containers, 62% of farmers in Mali said these are burnt, 14% bury them, 12% throw them in the field and another 12% in a toilet pit. A further 3% indicated that some containers are used for domestic storage, an extremely hazardous practice. In Senegal most empty containers end up lying in the fields (70%). The empty containers and sachets of pesticides frequently end up in water and contaminate the entire ecosystem, in particular the aquatic environment. In Tanzania burning or leaving containers in the field are the most common means of disposal, and an additional 7% of farmers indicated that they sell empty containers. No farmers return containers to pesticide suppliers. All of these disposal options can endanger health and/or the environment but farmers have no access to alternative means of disposal. Governments and manufacturers are urged to make return and recycling options available.

Label instructions

In Tanzania many of the participating farmers had received information to raise awareness of pesticide hazards in recent years. When asked whether they make use of label instructions, their responses suggest the effectiveness of such projects. A high proportion, 83%, read the label each time they spray or sometimes (Table 3.3). Nevertheless only 38% regularly, and 28% sometimes, follow these instructions. Only 13% have received any training in pesticide application and only 6% felt they were knowledgeable about pesticides. In practice it is difficult for farmers to follow label instructions, particularly, for example, regarding the use of PPE and disposal of empty containers.

Table 3.3 Making use of label instructions, training and knowledge in Ngarenanyuki		
	Number	% (n=120)
Read instructions on label each time	72	60
Sometimes read instructions	28	23
Follow instructions on label	45	38
Sometimes follow instructions	34	28
Received training on pesticide use	16	13
Knowledgeable about pesticides	7	6

Mixing and spraying is frequently done in bare feet and near water, Tanzania (Photo: AGENDA, October 2007)

Mixing pesticides without any protection in Velingara, Senegal (Photo: PAN Africa, August 2008)

Mixing pesticides without protection, Tanzania (Photo: AGENDA, October 2007)

3.2 The Asian surveys – conditions of use

In Asia, the surveys took place in 12 areas of eight countries – Cambodia, China, India, Indonesia, Malaysia, Philippines, Sri Lanka and Vietnam – between August and November 2008. Table 3.4 lists the countries and the location of the survey. The women and men interviewed produced crops typical of the region: rice, vegetables, cotton and palm oil, all of which use significant or large quantities of pesticides. Approximately 100 farmers or agricultural workers were interviewed in each location, in total 1,304 responded to the survey. Details of health incident reports were gathered from 69 respondents (see Chapter 4). In discussing results, each area is referred to by country, but it should be understood that this is specific to the area surveyed. In countries where more than one survey was carried out the area referred to is noted in brackets.

Across the countries surveyed pesticides are mostly applied using a manual backpack. In two areas farmers also used mechanical sprayers (a motorised mist-blower in Cambodia and a diesel-powered pump in Indonesia). Many instances of poor practices were uncovered, for example the widespread

Mixing granular pesticides with bare hands and no protection, Thrissur, Kerala, India (Photo: Thanal, September 2008)

Table 3.4 Surveys in Asia carried out between August-November 2008					
Country	**Area**	**No.**	**% f**	**% m**	**Crops**
Cambodia	Prey Veng Province: Prek Krabau Commune, Peam Chor District	100	16	84	Vegetables
China	Yunnan Province: two villages, with 20 farmer households separated by fields	121	42	58	Vegetables
India	Andhra Pradesh: Chittoor	150	51	49	Mixed farming – fruit, paddy, orchard, other
India	Kerala: Thrissur,	115	2	98	Rice farming
India	Orissa: Ragadaya District	103	3	97	Cotton
Indonesia	Java: Wonosobo	100	39	61	Vegetables
Malaysia	Perak	105	79	21	Palm oil plantations
Malaysia	Sarawak: Bintulu and Suai District	94	54	46	Palm oil plantations, fruit, vegetables
Philippines	Digos City: Barangay Ruparan	111	10	90	Vegetables
Sri Lanka	Badulla, Nuwara Eliya and Monaragala Districts	103	46	54	Vegetables
Vietnam	An Giang Province: Vinh Hanh commune, Chau Thanh district	100	7	93	Rice farming
Vietnam	Nam Dinh Province: Hai Van commune, Hai Hau district	102	71	29	Rice farming, vegetables
Total		**1,304**		**69%**	

practice of mixing a cocktail of pesticides was typified in the Cambodian survey where farmers were observed mixing between three and eight pesticides against insect pests and among the rice growers of Vietnam (Nam Dinh) where three or more brands of pesticides were mixed to kill brown plant hopper. In Malaysia (Perak) the pesticide applicators are not present when the cocktail is being mixed, so they do not know precisely what they

Farmer mixing three types of pesticides together to spray on mung beans Prek Kraboa, Peam Chor, Prey Veng, Cambodia (Photo: CEDAC, September 2008) are applying or the associated hazards. The results on conditions of use and symptoms of poisoning cover 11 of the 12 countries. The Indonesian survey focused on pesticides in use and incident reports.

Use of PPE

The survey shows that farmers or workers do not wear many of the items essential for protection (Table 3.5). The first column indicates the percentage who responded that they do wear PPE and the percentage items of clothing and equipment worn by this group. The use of long-sleeved shirts, trousers and boots or shoes is relatively high, although in China of 86 farmers who indicated wearing PPE, only 7% wear boots or shoes.

The most widely worn items of clothing are long-sleeved shirts, trousers and boots. However the understanding of protection is frequently misconceived. Few farmers keep special clothing for spraying. In India (Andhra Pradesh) 71% of respondents indicated they wore long-sleeved shirts but some explained that they wore the same clothing for 2-3 days. In Sri Lanka the monitors observed that the clothing worn afforded very little protection, with many only wearing t-shirts which would be soaked through quickly.

Farmer with no protection for hands and feet and wearing inappropriate mask – diluting pesticides before spraying in Hai Hau, Vietnam (Photo: CGFED, November 2008)

Table 3.5 PPE indicated by respondents

	% stating they wear wearing PPE	Items worn by applicators who wear PPE (% wearing)							
		Gloves	Overalls	Glasses	Respirator	Mask	Boots/ shoes	Long-sleeved shirt	Long pants	Other
Cambodia	**67**	70	0	5	0	92	38	97	94	0
China	**74**	3	5	0	2	2	7	90	88	8
India, Andra Pradesh	**1**	1	1	1	1	1	0	**71*	**7*	1
India, Orissa	**6**	0	0	0	0	0	**34*	**97*	**98*	8
Malaysia, Perak	**96**	95	94	68	61	33	99	99	99	31
Malaysia, Sarawak	**19**	43	21	14	14	29	79	71	71	0
Philippines	**94**	5	0	0	0	43	21	99	98	10
Sri Lanka	**16**	69	13	0	19	19	13	63	63	6
Vietnam, An Giang	**94**	3	1	22	56	10	1	97	95	1
Vietnam, Nam Dinh	**80**	68	58	13	1	97	74	76	74	24

* *This is a percentage of all farmers interviewed in Orissa and exceeds those who indicated they wear PPE: either they did not consider items as PPE or they understood the question to mean something different.*

Table 3.6. Reasons given by pesticide applicators for not wearing PPE (%)

Country	Uncomfortable	Not available	Expensive	Other reasons
Cambodia	19	11		
China	3			
India, Andhra	3	31	42	
India, Kerala	12			
India, Orissa		80		
Malaysia, Perak		2		
Malaysia, Sarawak	22	28	21	32*
Philippines	6			
Sri Lanka	41	25	35	
Vietnam, An Giang	3			
Vietnam, Nam Dinh	11	7	5	

* *Other reasons included 'don't know, never been told, never seen before' etc.*

PPE is uncomfortable to wear: in Sri Lanka 41% and in India (Kerala) 26% did not wear PPE, with 12% of non-wearers citing discomfort as a reason for not wearing protection. But cost and the fact that PPE is not available were major factors given for not using personal protection (Table 3.6). In India (Andhra Pradesh) 42% of farmers said it was expensive and 31% said it was not available. In India (Orissa), 80% of non-wearers indicated that PPE was not available. Even in Sri Lanka where a high number (41%) of respondents quoted discomfort as a reason, the remainder of non-wearers cited problems of cost and availability. Many respondents working as daily waged-workers had "no capacity to purchase [protective clothing] even though some of them are aware of the problems" indicated the India (Andhra Pradesh) monitor.

Even where a significant number indicate that they wear PPE the figures may be very misleading. In India (Kerala), 58% of respondents reported that they use protective clothing such as long-sleeved shirt and long pants but none of them wears conventionally recommended PPE. In the paddy fields, they have to roll up pants to their knees and work in bare feet. In Vietnam (Nam Dinh), while 80% of applicators said they wear PPE, and a local initiative has promoted wearing a raincoat, the items are often not worn because of the heat and farmers were observed spraying with bare feet. So a farmer's perception of protection is variable and answers may not fully reflect the reality. The items worn may only protect some parts of the body, and be inadequate protection against the full range of acute and chronic hazards of the pesticides they spray.

Disposal

Respondents were asked how they dispose of both pesticides and the containers. As shown in Figure 3.5, very few farmers were able to return the empty containers to the company or distributor; Malaysia provided the best case where 22% of farmers in Perak and 3% in Sarawak did so. Throwing in the open field was the most common method of container disposal in the Indian study sites in Andhra Pradesh, Orissa and Kerala, practised by over 70% of respondents. In Kerala 33% sold the containers to waste collectors which may result in selling on further for reuse. Disposal in the open field was the most common method in Vietnam (An Giang) (56%), and a smaller percentage (15%) in Nam Dinh. Farmers may use several methods, for example in Sri Lanka 85% indicated they throw containers in the trash but they also burn them (69%) and/or throw them in the open field (27%). In one of the Chinese villages, where IPM Farmer Field Schools are run, some farmers returned containers to a government agency.

In a number of cases the respondents reuse empty containers for other purposes, perhaps the most dangerous practice. In India (Andhra Pradesh) uses included storing kerosene and domestic items. In Sri Lanka 13% said they reuse them as flower pots, buckets, water cans and fuel containers; in Malaysia (Sarawak) 16% use to store water and fuel; in Philippines 14% store other pesticides, and in Cambodia 15% for unspecified uses.

Disposal of leftover pesticides

When asked to describe their disposal of pesticides left in the tank after spraying, respondents reported that they would use all the pesticide up, apply it again, or to keep for future use. Where users did describe methods of disposing of pesticides, the location was often the target field (advised practice for small quantities), but others indicated 'the 'land' or a body of water. For example, in India (Andhra Pradesh), 78% indicated disposal on 'the land' and in Cambodia 54% in a field or the river.

Water-bodies near fields are frequently used for multiple purposes including washing equipment, as quoted in India in both Kerala and Orissa. Spray drift

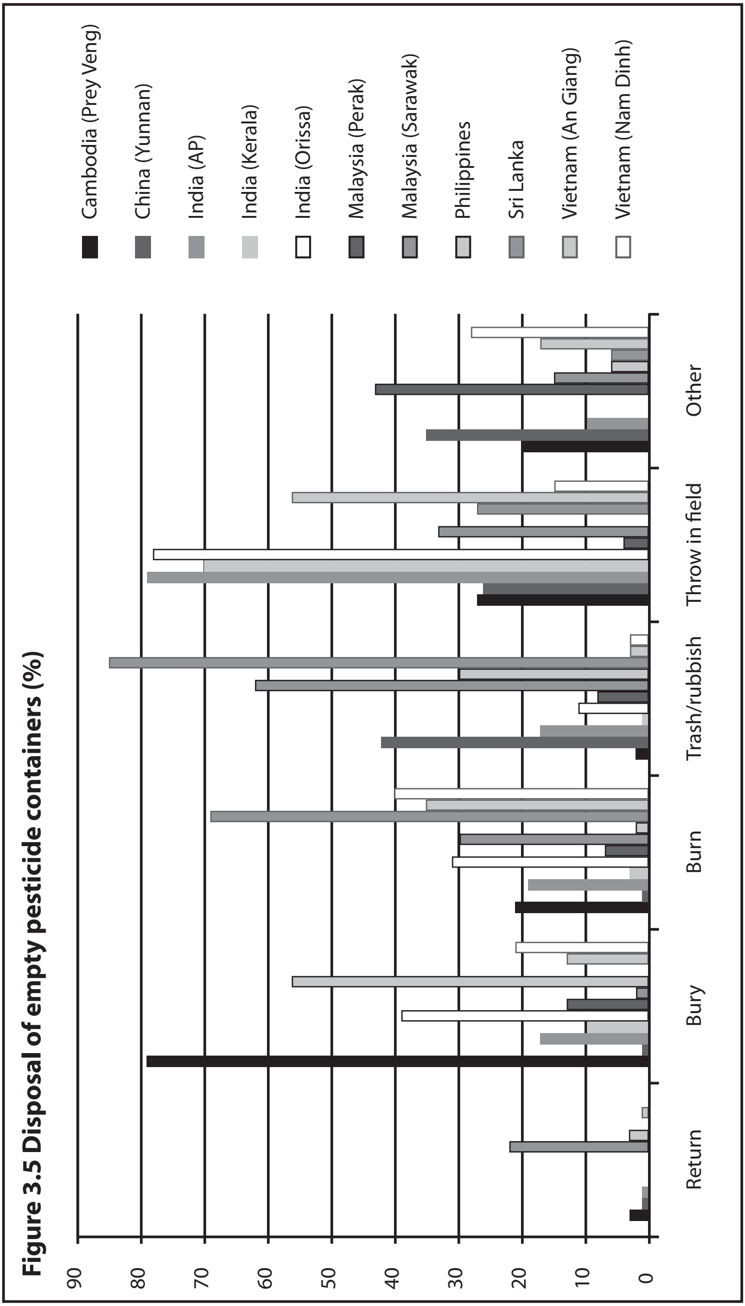


Figure 3.5 Disposal of empty pesticide containers (%)

or run-off of chemicals from fields enters the water, which is in some cases used for bathing and drinking. In Sri Lanka "polluted water is used by all residences for all purposes", particularly for a community at Monaragala which receives runoff from upstream use.

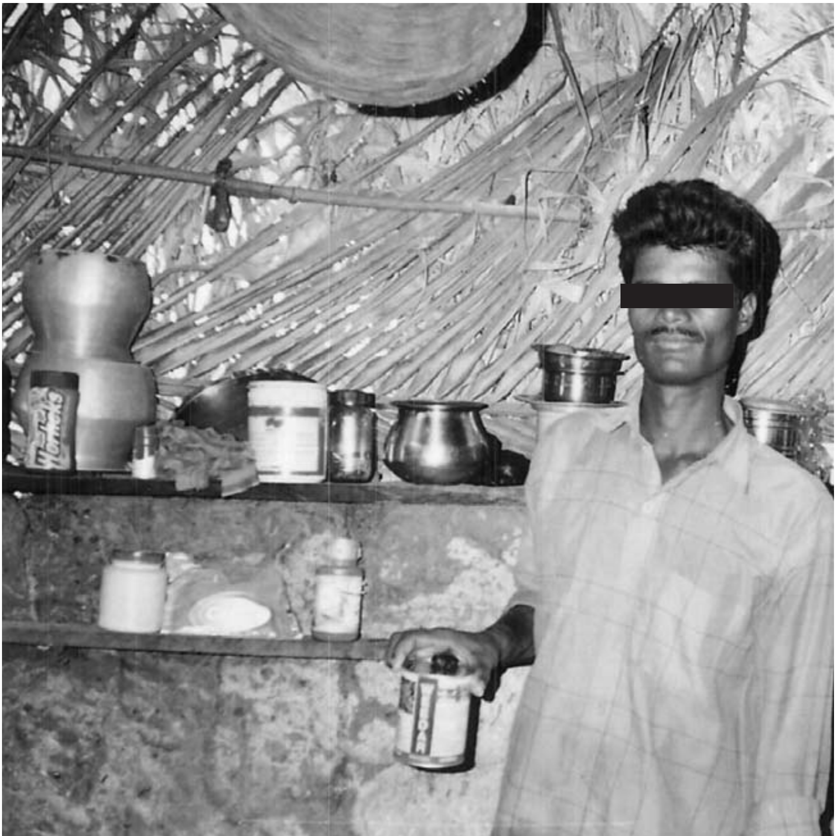
Storage practices

The most common places for storing pesticides were in the home, field or garden or the shed (Table 3.7). As many as 97% of farmers in India (Orissa) store at home, 71% in India (Andra Pradesh) and 56% in Cambodia. Various locations in the home are used, including the kitchen or bathroom: a piggery or chicken coop were mentioned in Vietnam (Nam Dinh), a sack in the Philippines, and hung on a tree in Cambodia. In Andhra Pradesh over a quarter of respondents do not observe any particular safeguards in storage, but others indicated that they were locked up out of reach of children, and

Table 3.7 Storage locations for unused pesticides (%)

	Field	Shed	Garden	Home	Other
Cambodia	4	15	15	56	10(e.g. hung on a tree)
China	3	79	12	4	3
India, Andhra Pradesh	23	9	11	71	0
India, Kerala	23	47	2	23	14
India, Orissa	0	0	0	97	0
Malaysia, Perak	22	65	0	11	16
Malaysia, Sarawak	28	31	5	12	29 (e.g. store room, farm)
Philippines	4	23	0	32	51 (container, box, sack, store room)
Sri Lanka	32	31	17	43	1
Vietnam, An Giang	0	21	0	59	15 (e.g. outside house, under bed)
Vietnam, Nam Dinh	0	13	18	7	67 (e.g. kitchen, toilet, animal housing)

separated from other items. On the other hand, access to an actual storage shed is rare, and many pesticides are stored inside the home. Locking and separation is easier when a shed is available and the highest number with such access was China (79%), Malaysia (Perak) (65%) and India (Kerala) (47%). In all other sites less than a third had this option.



Pesticides stored inside the home, Andhra Pradesh. (Photo: Sahanivasa, October 2008)

Women are often weeding in mung bean fields while their husband is spraying, Prek Kraboa, Peam Chor, Prey Veng, Cambodia (Photo: CEDAC, September 2008)

Pesticide spraying with little protection, An Giang, Vietnam (Photo: An Giang University, September 2008)

People walking through field while their neighbour sprays pesticides, Prek Kraboa, Peam Chor, Prey Veng, Cambodia (Photo: CEDAC, September 2008)

Farmer spraying pesticide on mung bean crop in Prek Kraboa, Peam Chor, Prey Veng, Cambodia (Photo: CEDAC, September 2008)

3.3 The Latin American surveys – conditions of use

Surveys took place in Argentina and Bolivia. The Argentina study focused on communities living in the heavily sprayed soya bean production areas who are regularly exposed to pesticide spray drift. The land was previously occupied by the indigenous peoples of Vilela and Guaycuru, who were displaced from the end of the 1970s when the area became a focus for cotton production. At the end of the 1990s the area moved to soya bean monoculture, and since then pesticides have been regularly applied, including through aerial spraying. The 210 interviews took place in 16 communities in the West Central Province Santiago del Estero. Proximity to soya bean production was a criteria for selection, with 48% living less than 100 metres from sprayed fields, a further 20% within 200 metres, and another 17% within 500 metres.

The Bolivian surveys took place in four areas, interviewing communities in three of the country's nine Departments: La Paz, Cochabamba and Ivirgarzama (see table 3.8). The areas are highly productive and grow a range of crops which are marketed in the cities of La Paz and El Alto. Farmers grow flowers, bananas for export, food crops and coca. In the Department of La Paz the Pucarani and Pacajes communities are based in the Cabecera de Valle where pesticide use is widespread. In Pacajes, 95% of the participants use pesticides compared to only 54% in Pucarani where the remaining 44% are in the process of adopting more ecological agricultural approaches; 2% did not respond to this question. In the Department of Cochabamba, it appeared that all farmers in Chipiriri use pesticides. In the area of Ivirgarzama almost all farmers now use pesticides.

Lack of PPE

The use of PPE is extremely limited (Table 3.9). The Argentina figures are derived from observation by communities living within the areas that are intensively sprayed, as pesticide applicators were not interviewed. Eighty percent of those interviewed observed that the spraying takes place in windy conditions and noted that temperatures reach 40° in the region. In Bolivia the level of protection is very low, with 64% using no PPE in both Pacajes and Pucarani, 55% in Chipiriri and 73% in Puerto Villarroel. There appears to be some awareness that additional precautions should be taken when mixing pesticides, as more interviewees said that they wear gloves, glasses and / or masks during this activity than they indicated that they take when spraying.

<table>
<tr><th colspan="6">Table 3.8 Surveys in Latin America carried out between April-June 2009</th></tr>
<tr><th>Country</th><th>Area</th><th>No.</th><th>% f</th><th>% m</th><th>Crops</th></tr>
<tr><td>Argentina</td><td>Santiago del Estero Province: 16 rural communities near Quimili City (NW): Bajo Hondo, El Colorado, El Carretel, Campo del Cielo, Rincon del Saladillo, La Reserva, Laguna Baya, Lote 26, Lote 29, Lote 28, Lote 4, Lote 5, Pozo del Toba, Santa María y Tres Mojones</td><td>210</td><td colspan="2">Mixed population: women, men and children</td><td>Soya bean</td></tr>
<tr><td>Bolivia</td><td>La Paz Department, Achocalla municipality, *Pacajes community</td><td>77</td><td rowspan="2">75</td><td rowspan="2">25</td><td rowspan="2">General</td></tr>
<tr><td>Bolivia</td><td>La Paz Department, Cabecera de Valle area: *Pucarani community</td><td>61</td></tr>
<tr><td>Bolivia</td><td>Cochabamba Department: Chapare Region, Amazony area, Villa Tunari Municipality: *Chipiriri</td><td>69</td><td>10</td><td>**
83+</td><td>General</td></tr>
<tr><td>Bolivia</td><td>Cochabamba Department: Chapare Region, Amazony area, Ivirgarzama, *Puerto Villarroel Municipality</td><td>79</td><td>5</td><td>**
82+</td><td></td></tr>
<tr><td></td><td></td><td>496</td><td></td><td></td><td></td></tr>
<tr><td colspan="6">* These names are used when analysing the four Bolivian survey areas.
** This figure does not account for all the sprayers as others were identified by their labour relationship as hired sprayers (for example 6% of farmers interviewed in Puerto Villarroel hired workers to spray); it is likely that those working in this capacity will be men.</td></tr>
</table>

Table 3.9 Pesticide users adoption of PPE (%)

	No PPE	Limited PPE	*Identification of PPE mentioned*					
			Gloves	Glasses	Mask	Clothing	Explanation of PPE	N/a
Argentina (n=210) (observation by spray-affected communities)	55	19	n/a	n/a	n/a	n/a	Observed to wear limited PPE (not specified)	26
Bolivia: (n=77) Pacajes	64	33	17	11	5	30	33% wear gloves, glasses mask when mixing; 30% wear some extra when spraying – e.g. face scarf	3
Bolivia: (n=61) Pucarani	64	30	22	22	n/a	n/a	As in Pacajes, more protection is worn when mixing.	6
Bolivia: (n=69) Chipiriri	55		15	14	n/a	n/a		
Bolivia: Puerto Villarroel	73	27	*6	*3	4	1	1% indicated they wear boots * another 5% wear both glasses and gloves	8

Spray preparation and practices

In Bolivia the spray frequency ranged between twice a month to twice a year (Table 3.10), but the most common is once or twice a month. The spraying preparation and practices are very poor:

- In Pacajes 87% use a backpack and mix the product in spray equipment; 6% use something like a bucket, both for preparing and spraying, and 1% use a watering can.
- In Pucarani pesticides are commonly applied using a backpack sprayer, but 3% sometimes use a watering can.
- In Chipiriri 91% of interviewees apply pesticides using a backpack sprayer, and 1% use a specialised backpack sprayer that is smaller and emits pesticides in smaller droplets. When mixing a pesticide, 80% use a stick, but 3% of those who answered use their hands. Commonly in this area users will spray for over two hours (42%), or between 1-2 hours (33%). Spraying is usually repeated on successive days because of the field size. Many applicators eat in the field (17%) and they commonly chew coca leaves (74%) while spraying. Only very rarely (4% of farmers) is a notice left to indicate that a field has recently been sprayed. The quantities of pesticides used vary from more than 31 kg a year (22%), to 11-20kg a year (26%) to 0-10 kg (32%).

Table 3.10 Spray frequency in Bolivia (%)

Site	2 x month	1 x month	3 x year	2 x year	Note
Pacajes	36	12	24	16	5% spray when pests observed; 9% did not answer
Pucarani*	11	18	7	--	Additionally 18% spray once a month on vegetables. 44% do not use pesticides.
Chipiriri	20	65	--	9	
Puerto Villarroel	32	56	--	--	

* As 44% of farmers in Pucarani do not use pesticides, most of those using pesticides spray at least once a month.

- In Puerto Villarroel, 91% of those interviewed prepare pesticides in the backpack used for spraying. The remainder prepare in a bucket. Of those not using a regular backpack, 5% use the specialised backpack referred to in Chipiriri and 4% use a tractor. Most farmers (67%) use over 31kg of pesticides a year; a further 11% use 21-31kg a year.

Disposal and storage of unused products, empty containers and cleaning equipment

General safeguards for health and the environment are poor. Information regarding unused products was not available in Argentina. In Bolivia, the unsafe practices identified include using up the product on a different, most likely unsuitable, crop (garden vegetables); emptying into streams or trenches, or selling on the remainder (Table 3.11). In Puerto Villarroel 64% keep unused pesticide to spray on the same crop at a future time. A small number (6%) indicate that they mix it with another product and then store it for later use. As for unused pesticides which remain in the container, most indicate that they store pesticides in their home and 22% in the field. Regarding storage, it is not clear in Pacajes or Pucarani whether there is a

Sale of empty pesticide containers in the city of Ivirgazama, Bolivia (Photo: RAPAL, January 2009)

Table 3.11 Disposal of unused pesticide spray in Bolivia (%)				
Storage of unused product	**Pacajes**	**Pucarani**	**Chipiriri**	**Puerto Villarroel**
Store remaining pesticides for later use	29	35		64
Store on the field			56	
Store at home			33	
Use completely on crops	25	18		18
Use up on gardens near homes	7	-		9
Empty in streams or trenches	10	2		
Sell to others	10	-		
No response		45		

secure storage space, whereas in Chipiriri there appears to be little secure storage and pesticides, including left-over spray, is kept on the field or at home. In Puerto Villarroel most interviewees (75%) say there is no secure storage and children and animals are exposed.

The information on empty containers indicates that in Argentina, 89% of those interviewed use available empty containers to store water, while 6% use them to store gasoil and 5% kerosene. The empty containers are free and readily available in the area and are in demand by the local communities, who need to travel some distance to collect water. Communities observed that equipment appeared generally to be washed in a shed (observed by 68%), however in other instances it is cleaned in the field (20%), near a well (7%), or elsewhere. In Bolivia, Chipiriri, 48% of those interviewed say they leave empty containers in the field and 38% burn them. In Puerto Villarroel packaging is thrown in the field (53%), water sources or garbage cans, and in 34% of cases were burnt.

3.4 Pesticide dealers – conditions of sale

For most pesticide users, the main point of reference for information about pesticides is their supplier. The community monitors visited 35 shops in Mali. Pesticides were supplied by local pesticides shop owners in the village. In Tanzania, an investigation found that none of the pesticides shops in

Pesticides being sold in street in Mali by man with skin exposed, wearing only a vest (Photo: PAN Mali, July 2009)

Pesticides being sold next to entrance of a restaurant in market at Sikasso, Mali;
woman is cooking for her family within centimetres of the stall (Photo: PAN Mali, July 2009)

the Ngarenanyuki area were registered with the required agency (Tropical Products Research Institute) and almost none of the shop owners had been trained in any aspect of pesticides. Pesticides were mainly sold in their original containers, but repackaging into plastic bags and empty water bottles was common to satisfy farmers' requirements to buy pesticides in more affordable small volumes. Repackaged pesticides were sold without labels or instructions of use. Pesticides were also brought to villages and sold door-to-door to farmers.

In the Asian surveys, monitors talked to a total of 118 pesticide retailers. However many were reluctant to answer questions and the results were difficult to analyse. The information reported here was provided by 52 pesticide dealers in Cambodia, China, India (Kerala and Orissa), Indonesia and Malaysia (Perak and Sarawak). Monitors observed conditions in the store, particularly regarding availability of PPE, state of labelling and packaging, training received, and pesticide sale requirements. The surveys yielded some basic information (Table 3.12) and are an indication of the range of situations met by pesticide users purchasing their products.

- Cambodia: almost none of the labels were in local languages; pesticides were sold alongside food and clothing without any indication that they were hazardous.
- India, Kerala: The store keepers give advice on which pesticides to use for controlling specific pests but were not aware of hazards and do not warn farmers of precautions to take. Store owners do not read labels, and do not encourage buyers to read the label. In one store the owner was standing over two farmers who were mixing pesticides by hand.
- India, Orissa: Storekeepers said that they warned of 'caution' for 38 of 43 products they sold, advising that these could cause 'death if it goes to the mouth'. Five of the products on sale had no label. Some of the storekeepers advised customers to bury, burn or throw away empty containers.
- Indonesia, Garung: Shops provide information on dosage, brands, and usage of pesticides, but rarely advise farmers to read the label. Chemical companies (Bayer, Du Pont, and Monsanto) hold meetings for pesticide sellers, and they provide prizes (hats, T-shirts, clocks, jackets, etc) to farmers who buy over a specified amount. Sales staff do not wear any protective clothing.
- Indonesia Kejajar: Pesticides are sold from homes of 'dealers' who live close to the farmers. Merchants hold meetings sponsored by

Table 3.12 Selected feedback from interviews with pesticide retailers

	No. stores	Training received	PPE sold	Licence held
Africa				
Mali	35	16 had received training mainly on precautions for mixing and storing pesticides	Between 19-23% stocked some PPE: gloves, overalls, boots or shoes, eye masks, glasses, masks, respirators	63% held relevant licence
Asia				
Cambodia	2	1 from government 1 from company	Limited PPE stocked: gloves and face masks	One held licence
China	10	Routine training from government on PPE, storage, relevant regulations	Not available in pesticide stores, but said it could be bought elsewhere	All
India (Kerala)	9	Not known (n/k)	2 stocked some PPE, but do not advise farmers to wear it	n/k
India (Orissa)	7	No training	None stocked	No licence
Indonesia (Garung)	4	Training from meetings with chemical companies	n/k	n/k
Indonesia (Kejajar)	7	No training; pesticides are sold from display cases in people's homes	No	No
Malaysia (Perak)	7	No training, retailers do not consider pesticides to be hazardous	No	n/k
Malaysia (Sarawak)	6	5 received company training; 5 received government training	6 stocked gloves; 5 stocked overalls, glasses, goggles, masks; 3 stocked a respirator	5 had licence
Asian total	**52**			
Total	**87**			

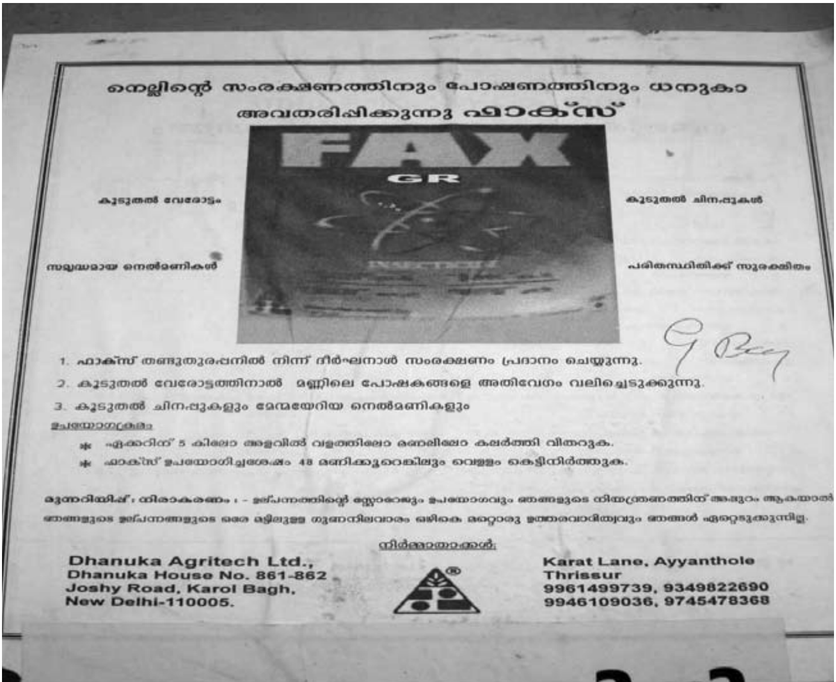
chemical companies to promote new brands and to map chemical needs of farmers. Farmers who attend the meetings receive 'prizes': hats, clothes, jackets, as well as snacks and money. The shops give an annual prize to farmers who buy more than Rp. 60,000, including electronic home appliances, a motorcycle and a ticket for two for a pilgrimage to Hajj. Merchants also monitor farms and have a system for farmers to borrow chemicals and pay after harvest.

- Malaysia, Perak: Retailers do not consider pesticides to be harmful and this attitude is carried over to their customers.
- Malaysia, Sarawak: Five of the sales staff interviewed indicated that they advised customers to bury their empty containers. Pesticides were sold alongside other consumer products, including food (in five shops), clothing (in three) and/or pharmaceuticals (in one).

Pesticide stores will carry advertising on behalf of companies selling certain products. These in-store ads do not always comply with the Code of Conduct, that says ads must not use statements such as 'guarantee of higher yields', 'more profits', 'harmless', and 'non toxic' should not be used (see photos).

Pesticide ad on wall of pesticide store in Thrissur, Kerala, India (Translation: Kritap 4G. A field full of golden rice grains; Kritap 4G. Sowing and after sowing) (Photo: Thanal, September 2008)

Sale of pesticides in a food market in Bolivia (Photo: RAPAL, January 2010)



Translation
Dhanuka introducing "FAX" for nourishment and protection of paddy

More roots, More ripening, Richer paddy grains, Environmental protection

1. FAX provides longer period protection from stem borer
2. Absorbs soil fertility due to more roots
3. More nutritious grains

Instructions for use:

- Apply with sand or fertilizer at 5kg/acre
- Water log fields for 49 hours after using Fax

Warning, Denial: we will only undertake responsibility for the quality of product but the storage and use of this product is not in our control.

Producers

Ad in pesticide store for product 'Fax', Thrissur, Kerala, India (Photo: Thanal, September 2008)

3.5 Observations on pesticide practices and protection

In none of the areas surveyed are pesticide users able to protect themselves adequately against exposure to the pesticides they are spraying, or in the case of Argentina to which they are exposed. The highest levels of PPE worn are in the plantation areas of Malaysia where PPE should be supplied to workers. However, boots, mask respirator and gloves are only worn for roughly three to four hours per day as workers find it too hot. PPE are therefore not appropriate to the tropical climate as they cannot be worn throughout the course of a spraying day, which means they are not preventative and protective in nature. Cotton based clothing absorbs spray drifts and leaks, which is also then not protective. In Asia a high proportion of workers wear long sleeved shirts and long pants (63-99%) though it was not clear from the survey whether these are clothes reserved only for pesticide spraying which are washed after each use. Other than these items, the ability of pesticide users to protect themselves is generally low, and similar to the extremely poor use of PPE in Africa and Bolivia. Even those who are aware of the importance of PPE have great difficulty obtaining it, and availability and cost are bigger issues than discomfort as a reason for not wearing PPE. The survey of pesticide retailers is limited and difficult to draw conclusions from, but among those surveyed results showed that it is not easy for pesticide users to buy PPE and suppliers do not advise on the importance of proper protection. To date, it seems that both governments and industry have failed to provide access to proper and affordable PPE as called for in the Code of Conduct.

The general indicators used to understand how well pesticide users avoid risks and hazards during application suggest on-going lack of awareness, information and training. In at least some areas, wind is not considered a factor to take into consideration when spraying. Some of the farmers who have received information about the importance of labels still do not read them or do not / cannot follow label instructions. Safe storage is lacking and pesticides are stored inappropriately. No facilities are in place for returning empty pesticide containers and these are consequently disposed of in a haphazard manner.

4. Results – Experience of acute poisoning from pesticide exposure

Farmers and workers using pesticides in developing countries have inadequate information and protection to safeguard their health and that of their families and nearby communities, as shown in chapter 3. Inevitably, these poor conditions lead to regular incidents of acute poisoning at varying levels of seriousness. Those exposed to pesticides cannot always identify the cause and effect as acute poisoning signs and symptoms are similar to many common illnesses. Most have poor access to antidotes or health care services. The CPAM survey investigates the ill-health experienced on a regular basis. This chapter demonstrates that intensified surveillance would show the extent of suffering inflicted on pesticide users who cannot adequately protect themselves. In addition to feedback from the 2220 interviewees for the questionnaire survey, 69 informants who had experienced more severe incidents of poisoning were interviewed (Appendix 3), most of whom were able to identify the product responsible.

The community monitors asked whether farmers and workers had experienced symptoms after using or being exposed to pesticides. Symptoms were listed in a multiple-choice question, and respondents could also describe any other symptoms experienced. This chapter presents the results from numbers 52-54 of the questionnaire (Appendix 2).

4.1 The African surveys - Experience of acute poisoning

Farmers interviewed identified a high number of poisoning symptoms from mixing or spraying pesticides (Table 4.1). In Sikasso, Mali, farmers appear

Table 4.1 Symptoms of pesticide poisoning identified in the African surveys (%)

	Sikasso (n=100)	Velingara (n=100)	Ross Bethio (n=100)	Ngarenanyuki (n=120)
Dizziness*	8	9	10	44
Headaches	21	61	57	50
Blurred vision	1	59	49	40
Excessive sweating	2	57	18	45
Hand tremor	1	7	2	22
Convulsion	0	12	2	0
Staggering	0	10	4	0
Narrow pupils (myosis)	0	15	0	0
Excessive salivation	0	0	0	58
Nausea / vomiting	4	23	19	53
Sleeplessness / insomnia	2	21	1	48
Difficulty breathing	0	11	10	43
Skin rashes / [irritation]	1	12	6	66
Diarrhoea	1	2	2	21
Irregular heartbeat	1	9	3	0
Other	16	29	5	**

* *Some farmers complained of blackouts and these have been included in this category*
** *See text: other symptoms included sore throat, eye irritation, excessive tearing eyes, cough, flu, loss of appetite, stomach ache, nose bleeds, wheezing, fever, pain when urinating, chest pain, losing consciousness.*

Pesticides and spray equipment in a home: stored near food and accessible to children. Ross Bethio, Senegal (Photo: PAN Africa, August 2008)

Used and empty pesticide packages stored in a house and easily accessible to children, Tanzania (Photo: AGENDA, May 2006) to suffer less than the other areas surveyed, with headaches (21%) and blackouts or dizziness (8%) being the biggest problems. Sixteen farmers indicated they experienced other health symptoms after spraying but these were not specified.

In the Senegal survey at Velingara, the most mentioned symptoms are headaches (61%), troubled vision (59%), excessive sweating (57%) and nausea and vomiting (23%). The 29% ‘other’ effects included: difficulty articulating words, itchy skin, runny nose, general pain, stomach ache and feeling bloated. There were similarities with symptoms in Ross Bethio, with 57% complaining of headaches, 49% of problems with blurred vision and 19% of nausea and vomiting.

In Tanzania the surveyed farmers suffer an excessive number of symptoms after pesticide application or during mixing: 50% or more experience headaches, excessive salivation, nausea or vomiting, skin or eye irritation; over 40% dizziness, blurred vision, sleeplessness, breathing difficulties, stomach ache, loss of appetite, flu, cough, excessive eye tearing or sore throat; and over 20% tremors, diarrhoea, chest pain, pain when urinating, fever, wheezing or nose bleed. Of other symptoms named in Ngarenanyuki, over 40% of farmers noted sore throat, eye irritation, excessive tearing

Pesticides stored in a house and easily accessible, Tanzania (Photo: AGENDA, May 2006)

Table 4.2 Farmers affected by pesticide poisoning in Ngarenanyuki in the farming season from December 2006 – March 2007 (n=120)		
	No. farmers	**% (n=120)**
Affected by pesticides in this season		
Health affected	83	69
Not sure	18	15
Number of times affected in this season		
One	11	9
Two	12	10
Three	9	8
More than three	26	22
Action taken after poisoning	*52*	*43*
Went to hospital	34	28
Drank milk	52	43
Washed with water	2	2
No action	4	3
Times admitted to hospital due to pesticide poisoning (more than this season)		
One	20	17
Two	23	19
Three	8	7
More than three	69	58

eyes, cough, flu, loss of appetite and stomach ache; over 20% nose bleed, wheezing, fever, pain when urinating or chest pain; 12% reported losing consciousness and 17% specifically mentioned vomiting (Work and Health in Southern Africa, undated).

The survey of farmers in Tanzania found that the majority of the farmers (69%) had experienced poisoning in the previous farming season. Poisoning most commonly occurred after using Fenon C (profenofos and cypermethrin) and Selecron (profenofos), followed by Dithane (mancozeb) and Thiodan (endosulfan); 22% of farmers experienced poisoning symptoms more than three times. To combat the impacts, most victims indicated that they drank milk (43.3%). A significant number (28%) went to a hospital for treatment. A high proportion (58%) had been admitted to hospital more than three times

Accumulation of empty containers, easily accessible in a home, Ngerananyuki, Tanzania (Photo: AGENDA, May 2006)

Empty pesticide packages discarded in fields can endanger health. Field in Velingara, Senegal (Photo: PAN Africa, August 2008) for pesticide poisoning (Table 4.2). In many instances farmers were able to identify the products responsible: over 20% of farmers were poisoned by profenofos; over 10% by mancozeb, endosulfan and chlorothalonil; over 7% by mancozeb (see section 5); lambda-cyhalothrin and deltamethrin were each named by one farmer.

4.2 The Asian surveys – Experience of acute poisoning

The community monitors in 11 of the 12 surveys collected data on the acute health effects following spraying (data not available for Indonesia). Respondents reported a wide range of the symptoms commonly associated with pesticide poisoning (Table 4.3). The frequency of these varied from region to region, but overall, dizziness was the most commonly reported symptom. This affected over 90% of farmers in Cambodia and Sri Lanka, and more than half in five other surveyed areas: India (Andhra Pradesh and Orissa), Malaysia (Sarawak), Philippines and Vietnam (Nam Dinh); and 49% in Malaysia (Perak).

Disposal of pesticide containers, among other rubbish, in open field- Hai Hau, Vietnam (Photo: CGFED, September 2008)

Table 4.3 Consolidated summary of symptom frequency in respondents (%)

Symptom	Cambodia	China	India, Andhra	India, Kerala	India, Orissa	Philippines	Malaysia, Perak	Malaysia, Sarawak	Sri Lanka	Vietnam, An Giang	Vietnam, Nam Dinh
Dizziness	90	5	73	21	67	79	49	53	91	19	53
Headache	87	1	67	20	38	81	72	31	90	27	60
Blurred vision	70	1	36	4	20	1	46	37	49	16	12
Excessive sweating	51	0	28	9	9	3	71	54	24	23	18
Hand tremor	52	0	11	6	29	0	22	14	17	15	9
Staggering	15	0	0	2	6	0	17	12	9	28	22
Narrowed pupils	3	0	0	0	11	1	18	24	2	2	0
Excessive salivation	42	0	59	7	72	1	23	24	10	1	0
Nausea	31	4	57	20	56	0	32	11	27	10	25
Insomnia	11	0	31	8	10	0	19	13	13	11	16
Difficulty breathing	11	0	15	10	31	0	23	15	15	16	13
Skin rashes	43	2	15	15	25	0	14	12	54	1	10
Diarrhoea	7	0	26	2	9	0	8	13	1	0	1
Irregular heartbeat	0	0	5	1	4	0	22	7	0	10	0
Convulsion	1	0	1	3	45	0	20	4	2	3	0
Other	0	1	9	23	47	1	8	5	0	0	44

Woman washes in water that flows off farm fields where pesticides are highly used (see page 41), Sri Lanka (Photo: Vikalpani, September 2008)

Headache was the most commonly reported symptom in Philippines (81%), Malaysia (Perak) and Vietnam (Nam Dinh), whilst Vietnam (An Giang) was alone in reporting staggering as the most common symptom (28%).

Many farmers reported 'other' symptoms, in particular in Vietnam (Nam Dinh) where the problems included: itching (15%), tired or very tired (15%), body pain and chest pain (6%), articulation problem, dry mouth, sneezing or stomach ache. In India (Andhra Pradesh) of 9% suffered body pain, cough, itching, eye problems, stomach pain or weakness. And in India (Kerala) a total of 23% described other symptoms which included itching (7%), stomach ache, pain or swelling (3%), chest pain, allergy, shivering, teary eyes, or mouth dryness.

The frequency of ever having experienced any symptoms from exposure to pesticides varied from a low of 5% in China to a high of 91% in Sri Lanka. In eight of the 11 reporting countries, over 50% of those using or exposed to pesticides experienced symptoms. Although the frequency of symptoms reported in the survey area in China is low, 12 women farmers interviewed separately and not included in these figures reported dizziness, weakness, nausea, difficulty in breathing, and loss of appetite.

Disposal of pesticide containers in open field, Sri Lanka (Photo: Vikalpani, August 2008)

Respondents were asked who they would call if they thought someone was poisoned. Responses varied, with the hospital being the most common response in China, Philippines and India (Kerala and Orissa). In Malaysia (Perak) where the interviewees were employed as pesticide sprayers, most would turn to their employer to deal with the situation: 67% would call the company and 34% would call the foreman, clerk or health advisor (Table 4.4).

Table 4.4 Response to poisoning (%)

	Hospital	Doctor	Friend	Company	Self-treat	Other
Cambodia	49	38	28	1		
China	96				2% drink sweet water; rest	
India (AP)	45	76	11			
India (Kerala)	97	8				
India (Orissa)	98					
Malaysia (Perak)	2	20		67		34%*
Malaysia (Sarawak)	71	33	35			
Philippines	91		1		4% drink coconut milk, or eat grated coconut and sugar	2% health care centre
Sri Lanka	48	50	98	3		
Vietnam (An Giang)	21	47	31		7% drink lemon juice or lemonade	18% go to first aid, clinic, or infirmary
Vietnam (Nam Dinh)		59	24	22	2% drink sugar water, 1% drink fresh orange juice	11% commune health centre

** 34% would call the foreman, clerk or health advisor, or would wash their body.*

Disposal of pesticide containers in open field, An Giang, Vietnam (Photo: An Giang University, September 2008)

4.3 The Latin American surveys – Experience of acute poisoning

Pesticide users in Bolivia and the communities in Argentina who were subjected to regular exposure via spray drift from nearby soya bean production could identify a wide range of acute symptoms (Table 4.5).

Table 4.5 Acute and chronic health effects: symptoms observed after spraying (%)

	Symptoms observed after spraying (%)					Chronic symptoms (%)	
Symptom	Argentina[1]	Bolivia[2] Pacajes	Bolivia[2,3] Pucarani*	Bolivia[1] Chipiriri	Bolivia[1] Puerto Villarroel	Argentina[1]	Bolivia[1] Chipiriri
Acute symptoms							
Dizziness	22	32	13	39	[4]34		5
Headache	52	37	18	59	[4]32		14
Blurred vision	22	3	4	6	32		
Excessive sweating	21	3	8	13	[4]27		
Hand tremor	9	10	12	6	32		
Staggering	0			0	[4]		
Narrowed pupils	0			0	0		
Excessive salivation	15			14	29		
Nausea / vomiting	16	1		7	37	15	
Insomnia	16			0	0		
Difficulty breathing	16			0	[4]	14	12
Skin rashes	0			6	[4]	13	20
Diarrhoea	26	9	9	22	28		
Irregular heartbeat				1	0		
Convulsion			2		37		
Other							
Drowsiness	27						

Numb mouth		3	1		34		
Fainting				3			
Other symptoms – noted as 'chronic' by interviewees							
Spitting blood							5
Eye redness/itch					31	23	9
Eyes – tearing					28		14
Muscle pains					24		19
Heart problems					12		8
Coughing					41		9
Allergies					4		7
Nose bleeding					16		7
Tremors					39		3
Difficulty urinating					8		4
Chest pain					30		
Paralysis					23		
Noisy breathing							
Genital (not specified)						10	

Notes:

1 *These percentages reflect all symptoms per respondent, i.e. more than one symptom is experienced*

2 *These percentages reflect the main symptom noted by each individual and therefore may under-estimate the range of symptoms.*

3 *In Pucarani 31% of interviewees did not respond to this question; 44% of these interviewees no longer use pesticides, but may be affected by spray drift or recent use before adopting ecological agriculture.*

4 *These impacts were also described as 'chronic' by many interviewees, as follows: dizziness 20%, headaches 15%, excessive sweating 6%, staggering 8%, difficulty breathing 7%, skin rashes 36%*

In Argentina the residents in the survey area suffer badly from aerial and land-based spraying. During the period of soya bean production, between October and April, aerial spraying takes place every 20 days with a range of products containing the herbicides 2,4-D, atrazine and glyphosate, and the insecticides endosulfan and methamidophos – as well as others that were not identified. Ground spraying equipment is also used. The spraying is not contained to the target fields and affects communities, water sources, non-target crops and animals. Often spraying takes place in windy conditions and the drift reaches communities living further from the soya bean crops. In these months the affected communities suffer from a range of health conditions, including breathing difficulties, skin and abdominal problems. The communities associate pesticide exposure with miscarriages and birth defects in their children. They record deaths of domestic animals. Drinking water, such as home wells and animal drinking water become contaminated from the spraying. These farming communities grow, among other crops, corn, pumpkin, cotton, watermelon, other melons, vegetables and fruits – and they have suffered crop losses and reduced productivity.

In the Cochabamba Department of Bolivia pesticide use is intensive and generates public health problems as well as food contamination and environmental pollution. In the period 2007/2008 poisoning figures showed an increase of 30% to 274 cases; 56% were women in rural areas (Numbela 2008) (See also Appendix 1).

Discarded pesticide containers close to the house, Argentina (Photo: RAPAL, January 2010)

In Argentina and Bolivia, monitors in Chipiriri and Puerto Villarroel identified multiple symptoms suffered by each farmer; whereas in the Bolivian areas of Pacajes and Pucarani it appears that the monitors listed only the most common symptom experienced by each interviewee. In Pucarani only 54% of interviewees apply pesticides.

In all survey areas in Latin America there are: significant problems with dizziness, headaches and diarrhoea; and moderate to high experience of blurred vision, excessive sweating and hand (or body) tremors. In Chipiriri 14% of respondents suffer chronic problems with severe headaches. In Argentina and Chipiriri there are problems with excessive salivation, nausea and vomiting. Other symptoms were noted by respondents, including 27% in Argentina who experienced drowsiness. In Argentina and Chipiriri a significant proportion of respondents believe that they suffer chronic health problems as a result of pesticide exposure. The pesticides used in each area differ and it is to be expected that symptoms will vary accordingly.

In Bolivia, Puerto Villarroel, 58% of all those interviewed said that they feel their health has been affected after having sprayed pesticides for years. Less than half (47%) of pesticide users interviewed knew that pesticides were harmful to human health, however many know cases of poisoning that they can directly associate with pesticides. The active ingredients most cited as responsible were rodenticides and methamidophos (Tamaron). About one-quarter of the farmers were aware that pesticides can affect the environment (23%), and the same number was aware of problems with farm animals or wildlife from pesticides.

In Bolivia those spraying pesticides could identify some of the products associated with health impacts (Table 4.6). These were most pronounced after the use of Tamaron and Stermin (methamidophos) and Folidol (methyl parathion) in Pacajes and Pucarani, and Caporal (methamidophos and cypermethrin) in Chipiriri. In Puerto Villarroel the most used pesticides were: chlorpyrifos (trade name Lorsban plus), cypermethrin (Murille), carbaryl (Sevin) and a product called Bazuka. Although symptoms were not associated with a particular active ingredient in Puerto Villarroel, the products used were identified as follows: *herbicides* 2,4-D, chlorimuron, glyphosate, paraquat, TCA; *insecticides* carbaryl, chlorpyrifos, cypermethrin, lambda-cyhalothrin, methamidophos, methomyl; *fungicides* propiconazole, tridemorph; and *fumigant* ethylene dibromide.

Table 4.6 Association between pesticides used and symptoms of acute poisoning in Bolivian communities

Area	Active ingredient (trade name)	Chemical family	Symptoms reported in monitoring
Pacajes and Purcarini	methamidophos (Tamaron, Stermin)	OP	Head ache, diarrhoea, tremors, dizziness, excessive sweating
	methyl parathion (Folidol)	OP	
Chipiriri	methamidophos + cypermethrin (Caporal)	OP + pyrethroid	Nausea, vomiting, headache, diarrhoea, tremors, blurred vision, tearing eyes and excessive salivation

4.4 Incidents of acute poisoning – interviews

The community monitors in seven of the Asian studies interviewed individuals who had suffered from pesticide poisoning. Altogether 69 cases were documented in five countries: China (1); India (Andhra Pradesh) (7), India (Kerala) (21), India (Orissa) (3); Indonesia (6); Sri Lanka (22); and Vietnam (Nam Dinh) (9). The full details of incidents are listed in Appendix 3.

All the documented cases were a result of exposure during pesticide application, and most took place within two years of the study. They reflect serious instances of ill-health: 40 led to treatment in a hospital and two in a clinic while others visited a doctor. The cases include two deaths in Orissa, with endosulfan, and one an Andhra Pradesh from phosphamidon, which occurred after six months (reported by family members), and two miscarriages (one in 2004). One farmer in India (Kerala) lost the sight in one eye after it was contaminated with methyl parathion (Metacid). The most common symptoms were headaches, dizziness, nausea and vomiting, blurred vision and sweating. There were five cases of losing consciousness or fainting, and the woman who reported a miscarriage in 2004 fainted while spraying in 2007. In 11 cases people treated themselves for example by washing, drinking coconut milk or water, or going home and resting.

Because of the different climate, crops and agricultural conditions the pesticides used in each location varied and the number of poisonings attributable to specific pesticides will reflect this. Some pesticides that account for a large number of poisonings may not be used by those interviewed on their crops in the other surveyed areas. Nevertheless poisonings with the same active ingredient were recorded in several locations. Of the 29 pesticides that could be named, 22 are considered 'highly hazardous' (see Chapter 5 and Appendix 4).

Figure 4.1 lists the number of times an active ingredient was mentioned in an incident. The highest number with the same active ingredient – nine cases of mancozeb – took place in Indonesia (4) and Sri Lanka (5). Eight cases of edifenfos poisonings were all recorded in India (Kerala), largely with the formulation Hinosan. Endosulfan poisonings all took place in India, in both Andhra Pradesh (4) and Orissa (3). Methyl parathion poisonings (6) were all recorded in Kerala, once in a mixture with edifenfos and once with phosphamidon. Fenobucarb poisonings (5) were in Vietnam; carbofuran (4) in Sri Lanka; phosphamidon in India, Andhra Pradesh (1) and Kerala (3); maneb (4) in Indonesia (1) and Sri Lanka (3); lambda-cyhalothrin in Kerala (1) and Indonesia (3) (see also Table 5.4). Some poisonings resulted from multiple active ingredients, for example in China a mix of methamidophos and triadimefon, and in Kerala two instances of a mixture of edifenfos and methyl parathion.

4.5 Acute pesticide poisoning in the United States

Pesticide-related illness in the US ranges from cases of acute poisoning – with symptoms including nausea, dizziness, numbness, and death – to pathologies whose origins are more difficult to trace, like cancer, developmental disorders, male infertility and birth defects. Agricultural workers have the highest rates of toxic chemical injuries and skin disorders of any working group in the US (NIOSH 2009). Among the additional challenges faced by farmworkers are the lack of health care, legal representation and, often, social standing required to make known the risks and costs that they and their families bear in order to put food on the table.

Approximately two million agricultural workers are employed in the US.[3]

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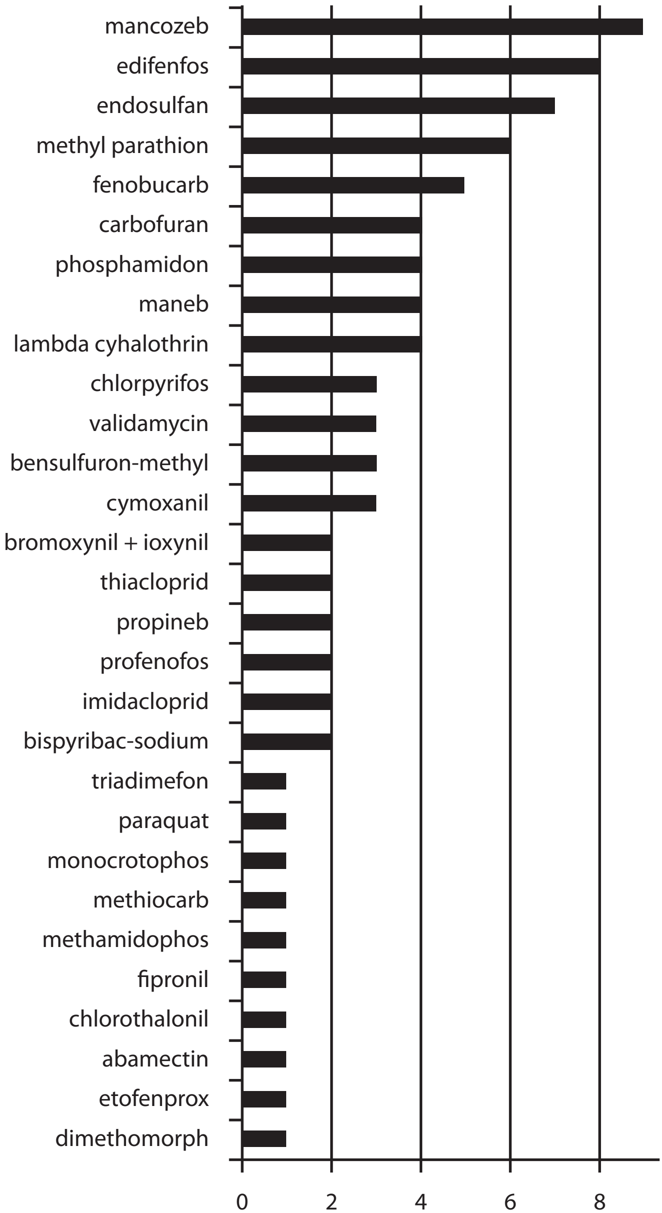
3 A commonly-used figure for the number of farmworkers is 2.5 million (Report of the Commission on Agricultural Workers, 1992), but one agricultural labor economist recently estimated 1.83 million hired farmworkers (Martin 2009).

Fig. 4.1 Active ingredients named in pesticide poisoning incidents



Between 400,000-500,000 farmworker children are estimated to work on farms and ranches (Hess 2007). A US EPA estimate of 10,000-20,000 acute pesticide-related illnesses among agricultural workers each year in the US is based on extrapolation of physician-reported cases in California (Blondell 1997) (see Box 2 for problems of pesticide poisoning in California). It is likely that this is a serious underestimate however, since reporting requires that workers identify the problem and seek treatment; that physicians correctly diagnose and report the poisonings; and that the cases are properly investigated and reported by state authorities: according to a government report, US EPA has "no capability to accurately determine national incidence or prevalence of pesticide illnesses that occur in the farm sector" (US GAO 1992, US GAO 1993). Chronic, long-term effects are rarely documented (Pease 1993).

A recent study of acute pesticide poisoning between 1998 and 2005 among agricultural workers in the US (Calvert 2008) found an average annual acute pesticide poisoning rate of 0.07% or 51 cases per 100,000 full-time-equivalent farmworkers. Researchers cautioned that this should be considered a low estimate because of the many factors contributing to underreporting including failure of affected workers to get medical care, seeking medical care in Mexico outside the US surveillance system, misdiagnosis and health provider failure to report in the 30 states where reporting is required.

4.6 Observations on health impacts

The surveyed regions covered different crops and cropping systems, in areas with diverse pest problems and varied geographic and climatic conditions. In spite of this, the commonly recognised signs and symptoms of pesticides were all experienced by the respondents, though in different degrees. Data from the US demonstrates the difficulties faced by farmworkers in protecting themselves even in a country with vast resources and an advanced pesticide regulatory system.

An overall average of surveyed areas in Africa, Asia, Argentina and Bolivia (Chipiriri and Puerto Villarroel) show considerable consistency in the type and scale of symptoms suffered (Bolivian data from Pacajes and Pucarani was recorded on a different basis and cannot be compared). In Asia, Africa, Argentina and Chipiriri almost half those exposed, 47-59% (and 39% in Puerto Villarroel), suffer regularly from headaches after spraying. Other

Box 2. California example: pesticide poisonings in the largest US agricultural economy

California has the largest agricultural economy among the 50 US states and employs approximately 750,000 (approximately 40%) of the country's agricultural workforce. California is also one of the few states to attempt to gather more comprehensive information on pesticide poisonings among agricultural workers. To shed light on the issue, PANNA, United Farm Workers of America (UFW) and California Rural Legal Assistance Foundation (CRLAF) worked with the state-wide coalition Californians for Pesticide Reform (CPR) to examine the data and published *Fields of Poison: California Farmworkers and Pesticides* in June 1999, with a new edition released in 2002. Since then, PANNA has tracked annual updates of state data, the latest being 2007 (the most recent year for which data are available from the state of California Department of Pesticide Regulation (DPR). In 2007, a total of 982 cases were considered at least possibly related to pesticide exposure; 318 involved exposure to agricultural pesticides. In 2007, 126 cases of field worker illness or injury were evaluated as definitely, probably or possibly related to pesticide exposure. Fifty-eight of them (46%) involved exposure to pesticide residue in 33 separate episodes and 66 (52%) involved exposure in eight drift episodes.

These reported illnesses may represent only the tip of the iceberg of a serious and pervasive problem. According to advocates and farmworkers in the field, along with discussions conducted during community–based monitoring work, many cases go unreported, so true figures are much higher. An analysis of 2006 DPR data found inadequate funding for several government programmes that facilitate reporting (DPR 2008). Other ongoing challenges to accurate reporting may include doctors' failure to recognize and/or report pesticide-related illnesses; failure of insurance companies to forward doctors' illness reports to the proper authorities; or farmworker reluctance to seek medical attention for suspected pesticide exposure for fear of losing their jobs. The evidence is that most agricultural pesticide poisoning cases in the US are not reported. Among the reasons are: no medical insurance, no transportation provided to medical care, fear of retaliation and job loss, institutional racism and cultural and language barriers, the fact that workers receive no or little information about pesticide hazards, and that physicians are unfamiliar with signs and symptoms or reporting. Pesticide poisoning is exacerbated by the facts that worker housing is inadequate and unsafe, field sanitation is poor and workers and their families typically suffer nutritional deficiencies.

widely experienced symptoms in Asia, Africa and Bolivian areas included are dizziness (34-39%), blurred vision (31%) and excessive sweating (28%); in Argentina the numbers suffering these symptoms was between 21-22%. The average of those suffering from nausea, insomnia, skin rashes and difficulty breathing is between 15-20% in Africa, Asia and Argentina (apart from skin rashes, which were not recorded in Argentina), and in Puerto Villarroel 37% suffered from nausea and vomiting. Diarrhoea was a significant problem in Africa, Argentina and Bolivia, affecting between 21-28% in these communities. The figures for Africa and Asia showed that between 10-15% suffered hand tremors, excessive salivation and 'other symptoms', and between 5-10% suffered from staggering, narrowed pupils, irregular heartbeat and convulsions.

5. Highly hazardous pesticides and their use in surveyed areas

This chapter examines the problem of eliminating the pesticides responsible for poisonings in developing countries. International agencies have identified a raft of actions to address the vulnerability of pesticide users in developing countries but these have had limited impact. This chapter sets out progress on action against highly hazardous pesticides, and supports the calls for an increased sense of urgency to eliminate hazardous pesticides and promote safe substitutes for pest control. The chapter names the pesticides which were reported by farmers and agricultural workers in the survey and identifies those categorised as highly hazardous. Information on pesticides responsible for poisonings and numbers affected by each active ingredient were identified in the surveys in seven Asian countries and in Tanzania. In Latin America the pesticides most used by survey participants were identified, along with symptoms experienced, but the percentage affected was aggregated rather than linked to use or incidents.

5.1 Call for action on highly hazardous pesticides – from 1985 to 2010

International bodies have identified the urgency of taking action against 'highly hazardous pesticides' (HHPs). Article 7.5 of the Code of Conduct stipulates that:

> **7.5** Prohibition of the importation, sale and purchase of highly toxic and hazardous products, such as those included in WHO classes Ia and Ib (34), may be desirable if other control measures or good marketing practices are insufficient to ensure that the product can be handled with acceptable risk to the user.

And that pesticide industry should:

> **5.2.4** halt sale and recall products when handling or use pose an unacceptable risk under any use directions or restrictions.

The history of codes, treaties and pledges
Efforts have been made for over 25 years through United Nations bodies to address pesticide hazards around the world. For action in developing countries, the Code of Conduct was adopted in 1985, and amended in 1989 to incorporate the principle of 'Prior Informed Consent' (PIC) so that governments could refuse the import of pesticides that were banned or severely restricted in the exporting country. Following the 1992 Earth Summit, governments set up the Intergovernmental Forum on Chemical Safety (IFCS) to strengthen action on hazardous chemicals in international trade. IFCS surveyed poisonings in developing countries (Kishi 2002) and encouraged a more rigorous approach to combat the scourge of acutely toxic pesticides.

PIC is now enshrined in the Rotterdam Convention, ratified (as at April 2010) by 134 governments. The treaty, which operated on a voluntary basis firstly within the Code of Conduct and then within the Convention before it entered into force in 2004, provides an early warning system for countries on the potential danger of banned and severely restricted pesticides. The Convention has a mechanism for listing severely hazardous pesticide formulations causing problems under conditions of use in developing countries and countries with economies in transition, but this procedure is not being implemented by countries. In 2006 ICCM made further recommendations which are detailed in the Strategic Approach to International Chemicals Management (SAICM), many of which are complementary to the Code of Conduct (FAO 2006).

FAO and WHO – developing action on highly hazardous pesticides
In November 2006 the FAO Council endorsed SAICM and noted that FAO activities include, among other priorities, *risk reduction, including the progressive ban on highly hazardous pesticides*. The Council directed the FAO's Committee on Agriculture (COAG) to address this and in April 2007 the COAG affirmed the need for urgent action and invited donor countries to make additional resources available for this purpose (FAO, COAG 2007).

As a result of these commitments, at its 2007 meeting the FAO / WHO Panel of Experts on Pesticide Management developed criteria for identifying HHPs (FAO 2007). The Panel's criteria are a valuable step forward, and encompass: the hazard classification the WHO and the forthcoming Globally Harmonised System of Classification and Labelling of Chemicals (GHS); pesticides classified for carcinogenicity, mutagenicity and reproductive toxicity; pesticides in international Conventions (Stockholm, Rotterdam and Montreal Protocol); and those which show a high incidence of severe or irreversible adverse effects on human health or the environment (see Appendix 4).

Nevertheless the indicators have significant shortcomings. In particular these criteria do not take into account: pesticides with endocrine disrupting potencies, eco-toxicological properties, or toxicity by inhalation. Furthermore, the Panel recommended that FAO and WHO "… should prepare a list of HHPs based on the criteria identified, and update it periodically in cooperation with UNEP." No list of HHPs has been developed by the FAO or the WHO to date.

PAN initiative to name HHPs
PAN has expanded the criteria for listing HHPs to include those overlooked by the Panel of Experts (PAN Germany 2009). The PAN criteria for analysing toxicity are all based on internationally recognised classifications and sound scientific principles. The classifications are contained in the PAN Pesticide Chemical Database, which lists information from over 100 sources on 3,700 pesticide active ingredients including product information, human and environmental toxicity, regulatory status, chemical use types and classifications, chemical structures and pesticide use (see www.pesticideinfo.org). Drawing on these classifications, a pesticide is considered to be highly hazardous by PAN International if it has one of the following characteristics:

- high acute toxicity (classified as WHO Ia or Ib or very toxic by inhalation, as noted by the European Union risk phrase R26)
- long-term toxic effects at chronic exposure (carcinogenicity, mutagenicity, reproductive toxicity, endocrine disruption)
- high environmental concern either through ubiquitous exposure, bioaccumulation or toxicity, and for high toxicity to bees
- known to cause a high incidence of severe or irreversible adverse effects on human health or the environment

Based on these criteria, PAN has drawn up a list of 395 HHPs. Appendix 4 sets out the criteria, classifications and sources to support this listing, with a list of those currently meeting this criteria. The information to support the development of these criteria, reasons for listing each active ingredient, and a table of pesticides that currently meet the criteria (updated periodically) are available on the *List of Highly Hazardous Pesticides* (http://www.pan-germany.org/download/PAN_HHP-List_090116.pdf).

The following section examines those pesticides named by respondents in the survey. It shows which of these are on the PAN International HHP list, and asks whether other criteria are required to cover those pesticides not on the list, but which have been found by participants to cause ill-health.

5.2 The African surveys - Pesticides associated with poisoning

The surveyed area in Tanzania is a high risk area. In the previous season 73% of farmers applied pesticides once a week and 18% applied twice a week. The majority of the farmers (69%) had experienced pesticides poisoning in the previous farming season due to exposure, much of which occurred more than three times to a single farmer; as noted above 58% of farmers had recently been admitted to hospital for pesticide poisoning more than three times.

Many of the farmers surveyed were able to link their poisoning incident to use of specific products (Table 5.1). This totalled 139 incidents which took place in a four month period from December 2006 to March 2007. Of those who could identify the product responsible: 32 named Fenon C (profenofos + cypermethrin), 25 Selecron (profenofos), 22 Dithane or Ivory (mancozeb), 14 Thiodan (endosulfan), 12 Banco (chlorothalonil, eight Karate (lambda-

Table 5.1 Pesticides most associated with poisoning incidents of farmers in Ngarenanyuki, Tanzania farmers, December 2006 – March 2007 (n=120)

Pesticides used	Active ingredient	Class	No. of farmers	% farmers (n=120)	HHP*
Fenon C	profenofos+ cypermethrin	OP + pyrethroid	32	27	Y+Y
Selecron	profenofos	OP	25	21	Y
Dithane, Ivory	mancozeb	OP	22	19	Y
Thiodan	endosulfan	OC	14	12	Y
Banco	chlorothalonil		12	10	Y
Karate	lambda-cyhalothrin	Pyrethroid	8	7	Y
Decis	deltamethrin	pyrethroid	1	1	Y
Other named products	a.i. not identified		13	11	?

*** Y= yes, on list**

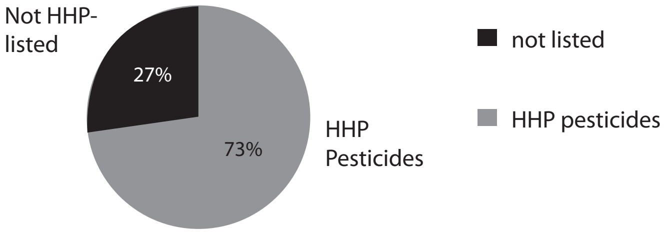
cyhalothrin) and one Decis (deltamethrin). All these active ingredients are on the HHP list. Farmers named another 13 products whose active ingredients were not identified.

Farmers listed the pesticides they used during the months March-April 2007. Of those identified, 73% (Figure 5.1), or 16 active ingredients, appeared on the PAN International HHP list: abamectin, chlorfenvinfos, chlorothalonil, chlorpyrifos, cypermethrin, DDT, deltamethrin, dimethoate, endosulfan, fenitrothion, lambda-cyhalothrin, mancozeb, paraquat, permethrin, profenofos and triadimefon. Some of these were a formulation in the same product, and several of the non-listed active ingredients were in a product formulation with a listed HHP.

5.3 The Asian surveys - Pesticides associated with poisoning

All respondents in the 12 participating communities of eight Asian countries were asked to identify pesticides they used or were exposed to. Responses

Figure 5.1 Proportion of HHPs used by Ngarenanyuki farmers, March-April 2007



from 1185 interviewees in 11 communities were consolidated for toxicity analysis – counting each reported pesticide from each respondent a total of 4,784 reports were obtained.

When compared with the PAN International HHP list, 66% of the pesticide active ingredients are HHPs (Figure 5.2); 24% do not meet the HHP criteria, and the remaining proportion were not identified by the respondents. (For a full list of all reported pesticides in the Asian studies with reference to HHPs and linked to study sites see the Asian study, Communities in Peril Annexes 1 and 2 www.panap.net/panfiles/download/asrep_lowres.pdf).

The community monitor in China, Pesticides Eco-Alternatives Centre (PEAC), adopted a different methodology for collecting and analyzing data from the Yunnan study site. Farmers identified 64 products, with 39 different active ingredients (see Asia report Appendix 3 for full details). Approximately half of these active ingredients (18) appeared on the PAN International HHP list.

The number of reports of HHPs per respondent in the 11 communities from seven countries is shown in Figure 5.3. In all: 1,034 (87%) of respondents reported one or more HHPs; 790 (67%) identified two or more; and 513 reported three or more. A maximum of 16 HHP pesticides was reported by four respondents. The pesticide categories below for most common use identified 23 active ingredients (Table 5.2; see also consolidated Table 5.4):

- *10 most common pesticides in use:* seven were listed as HHPs, some for multiple reasons, including: three possible or probable carcinogens (cypermethrin, 2,4-D [possible], mancozeb [probable]), two endocrine disruptors (lambda-cyhalothrin, mancozeb); two

Figure 5.2 Reports of pesticide use by 1185 respondents in seven Asian countries

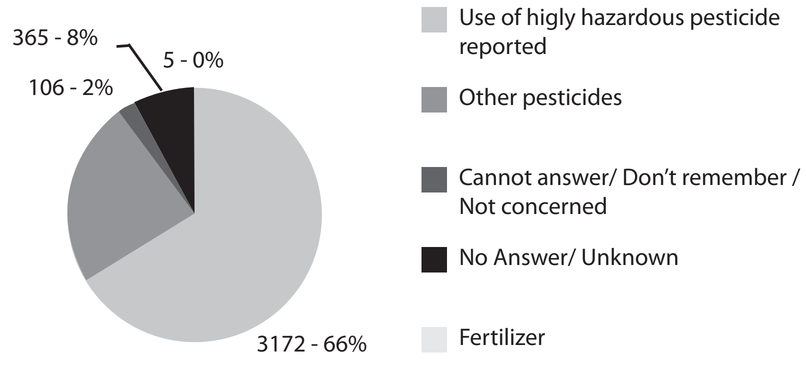
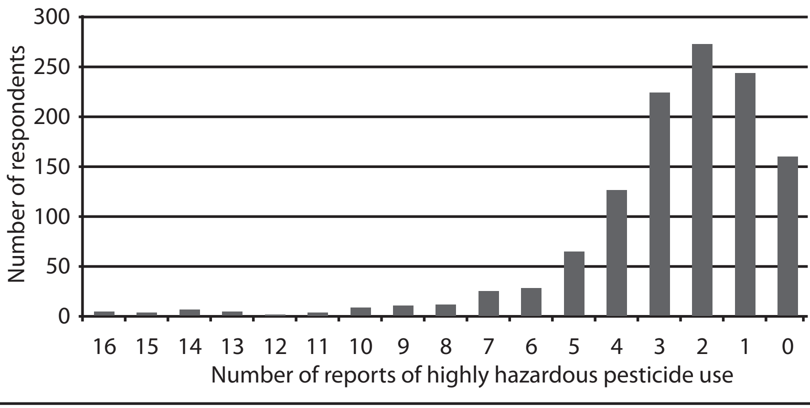


Figure 5.3 Number of reports of HHP use from seven Asian countries (n=1,194)



acutely toxic by ingestion or inhalation (lambda-cyhalothrin, monocrotophos). Environmental concerns of high bee toxicity applied to four active ingredients (lambda cyhalothrin, chlorpyrifos, imidacloprid, monocrotophos). Three were not listed as HHPs.

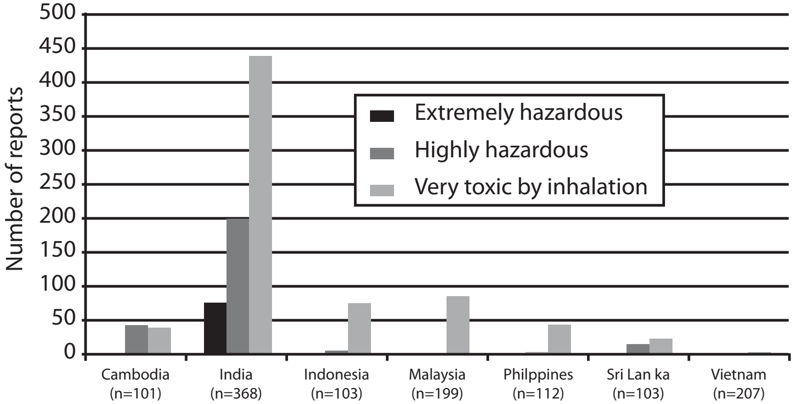
- *10 most common HHPs:* six are listed for chronic toxicity, including possible or probable carcinogens (cypermethrin, mancozeb, 2,4-

D, propiconazole, butachlor, fipronil) and an endocrine disruptor (mancozeb); four are listed for acute toxicity by inhalation (lambda-cyhalothrin, monocrotophos, endosulfan, paraquat). Monocrotophos is also listed as 'highly hazardous' by the WHO and is included as a severely hazardous pesticide formulation in the Rotterdam Convention.

- *10 most common HHPs – acute toxicity:* lambda-cyhalothrin, monocrotophos, endosulfan, methyl parathion, paraquat, triazophos, carbofuran, chlorothalonil, beta-cyfluthrin, phosphamidon. Phosphamidon is listed as 'extremely hazardous' by the WHO and is included as a severely hazardous pesticide formulation in the Rotterdam Convention. Figure 5.4 shows the number of reports of acutely toxic pesticides used in the regional survey areas.

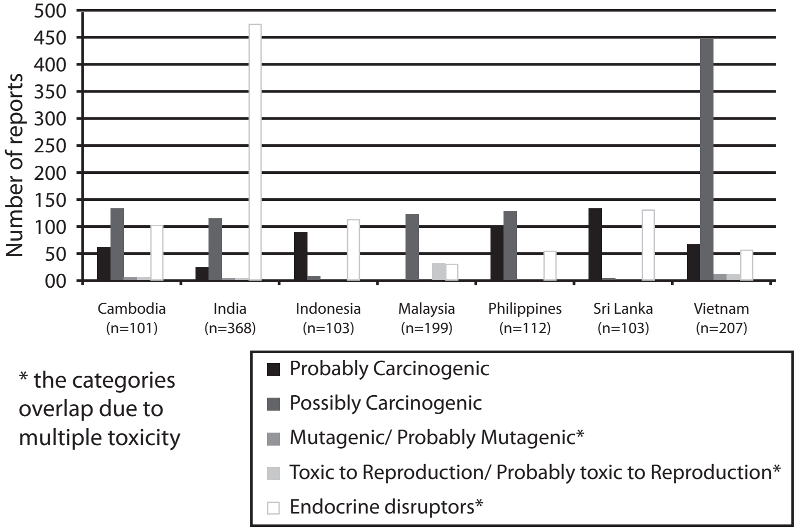
- *10 most common HHPs – chronic toxicity:* eight are listed as possible or probable carcinogens (cypermethrin, mancozeb, 2,4-D, propiconazole, butachlor, fipronil, difenoconazole, hexoconazole) and three as endocrine disrupting pesticides (lambda-cyhalothrin, mancozeb, endosulfan). Figure 5.5 shows the number of reports of pesticides with chronic health concerns used in the regional survey areas.

Figure 5.4. Number of reports of acutely toxic pesticides used
(n = study participants; each may have reported use of multiple pesticides)



* the category "Very toxic by inhalation" overlaps partly with WHO la, lb

Figure 5.5 Number of reports of chronically toxic pesticides used
(n = study participants; each may have reported use of multiple pesticides)



* the categories overlap due to multiple toxicity

Table 5.2 Comparison of 23 active ingredients named in 'top 10' categories in Asian survey, and numbers using these pesticides (11 areas, 1185 responses)

Active ingredient	No. using	% using	10 top a.i.s	10 top HHPs	10 top HHPs: acute	10 top HHPs: chronic	10 top Environment**
Cypermethrin	220	19					
Lambda-cyhalothrin	183	15					1
Niclosamide	174	15					
Chlorpyrifos	165	14					1
Fenobucarb	158	13					
Mancozeb	141	12					
Monocrotophos	139	12					
Glyphosate	132	11					
2,4-D*	126	11					
Imidacloprid	120	10					1
Endosulfan	112	9					
Propiconazole	110	9					2
Butachlor	103	9					
Paraquat	99	8					

Active ingredient	No. using	% using	10 top a.i.s	10 top HHPs	10 top HHPs: acute	10 top HHPs: chronic	10 top Environment**
Fipronil	83	7					1
Difenoconazole	75	6					2
Hexaconazole	68	6					2
Methyl parathion	63	5					
Triazophos	51	4					
Carbofuran	50	4					1
Chlorothalonil	31	3					
Beta-cyfluthrin	30	3					1
Phosphamidon	14	1					

* *Includes all reports for 2,4-D sodium monohydrate, 2-4-D dimethylamine, 2,4,D- butyl ester, 2,4-D iso-butyl ester, 2,4-D ethyl ester and 2,4-D*

** *Environment: 1 – High bee toxicity; 2 – very persistent in water or sediment*

Source: http://www.pan-germany.org/download/PAN_HHP_List_Annex1_090929.pdf

5.4 The Latin American surveys – pesticides identified with poisonings

In Argentina, the survey focused on communities affected by spray drift; spraying takes place every 20 days from October to April. The pesticides that they identified as most commonly used were glyphosate, 2,4-D, endosulfan, atrazine and methamidophos. Other pesticides were used but not identified by the spray-affected community. It was not possible to associate specific pesticides with symptoms, but during the months of spraying the communities suffered considerably. In the two Bolivian areas of Pacajes and Pucarani, the community monitoring found an association of symptoms of poisoning (headache, diarrhoea, tremor, dizziness and excessive sweating) associated with products containing methamidophos (Tamaron and Stermin), methyl parathion (Folidol), lambda cyhalothrin (Karate) and cypermethrin (Nurelle). The active ingredients and products used in the four communities surveyed in Latin America are set out in Table 5.3.

Table 5.3 Pesticides identified in use in the four Latin American areas surveyed, indicating whether HHP listed (%)

Active ingredient	Trade names (Bolivia)	Pacajes	Pucarani	Chipiriri	Puerto	Argentina (a.i. only)	HHP listed
2,4-D	2,4-D / Tordon / Hormonyl			1	10	Regular use	Y
Aldicarb	Temik	3	Most used				Y
Atrazine			Most used			Regular use	Y
Benomyl	Benomyl			6			Y
Carbaryl	Sevin				27		Y
Chlorimuron	Clean C				10		N
Chlorpyrifos	Lorsban plus				27		Y*
Cypermethrin	Nurelle,		Most used	16	27	Regular use	Y
DDT	DDT	1					Y
Dimethoate	Dimethoate			6			Y
Endosulfan				1		Regular use	Y
Glyphosate	(Roundup) (Randan – local name)			25 34	22	Regular use	N

Active ingredient	Trade names (Bolivia)	Pacajes	Pucarani	Chipiriri	Puerto	Argentina (a.i. only)	HHP listed
Lambda-cyhalothrin	Karate			28	Some use		Y
Lambda-cyhalothrin+ methamidophos	Karate+Stermin		Most used				Y,Y
Methamidophos	Stermin				22		Y
Methamidophos	Tamaron				8		Y
Methamidophos	Tamaron, Stermin, Thodoron	68	Most used	20		Regular use	Y
Methamidophos + cypermethrin	Caporal			31	22		Y,Y
Methamidophos + methyl parathion	Tamaron+ Folidol	4					Y,Y
Methyl parathion	Folidol		Most used			Some use	Y
Methomyl	Metroni (local name)				3		Y
Paraquat	Gramoxone			98	22		Y
Propiconazole	Tilt				10		Y
Tridemorph	Calixin				10		Y

Active ingredient not identified	Babistín			6			
	Basoka				27		
	Cercon	3					
	Cingora		Most used				
	Eskoba					Some use	
	Etidetrín			3			
	Glifomax			4			
	Murilli			16			
	Nobolate					Some use	
	Panzer			1			
	Sulfotato					Some use	
	Thodotrin				22		
	Triplex				10		
	U-46 Seven (possibly Sevin?)			9			
	Unnamed			13			

** Listed only for highly toxic to bees*

Source: Regional report and PAN International list of HHPs http://www.pan-germany.org/download/PAN_HHP_List_Annex1_090929.pdf

5.5 Summary of most used HHPs in survey areas

The areas surveyed represent a very small proportion of the pesticide use in each country. The products identified may be only specific to that particular area, reflecting the crops produced, the local pests, the choice of the farmers surveyed, and commercial factors. On the other hand they may be widely used throughout the country; indeed HHPs may be used in even greater concentrations in other areas. In the Asian survey, respondents reported in total the names of 150 active ingredients which they use, of which 82 were classified as HHPs (PAN AP, 2010).

The reasons for HHP listing of all named pesticides in the survey are set out in Tables 5.4 and 5.5. Of the active ingredients in these tables, four are listed for both acute and chronic toxicity; 11 for acute toxicity; 20 for chronic toxicity; and five for environmental effects (toxic to bees). Table 5.4 includes the 23 from the Asian 'common use' categories listed in Table 5.2. From the African and Latin American surveys these are the pesticides identified as causing health problems. Table 5.5 lists the active ingredients noted in the Asian interviews of poisoning cases from Appendix 3: seven of these are identified as HHPs and a further seven are not listed, even though some are responsible for multiple poisoning incidents.

Many HHPs are still in use in industrialised countries, and Appendix 6 provides data on the situation in the US, where pesticide poisoning remains a problem.

Table 5.4 Consolidated table of HHP pesticides identified in surveys; reason for HHP listing; country reporting use[(a)]

Pesticide name	HHP – toxicity resulting in listing	Asia: No. using	Asia: Country reporting	Africa and Latin America: Country[(b)] reporting[(b)]
2,4-D[(c)]	Chronic: Possible carcinogen	126	Malaysia, India, Philippines	Argentina, Bolivia (Ch)
Abamectin	Environment: High bee tox			Tanzania
Aldicarb	Acute: WHO 1a, EU R26 Chronic: suspected EDC			Bolivia (Pac, Puc)
Atrazine	Chronic: carcinogen, suspected EDC			Argentina, Bolivia (Puc),
Benomyl	Chronic: EPA possible cancer; EU mutagen, reproductive			Bolivia (Ch)
Beta-cyfluthrin	Acute: EU R26	30	Philippines	
Butachlor	Chronic: Probable carcinogen	103	Philippines	
Carbaryl	Chronic: Probable/ likely carcinogen; EU cancer, EU EDC; Environment: High bee tox			Bolivia (Puerto Villarroel)
Carbofuran	Acute: WHO Ib, EU R26	50	India, Sri Lanka	
Chlorfenvinphos	Acute: WHO 1b, EU R26 Chronic: suspected EU EDC			Tanzania
Chlorothalonil	Acute: EU R26	31	Indonesia, Sri Lanka	Tanzania

Chlorpyrifos	Environment: High bee toxicity	165	Cambodia, India, Malaysia, Sri Lanka	Tanzania Bolivia (PV)
Cypermethrin	Chronic: Possible carcinogen	220	Cambodia, Philippines, Vietnam	Tanzania, Argentina, Bolivia (Puc, Ch, PV)
DDT	Chronic: possible carcinogen; EU EDC			Tanzania, Bolivia (Pac)
Deltamethrin	Chronic: EU EDC Environment: High bee tox			Tanzania
Difenoconazole	Chronic: Possible carcinogen	75	Vietnam	
Dimethoate	Chronic: possible carcinogen, EU EDC Environment: High bee tox			Tanzania Bolivia (Ch)
Endosulfan	Acute: EU R26	112	India	Tanzania, Argentina, Bolivia (Ch)
Fenitrothion	Chronic: EU EDC Environment: High bee tox			Tanzania
Fipronil	Chronic: Possible carcinogen	83	Vietnam	
Hexoconazole	Chronic: Possible carcinogen	68	Vietnam	
Imidacloprid	Environment: High bee tox	120		
Lambda-cyhalothrin	Acute: EU R26 Chronic: EU EDC Environment: High bee tox	183	India, Indonesia	Tanzania Bolivia (Ch, PV)
Mancozeb	Chronic: Probable carcinogen, EU EDC	141	Sri Lanka Indonesia	Tanzania

Methamidophos	Acute: WHO 1b			Argentina, Bolivia (Pac, Puc, Ch, PV)
Methyl parathion	Acute: WHO Ia, EU R26	63	India	Argentina, Bolivia (Puc, PV)
Methomyl	Acute: WHO Ib Chronic: EU EDC Environment: High bee tox			Bolivia (PV)
Monocrotophos	Acute: WHO Ib, EU R26	139	India, Cambodia	
Paraquat	Acute: EU R26	99	Malaysia	Tanzania, Bolivia (Ch, PV)
Permethrin	Chronic: Possible carcinogen, EU EDC	14		Tanzania
Phosphamidon	Acute: WHO Ia	14	India	
Profenofos	Chronic: Possible carcinogen, EU EDC			Tanzania
Propiconazole	Chronic: Possible carcinogen	110	Vietnam	Bolivia (PV)
Triadimefon	Chronic: Possible carcinogen, EU EDC			Tanzania
Triazophos	Acute: WHO Ib	51	India	
Tridemorph	Chronic: EU reproductive tox			Bolivia (PV)
Total: 36 pesticides				

Source: PAN International List of Highly Hazardous Pesticides http://www.pan-germany.org/download/PAN_HHP_List_Annex1_090929.pdf.
An updated version of this list is available at http://www.pan-germany.org/gbr/project_work/highly_hazardous_pesticides.html.

(a) WHO Ia = Extremely hazardous
WHO Ib = Highly hazardous
R26: Very toxic when inhaled
Chronic toxicity information taken from EU, US EPA and the IARC
(b) Bolivia – 'Pac – Pacajes; Puc – Pucarani; Ch – Chipiriri; PV – Puerto Villarroel
(c) Includes all reports for 2,4-D sodium monohydrate, 2-4-D dimethylamine, 2,4,D- butyl ester, 2,4-D iso-butyl ester, 2,4-D ethyl ester and 2,4-D

Table 5.5 Pesticides responsible for poisoning incidents in Appendix 3 where active ingredient or country is not listed in Table 5.4

Active ingredient/s of product	No. of incidents	Location of incident/s	HHP listing
Edifenfos	8	Kerala	Acute: WHO 1b
Methiocarb	1	Indonesia	Acute: WHO 1b Chronic: EU EDC Environment: Bee toxicity
Thiacloprid	2	Sri Lanka	Chronic: likely carcinogen
Maneb	3 1	Sri Lanka Indonesia	Chronic: likely carcinogen, EU EDC
Bromoxynil+ioxynil (product Novacron)	2	India (Orissa)	Chronic: Possible carcinogen (bromoxynil), EU EDC (both)
Etofenprox	1	Vietnam	Environment: Bee toxicity
Imidacloprid	2	Vietnam	Environment: Bee toxicity
Active ingredients named in poisoning incidents but not listed as HHPs			
Bensulfuron-methyl	3	Sri Lanka	Not listed
Bispyribac-sodium	2	Sri Lanka	Not listed
Cymoxanil	3	Indonesia	Not listed
Dimethomorph	1	Indonesia	Not listed
Fenbucarb	5	Vietnam	Not listed
Propineb	2	Sri Lanka	Not listed
Validamycin	3	Vietnam	Not listed

5.6 Community-based monitoring in the US – sample findings

Since their launch in 2003, Drift Catchers have been deployed for 27 projects by trained volunteers and community leaders in ten US states: Alaska, California, Colorado, Florida, Hawaii, Indiana, Maine, Minnesota, North Carolina and Washington (see Appendix 5). The pesticides most captured in the Drift Catcher are volatile chemicals, many of which are HHPs. Those of particular concern which are also HHPs were: azinphos-methyl, chloropicrin, chlorpyrifos, cypermethrin, diazinon, endosulfan, malathion, molinate, permethrin and telone (1,3-dichloropropene). Other HHPs found at lower levels were chlordane, chlorothalonil, DDE (breakdown of DDT) and trifluralin. Examples of monitoring exercises, from the three years 2006-2009 follow and Box 3 provides two case studies from Florida and California.

Chlorpyrifos was found in 100% of the 42 samples collected at two sites in Washington in the spring of 2006 in a PANNA project with the Farm Worker Pesticide Project. It exceeded the Level of Concern (LOC) in 38% of samples. In 40 samples taken at two sites in June, low levels of chlorpyrifos, endosulfan, and/or azinphos-methyl were found in 98% of samples, though always in amounts lower than the LOC.

In Florida, sampling by an elementary school yielded striking results in 2006-2008. In 2006, 100% of eight samples contained pesticides: endosulfan, diazinon and trifluralin (all HHPs) were found in eight, seven and seven samples, respectively, and exceeded LOCs in 3, 5 and 0 samples respectively. The next year, 39 samples were collected. Endosulfan was detected in 87% of samples and exceeded LOCs 23% of the time; diazinon was found in 23% of samples and exceeded LOCs in four; and trifluralin was found in 92% of samples. In 2008 chlorothalonil – a persistent fungicide, HHP and EPA 'probable carcinogen' – was also found. It showed up in 85% of samples, but never in levels exceeding LOCs. Sampling continued in 2008–09, and endosulfan was detected in most samples.

Mosquito abatement spraying was monitored at two sites in Colorado in 2006 and 2007. As one would expect, the adulticide (malathion in 2006 and malathion and permethrin in 2007) was found in 100% of samples collected during the hours when spraying occurred. Samples collected just prior to the weekly spraying were pesticide free.

Box 3. Cases from Drift Catcher monitoring in Florida and California

Drift Catching in Florida

South Woods Elementary School in St Johns County, Florida, is bordered on three sides by a large seed farm that sprays toxic pesticides during the school year. Motivated by concerns about the health of the children at the school, residents of the county have been using the Drift Catcher to monitor the air near the school since 2006. In December of that year, two high school students collected eight samples and all contained endosulfan, a persistent organochlorine insecticide linked to autism, birth defects, and delayed puberty in humans. The concentration of endosulfan exceeded levels of concern (LOCs) derived from EPA toxicology data on three days. Diazinon, a neurotoxic organophosphate insecticide, was found in all but one sample and exceeded LOCs in five. Finally, the herbicide trifluralin – ranked by the EPA as 'possible carcinogen' – was detected in all but one sample, but never in levels exceeding LOCs. All three pesticides are PAN International HHPs.

In 2007, a local mother continued the sampling, collecting 39 samples between October and December. As in the previous year, at least one pesticide was found in each sample, and there were frequent exceedences of LOCs. Endosulfan was detected in 87% of samples and exceeded LOCs 23% of the time; diazinon was found 23% of samples and exceeded LOCs in four of them; and trifluralin was found 92% of samples. This year, chlorothalonil – a persistent fungicide, PAN HHP, and EPA 'probable carcinogen' – was also found. It showed up 85% of samples, but never in levels exceeding LOCs.

Drift Catching and biomonitoring in California

Lindsay, California, is a predominately Latino community in California's fertile San Joaquin Valley. The town grew up around orange trees, and most of its homes and schools are situated right next to groves where neurotoxic organophosphates are routinely sprayed. The organisation *El Quinto Sol de America* used Drift Catchers from 2004 to 2006 to document the movement of chlorpyrifos from the groves and into residents' yards. In 2004, 104 samples were collected across five different sites during July and August. Chlorpyrifos was found in 76% of the samples, and 11% had levels exceeding the LOC for infants. The next year sampling continued at four sites, with 108 samples collected. Eighty percent contained chlorpyrifos, and the LOC was exceeded 23% of the time. In 2006, 28% of the 116 samples collected from six sites contained chlorpyrifos in levels that exceeded the LOC. That year, urine samples were also collected from 12 residents and tested for a metabolite of chlorpyrifos. The metabolite was found in everyone's urine; all but one had levels above the national average and above the level EPA is says is 'acceptable'.

Sampling took place in Minnesota from 2006–2009. Out of 186 samples collected at 11 sites in 2006 and 2007, chlorothalonil was found in 66% of samples, though always in levels less than the LOC. Subsequent sampling has continued and found chlorothalonil most of the time, and sometimes also small amounts of additional pesticides.

Sampling for chloropicrin (fumigant and HHP) in Sisquoc, California, in 2008 found high levels in 46% of 28 samples at one site and 55% of 29 samples collected at another. Acute LOCs were exceeded in one sample from each site, and for one site the average concentration over the 18-day sampling period exceeded sub-chronic LOCs.

5.7 Observations on hazardous pesticides from the survey

International initiatives have called for consideration of a *progressive ban on highly hazardous pesticides*. Such a public health strategy needs to move away from case-by-case, product-by-product, and incident-based approaches and instead to take action based on the intrinsic hazardous properties of pesticides. To implement this recommendation HHPs need urgently to be identified. In the absence of guidance from a UN or other international agency, PAN International developed a list with the transparent criteria noted at the beginning of this chapter.

This survey demonstrates that the use of hazardous pesticides is endemic, and exposure is a problem in the US as well as in developing countries. In Asia, seven of the 10 most common pesticides in use were listed as HHPs. In Tanzania, 73% of the pesticides used in a study period (March-April 2007) were HHPs. Tanzanian farmers identified by name seven pesticides which have caused poisoning incidents, all of which are listed as PAN International HHPs. In Latin America, of the 19 different active ingredients identified in the survey as commonly used, 17 were were named as HHPs. The HHP pesticides are clearly in widespread use and are causing health problems, including those listed for both acute and chronic toxicity.

6. Conclusions and recommendations

Twenty-five years ago, the International Code of Conduct on the Distribution and Use of Pesticides was adopted as part of a global commitment to reduce pesticide poisonings in developing countries. It requires both governments and the pesticide industry to implement a range of measures to eliminate health and environmental hazards of pesticides. Following a renewed call from the international community for pesticide *risk reduction, including the progressive ban on highly hazardous pesticides,* the surveys reported here have looked at common practices in the field, the health impacts experienced by pesticide users and exposed communities, and the highly hazardous pesticides in use and causing harm.

The surveys reported here found that pesticide users are not able to adequately protect themselves against exposure to the pesticides they are spraying. Full PPE is not worn in any of the areas, although in the Asia region a higher percentage of those spraying wear long sleeved shirts and long pants. The discrepancy between recommended clothing that would be required for pesticide application in any industrialized country and that worn by users in these surveys is incomparable. It is sometimes assumed that pesticide users do not wear PPE because it is hot and uncomfortable, but the survey showed that availability and cost are greater factors than discomfort. There is widespread failure among both governments and industry to provide access to proper and affordable PPE. This situation is not limited to developing countries, as even in the US, agricultural workers frequently report lack of use of PPE and workers face significant barriers to reporting lax enforcement of pesticide policies.

Indicators suggest that pesticide users take little action to avoid risks during spraying. In some cases information and awareness may remedy this problem but in other cases users simply do not have the resources to take precautions. Some of the farmers who have received information about the importance of labels still do not read them or do not / cannot follow label instructions. Safe storage is lacking and pesticides are stored inappropriately. No facilities are in place for returning empty pesticide containers and these are consequently disposed of in a haphazard manner. These problems indicate not only lack of awareness, information and training, but also of the resources that are essential in order to take precautions.

A disturbing picture of ill-health from pesticides emerged from the surveys. The most common symptoms are headaches, dizziness and blurred vision. These were each experienced by over one-third of the respondents. Further investigation would be needed to identify the number who suffer some symptoms (which could be all users), compared to the numbers experiencing multiple symptoms. Overall, there was widespread experience of these and other signs and symptoms commonly associated with acute pesticide poisoning: excessive sweating, insomnia, skin rashes, difficulty breathing, diarrhoea, hand tremors, excessive salivation, staggering, narrowed pupils, irregular heartbeat and convulsions. Symptoms should not be underestimated and are very often even more severe than conveyed by these terms. These impacts can easily be confused with common illnesses; in most cases sufferers do not go to a doctor, clinic or hospital for treatment but if they do there is a high likelihood that the symptoms will not be associated with pesticide poisoning, particularly as there is a shortage of functional poisons information centres in these regions.

There can be many knock-on impacts from pesticide poisoning which were not investigated in the surveys. Agricultural spraying takes place when the crop requires attention, and ill-health may mean that farmers forgo important crop-related activities, resulting in yield losses. Even mild symptoms may affect the ability to work for some days resulting in loss of valuable income. The cost of travelling to a hospital, or taking a remedy was not calculated.

Pesticide users, including small scale farmers and agricultural workers, are at a high risk from exposure to products that are acutely and / or chronically toxic. In addition, many communities living near sprayed fields are affected. This is particularly true where large scale production and monocultures have become the norm. The issue of pesticide drift from these areas needs to be urgently addressed. The Drift Catcher developed by PANNA provides a scientifically-sound way of measuring the scale of drift from volatile pesticides. Measures that replace some volatile pesticides, restrict spray times and increase 'buffer zones' will need to be agreed and enforced.

To date, international agencies have not identified specific HHPs to target for action. PAN International has drawn up criteria which are based on, but extend to those recommended by the FAO Panel of Experts on Pesticide Management. From these criteria PAN has identified 395 HHPs, for reasons of acute, chronic or environmental toxicity. There is a high correlation between the pesticides that users know to cause harmful health effects and those identified in the PAN International HHP classification. An analysis of the pesticides used in Asia region found that of 150 pesticides used, 82 are on this HHP list, and almost all pesticides noted as causing adverse health effects in Africa and Latin America were HHPs. Of the 36 'common' pesticide active ingredients in these surveys (Table 5.4), 23 are listed for chronic health impacts. There may be on-going or permanent chronic effects as a result of acute exposure, or from regular exposure to many pesticides.

Major international efforts for identifying pesticides that cause problems in developing countries have focused on a case-by-case, or incident-by-incident basis, for example through the procedures set out in the Rotterdam Convention on PIC. This approach has failed to identify problem pesticides and more proactive and far-reaching action is required, taking into account the recommendation for a progressive ban on HHPs.

Pesticide use is continuing to expand globally, particularly in Asia and Latin America. It is essential that governments and the pesticide industry implement assertive actions for pesticide risk reduction. Actions need to be taken and supported by all entities addressed by the Code of Conduct, including the food industry which exerts a significant influence over agricultural production strategies. Recommendations that flow from the observations of this survey include:

Recommendations for action

Governments should:

- Adopt and practice good governance regarding the development and implementation of plant protection policies and regulations.
- Invest in research and participatory, community-based trainings in agroecological systems. Strengthen national and regional research on agroecology, especially in Africa.
- Insist on an agroecological approach. Support policies that incentivize the rapid adoption of agroecological production systems, i.e., reducing taxes for land managed with agroecological approaches, ensuring access to credit and markets for agroecological producers.
- Promote ecological, safer and non-chemical alternatives as SAICM clearly states: to "promote and support the development and implementation of, and further innovation in, environmentally sound and safer alternatives, including cleaner production, informed substitution of chemicals of particular concern and non-chemical alternatives."
- Strengthen consumer movements on food security and food safety, especially in Africa.
- Adopt, through an international process, the PAN International list of HHPs as the basis for a progressive ban on highly hazardous pesticides, and identify additional risky active ingredients to target for elimination, such as 'Pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available' (Article 3.5, Code of Conduct). The basis for policy decisions should be hazard assessment rather than risk assessment.
- Adopt a pro-public health approach to eliminating pesticide poisonings, based on a progressive ban on highly hazardous pesticides that takes action based on the intrinsic hazardous properties of pesticides, rather than considering pesticides on a case-by-case or incident-based approaches.
- Adopt a precautionary approach to pesticide regulation.

- Place liability onto pesticide manufacturers and distributors for human health and ecosystems harm. People and governments should not be left bearing the costs.
- Legally require those who employ pesticide sprayers to provide full personal protective equipment (PPE), along with training and retraining on a regular basis.
- Support and expedite the establishment through the WHO of poisoning information centres in developing countries.
- Promote the use of community–based monitoring of pesticides worldwide. Adopt innovative strategies for measuring pesticide exposure and identifying priority areas for action.
- Insist upon the implementation of international conventions related to chemicals.
- Enact regulations on “right to information” and “right to know” to ensure that communities and agricultural workers are provided with full information on the pesticides that they exposed to or spray.
- Implement legislation and regulations on pesticide management on national and regional levels, especially in Africa.

Governments and the pesticide industry should:

- Adopt the life-cycle concept of pesticide management (Code of Conduct Article 1.7.5).
- Pull pesticides from the market until proven safe, rather than leave them on the market until proven harmful. Pesticide companies must stop the production, distribution and use of highly hazardous pesticides due to their uncontrollable negative consequences on health and the environment.
- Establish and implement extensive no-spray zones around heavily sprayed fields, particularly those where pesticides are sprayed by air or by large scale spray equipment, and where families , workers and children live, work and play.
- Ensure that affordable and effective PPE is available as a matter of course throughout all areas where pesticides are sold, and restrict the sale of pesticides in areas where PPE cannot be supplied.
- Establish a large-scale programme of public awareness of pesticide hazards aimed at women, men and children; back up this programme with easily accessible information that will help pesticide users to protect themselves.
- Establish a network for best management practices for empty

pesticide containers throughout rural areas, including the ability to return to supplier or collection schemes.

- Make available cheap and safe lockers for storing pesticides in all areas where pesticides are in use.
- Fund programmes for government and community led biomonitoring studies as well as independent plant protection services. Every bottle of pesticide sold should have a percentage of its profits going towards biomonitoring and independent extension services to support ecosystem based plant production systems and toward preventing pest outbreaks.

The food industry should undertake initiatives to:

- Implement higher standards throughout the supply chain, including agricultural production based on agroecology, to ensure that food and fibre is produced in a way that does not cause harm to small scale farmers, agricultural workers, their families and the environment.
- Use market influence to phase out use of HHPs in agricultural production and to secure products grown using agroecological approaches.
- Promote organic products in developing countries, especially in Africa.

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Appendix 1. Documentation on certain pesticide poisonings: Africa, Asia, Latin America

Africa	
Benin	105 cases, including nine deaths, between May 2007 and July 2008, due to endosulfan (Badarou, Coppieters, 2009). 37 deaths and 73 poisonings (farmers and others) were documented between May and September 1999 as a result of severe poisoning from Callisulfan (endosulfan 350g) in the administrative department Borgou. In the following season research found 241 acute poisonings and 24 deaths, including those of 11 children aged under 10. These poisonings are both direct (occurred during or after application) and indirect (spray drift, consumption of contaminated products). (Ton et al. 2000, Tovignan et al. 2001)
Burkina Faso	100 producers spraying cotton crops in the area of Gourma, experienced severe headaches (92%), dizziness (83%), trembling hands (54%), nausea or vomiting (21%), troubled vision (21%), excessive sweating (13%), blackouts (8%) and hypersalivation (8%). The 2006 study found that the most serious incidents (13%) occurred during pesticide use and other symptoms occurred hours or days after use. The pesticide responsible was not positively identified, but was most likely endosulfan. (Glin et al. 2006)
Côte d'Ivoire	A survey of 88 market gardeners in Abidjan documented evidence of hazardous pesticide practices used by untrained growers supplying fruit and vegetables to the city. The chemicals used are primarily Décis 12.5 EC and Cypercal 250 EC; only 27% of products applied were approved for use on market gardening crops. Growers complained of: headaches, sore throats (from irritation to violent cough), stomach pains (from cramps to vomiting), diarrhoea, itching and heart palpitations. Headaches and stomach pains were recorded in 55% of cases (Doumbia, Kwadjo 2009). The National Centre for Agronomical Research in Abidjan estimates that 65% of the illnesses suffered by market gardeners, the cotton growers, mango producers, as well as consumers in Ivory Coast, are due to pesticides (Hala, Kehé, 2009).
Mali	In 2000, the FAO estimated that acute pesticide poisoning affected 329 people a year, with 30 to 210 deaths and from 1150-1980 chronic poisonings (FAO/CILSS 2000).
Morocco	2609 cases of poisoning recorded at the Moroccan Anti-Poison Centre over the period 1992-2007 (Rhalem et al. 2009).

Senegal	258 cases of acute poisoning listed in PAN Africa database between 2002-2005, based on surveillance and interviews (Thiam, Touni 2009).
Togo	More than 500 cases of poisonings linked to endosulfan have been recorded each year by the Toxicology Division of the Public Hospital of Lomé-Tokoin (Kodjo 2007).
Asia	
Bangladesh	In 2008, pesticide poisoning was recorded as a leading cause of death, and was officially recorded as the second highest cause of death among the 15-49 year old age group, accounting for 8% of deaths (DGHS 2009).
Cambodia	At least 88% of 210 farmers surveyed in three vegetable growing areas of Cambodia had suffered from symptoms of acute pesticide poisoning (Sodavy et al. 2000).
China	Between 53,000 and 123,000 people are poisoned by pesticides annually, and 300 to 500 farmers die each year. Localized studies suggest much higher rates (OCA, 2003).
Japan	Out of 346 pesticide poisonings recorded between 1998 and 2002 in Japanese hospitals, 70% were recorded as suicides, 16% occupational and 8% due to accidental ingestion. The most common pesticides were organophosphates and paraquat (Nagami et al. 2005).
Korea	Between 1996 and 2005, approximately 2,500 fatalities were reported to occur annually due to pesticide poisoning. Paraquat was the main causal agent (Lee, Cha 2009).
India	WHO estimates that 600,000 cases and 60,000 deaths occur in India annually, with the most vulnerable groups consisting of children, women, workers in the informal sector, and poor farmers (WHO 2009). Andhra Pradesh state records over 1,000 pesticide poisoning cases each year and hundreds of deaths; the pesticides monocrotophos and endosulfan accounted for the majority of deaths with identified pesticides in 2002 (Rao et al. 2005). In Andhra Pradesh state alone, the WHO estimated that the toll of annual deaths from pesticide poisoning may exceed 5,000; monocrotophos poisoning may be responsible for close to 2,000 deaths, or 40% of the total (WHO 2009).

Indonesia	A one-year study of pesticide poisoning in seven hospitals in Java between 1999 and 2000 identified 126 cases. Organophosphates were the most commonly used poisoning agents (WHO, 2002). In 2003, 317 cases of pesticide poisoning were reported; likely to be an underestimate (WHO 2004). A survey of Indonesian farmers found that 21% of the spray operations resulted in three or more neurobehavioral, intestinal, or respiratory symptoms (Kishi et al. 1995).
Malaysia	Between 2006 and 2009, the pesticide poisoning cases, listed by the National Poison Centre (NPC) were 490 (2006), 678 (2007) and 841 (2008) (NPC 2010). A ban was placed on the herbicide paraquat in 2002 but was lifted in 2006 and paraquat poisoning cases have more than doubled since then, as shown below (NPC 2009): 2002 10 2006 31 2003 15 2007 39 2004 16 2008 71 2005 36
Philippines	Between April 2000 and May 2001, 273 poisoning cases were reported (commonly by ingestion) with 16 cases resulting in death. Pesticides commonly used for self-harm were cypermethrin, malathion, carbofuran, cyfluthrin, deltamethrin (Dioquino, undated). Local studies using focus group discussions with those exposed to aerial spraying in the plantations have revealed a spectrum of medical complaints and symptoms consistent with acute pesticide poisoning (Quijano & Quijano 1997).
Sri Lanka	Pesticide poisoning is one of the leading causes of hospitalization; some 15,000-20,000 cases were admitted annually to government hospitals in the period 1998-2000. Of these, 500-2,200 died each year. Self-poisoning with suicidal intent was very common (WHO, 2002). WHO Class 1 organophosphates were banned in January 1995; endosulfan was banned in 1998. A corresponding fall in the number of deaths caused by these pesticides has been observed. In 2003 the majority of deaths were due to WHO Class II organophosphates, particularly fenthion and dimethoate, and the herbicide paraquat (Roberts et al. 2003).
Vietnam	In 2002, 7,170 cases of pesticide poisoning were reported (WHO 2005). Blood tests of 190 rice farmers in the Mekong Delta, Vietnam, revealed that over 35% of test subjects experienced acute pesticide poisoning, and 21% were chronically poisoned (Dasgupta et al. 2007).

Latin America	
Bolivia	In Cochabamba 2007/2008 poisoning figures increased by 30% (274 cases) in 2007-2008; 56% of those poisoned are women from rural areas (Numbela 2008). There were two accidental deaths of children associated with pesticide use in Santa Cruz and 11 persons in Chuquisca in recent years (CEIISSA 2008, Condarco & Jors 2006).

Appendix 2. Questionnaire – Pesticide use and effects

Part A: Conditions of use (general)

Personal details

1. Name:
   Family name:___________First name:__________Middle name:_________

2. Do you wish to remain anonymous? _ No _ Yes

3. Address: ____

4. Age:_____________ Or tick:
   _ 18-19
   _ 20-29
   _ 30-39
   _ 40-49
   _ 50-59
   _ 60-69
   _ 70+

*If under 18- should **not** complete this questionnaire*

5. Sex: _ male _ female
   For females:
   _ Pregnant?
   _ Breastfeeding?

6. Ethnic group: _____________________________

7. Marital status: _____________________________

8. Educational attainment:
   _ Grade school
   _ High school
   _ College
   _ Vocational course
   _ Postgraduate

Household and home environment

9. How many people live in your home (including yourself)? ______________

10. Of these people, how many are children less than 18 years old? ______________

11. Do any of these people work in agriculture? If **yes**, please state how many are:
    _ child (<14yrs) ______________
    _ adolescent (14-18 yrs) ______________

12. Household income: ______________

13. Length of stay in present address (in years): ______________

14. Distance from plantation/workplace (in kilometers or metres): ______________

15. Occupation: ____________________________

16. Are you a pesticide applicator: _ No _ Yes
    _ Worker applicator
    _ Farmer applicator
    _ Household applicator

17. Sector:
    _ Farm (specify crop/s):___________
    _ Plantation (specify crop/s):___________
    _ Orchard (specify fruit/s):_____________
    _ Floriculture
    _ Others, please specify:___________________________

18. Work undertaken: ____________________________

19. Place of employment (farm, estate, garden etc): ____________________________

20. Place of employment owned by:
    _ Corporation (state company):______________
    _ Family (detail):_____________
    _ Contract arrangement/Leasehold (detail)_______________
    _ Other (detail):____

21. Spouse's occupation (if married): ____________________________

Pesticide use and exposure

22. Do you use pesticides at:
    _ work
    _ home (house or garden)
    _ farm

    If answered yes to any of the above, please also complete the table "Product Identity and use" (27)

23. If you do not use pesticides, then how do you control pests or weeds:
    In the garden_____________
    At home_____________
    In the farm _____________

24. Activities at work and home:
    _ application in field
    _ mixing/loading
    _ veterinary therapy (e.g. to kill parasites on domestic animals)
    _ household application (e.g. use of mosquito repellent)
    _ vector control application (i.e. to kill an insect or animal that can carry disease. For example, the government may undertake a public health programme to kill mosquitos carrying parasites that can cause malaria)
    _ human therapy (e.g. to kill lice, scabies, parasites)
    _ working in fields where pesticides are being used or have been used
    _ re-entry to treated fields
    _ washing your clothes that have been used when spraying or mixing pesticides
    _ washing family's clothes that have been used when spraying or mixing pesticides
    _ washing equipment that has been used when spraying or mixing pesticides

- _ purchasing or transporting
- _ other, please specify:_______________________________________

25. Are you exposed to pesticides:
    - _ applied by ground-methods (e.g. backpack spray, or off a tractor)
    - _ applied from the air (plane or helicopter)
    - _ water contamination (e.g. drinking or bathing in water that is close to sprayed areas)
    - _ food: eating food that is potentially exposed to pesticides
    - _ eating after spraying pesticides without washing your hands first
    - _ neighbours usage of pesticides
    - _ governments spraying for public health purposes (e.g. Malaria)
    - _ other ways, please specify: _____________________________

26. How often does this occur (for each exposure in questions 24-25)? _____
    ____
    ____

Product identity and use

27. Indicate the name of pesticide and its use/s (from Question 22, 24, or 25):
Complete the below table as much as possible, otherwise describe below. Please attach copies of the labels if possible.

Product or trade name	Company name (manufacturer)	AI &concentration (% or grams / litre)	Type of formulation*	Animal/ crop being treated with the product	Target pest, weed, disease	When was the last time you used it

**Type of formulation (state one of the following in table) see Annex 4 for descriptions:*

Emulsifiable Conc. (EC)	*Tablet (TB)*
Wettable Powder (WP)	*Granular (GR)*
Dustable powder (DP)	*Aerosols and baits (AB)*
Water Soluble Powder (SP)	*other, (specify):*
Ultra Low Volume (ULV)	

OR name the combination of pesticides if more than one type was used: ____________________________________
____

Method and timing

28. How is the pesticide applied, and how often?

Product or trade name, or state 'mixture'	Equipment	Dose applied (amount of pesticide)	Application time per load (minutes or hours)	Application time per day (minutes or hours)	Frequency (weekly or monthly)	Duration (years)

**Equipment (state one of the following in table) see Annex 5 for descriptions:*

Hand	*drip irrigation*
bucket and brush	*aerial spray (helicopter or plane)*
spray (aerosol can)	*seed treatment*
spray (backpack)	*other: (specify)*
spray (vehicle-mounted)	

IF a combination of pesticides were used, please describe method and timing:

Pesticide use (continued)

29. If you work in pesticide sprayed fields, how soon after spraying do you re-enter the area? ___________________________

30. Where do you use the pesticides?
    _ field
    _ garden
    _ greenhouse
    _ house
    _ other (specify):__________________
31. Do you spray:
    _ against the wind
    _ along the wind
    _ unknown

32. Have you ever had pesticide spilled on you?
    _ while spraying
    _ while loading
    _ while mixing
    _ what part of the body?

    Reason for spill_____________
    What did you do about it?_________________

33. If there is pesticide left over, where is it disposed?

34. Where is the equipment washed?

35. Where does the residue from the washed equipment go?

36. How many years have you been using pesticides?
    ____

Protective clothing

37. Do you wear protective clothing when applying pesticides?
    _ Yes _ No

    If **no**, please pick one:
    _ too expensive
    _ not available

_ uncomfortable
_ other (specify): __________________

If **yes**, check one or more of the following:
_ gloves
_ overalls
_ eye glasses
_ respirator - how often do you change it ?____________________
_ face mask
_ boots/shoes
_ long-sleeve shirt
_ long pants
_ other (specify): __________________

38. Are there washing facilities (for your hands and body) where you apply the pesticides?
_ Yes _ No

Understanding of hazards and alternatives

39. For the pesticides you use, do you have access to the following:
_ Label
_ Safety data sheet

40. Have you received any training on the pesticides you use?
_ Yes _ No

41. Do you know the hazards of the pesticides you use?
_ Yes _ No

If **yes**, can you please mention some? _____________________________

If **yes**, how do you know?
_ Label
_ Safety data sheet
_ Told by another person
_ Training (specify):__________________
_ Other (specify)_________________

If **no**, why not?____

42. What pest are you using it for? ________________________

43. Do you know of another way to control this pest without pesticide?
____

Purchasing pesticides

44. Where do you buy the pesticides? ________________________

45. How did you choose those pesticides:
    _ Own experience
    _ Others' recommendations. Specify (e.g. extension worker, promotion, friend): ________
    _ Labels on pesticides
    _ Suggestion from pesticide sellers
    _ Other (specify):________________

46. When purchasing, do you wear any protective clothing to avoid contacting pesticide containers (if any). Specify:
____

Storage and disposal

47. Where are the pesticides stored?
    _ Field
    _ Shed
    _ Garden
    _ Home
    _ Other (specify)________________

48. Are they locked up and out of reach of children?
    _ Yes _ No

49. Are they separated from other items (e.g. food, medicine)?
    _ Yes _ No

50. Do you decant into other containers?
    _ Yes _ No

51. Are the pesticide containers used for other purposes afterwards?
    _ Yes _ No

If **yes**, what? _________________

If **yes**, are you aware that you should not do this?
    _ Yes _ No

How are the containers disposed of?
- _ Returned to company/distributor
- _ Thrown in open field
- _ Buried
- _ Burnt
- _ Put in rubbish/trash
- _ Other (specify)_________________

Description of adverse effects:

52. When using pesticides or being exposed to them have you experienced (check one or more of the following):
- _ Dizziness
- _ Headache
- _ Blurred vision
- _ Excessive sweating
- _ Hand tremor
- _ Convulsion
- _ Staggering
- _ Narrow pupils/miosis
- _ Excessive salivation
- _ Nausea/vomiting
- _ Sleeplessness/insomnia
- _ Difficulty breathing
- _ Skin rashes
- _ Diarrhoea
- _ Irregular heartbeat
- _ Other (specify)_________________

For more effects, refer to questionnaire 1B (and state answer in 'other' above). Also please check ANNEX 2 for some illustrations and descriptions.

53. If you thought someone was poisoned, who would you call?
    _ Local doctor
    _ Company
    _ Friend or family member
    _ Hospital
    _ Poison centre
    _ Other (specify): _________________

54. Can you recall the last time this happened due to pesticide exposure?
    If the respondent reported this, please complete ***Questionnaire 2: Incident report****.*

Reporting

Name of interviewer: _________________

Organisation/address: _________________

Return this Questionnaire to: _________________

Appendix 3. Poisoning incidents – interviews with victims

Following their reporting of symptoms, respondents were asked if they could recall any detailed incidents. In total 69 poisoning incidents were reported in detail from: China (1); India – Andhra Pradesh, Chittoor (7), Kerala (21), Orissa, Padmapur (3); Indonesia, Wonosobo (6); Sri Lanka (22); and Vietnam Nam Dinh (9),

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
China: Yunnan – 1 incident					
1	Woman (41)	Methamidophos EC and Triadimefon WP	Mixed products together and sprayed peas in the field wearing a long-sleeved shirt and long pants while working.	Dizziness and nausea two hours after spraying	Self-treated: went home to bed without any food
India: Andhra Pradesh, Chittoor – 7 incidents					
2	Man (35)	REEVA-5 (synthetic pyrethroid)	Vector control application. Only wore long sleeved shirt and long pants. Application by hand (without gloves). "Fall down while spraying in a mango tree due to giddiness".	Dizziness, headache, blurred vision	Not hospitalised. Met the Government doctor at Pilerm. Medicines were purchased for 23000 Rs.

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
3	Man (80)	Molazine, Palameoil, Endosulfan,	Application in field (equipment: hand, bucket, backpack). "No information was given".	Headache, blurred vision	Treatment given.
4	Man (19)	Endosulfan, Chlorpyrifos, Monocrotophos	Application in field, vector control. "With hand". More than one pesticide formulation was used: "followed shop-keepers instructions and with our experience".	Headache, blurred vision, excessive sweating	Hospitalised. "met local doctor … later went to hospital at Tiurpati. But no certificate was given."
5	Man (45)	Pyarisulfan (endosulfan)	Application in field, during spraying. No protective clothing was worn ("not available"), only long-sleeved shirt.	Blurred vision, nausea/vomiting, small wound on the body	Treated and hospitalised.
6	Man (20) - family reported	Super sulf, Phosphamidon	Application in field, re-entry to treated field. No protective clothing "nobody told me".	Dizziness, blurred vision. Adverse effects occurred after 6 months, culminating in death	Treated and hospitalised.

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
7	(35)	REEVA-5 (synthetic pyrethroid)	Mixing/loading, vector control "due to moving and spraying". No protective clothing ("land owner did not supply"); long-sleeved shirt.	Dizziness, headache, nausea/vomiting	Treatment given but not hospitalised.
8		Endosulfan, Mithen, Barispie, Daizen	Application in field, vector control, re-entry to treated field. No protective clothing was worn "don't know about it".	Headache, blurred vision, excessive sweating, nausea/ vomiting	Treated and hospitalised: "first met local doctor and then went to Chittoor"
India: Kerala – 21 incidents (name and age not available; worker or farmer applying pesticides)					
9		Hinosan + Metacid	Edifenfos + methyl parathion	Slurred speech, uneasiness, nausea, vomiting.	Hospitalised for 1 week
10		Hinosan		Sweating, fainted.	Hospitalised
11		Dimecron		Itching, allergy	
12		Endrin, Paramour		Vomiting, dizziness.	Hospitalised
13		Endrin		Vomiting.	Hospitalised

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
14		Hinosan + Paramour		Head ache, dizziness, blurred vision, excessive sweating, hand tremor, excessive saliva, sleeplessness, vomiting.	Hospitalised
15		Does not remember		Nausea, diarrhoea, dizziness.	Hospitalised
16		Hinosan		Vomiting, stomach swelling.	Hospitalised
17		Does not remember		Dizziness, head ache, blurred vision, excessive sweating and salivation, hand tremor, , nausea, vomiting, difficult breathing, skin rash, irregular heart-beat, stomach pain.	Hospitalised
18		Dimecron		Dizziness, excessive sweating, fainted	
19		Karate		Headache, vomiting	

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
20		Hinosan + Metacid		Vomiting, dizziness, sweating, skin rashes.	Hospitalised
21		Does not remember		Excessive sweating, convulsion, vomiting, hand tremor, difficult breathing.	Hospitalised
22		Metacid		Dizziness, head ache, excessive salivation, vomiting	
23		Does not remember		Dizziness, head ache, blurred vision, excessive sweating, hand tremor	
24		Metacid		Eye sight lost (one eye).	Hospitalised
25		Hinosan		Excessive saliva, vomiting. Hospitalised	
26		Hinosan		Convulsion, sleeplessness, dizziness	

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
27		Does not remember		Headache, dizziness, convulsion, excessive saliva, vomiting, sleeplessness.	Hospitalised
28		Paramour, dimecron, metacid		Dizziness, headache, excessive sweating and saliva, hand tremor, vomiting, sleeplessness, nausea, difficult breathing.	Hospitalised
29		Hinosan + Metacid		Mouth dryness, staggering.	Hospitalised
India: Orissa, Padmapur – 3 incidents					
30	Woman (25)	Endosulfan (25% EC) and Novacron (36% SL)	Incident occurred in 2004, during application in the field. No protective clothing.	Excessive sweating, excessive salivation, nausea/vomiting, death.	Dead before treatment: incident reported by brother

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
31	Woman (adolescent)	Endosulfan (35% EC)	Application in field. Not wearing protective clothing. Items worn: boots/shoes, long-sleeve shirt, 'frock'.	Dizziness, convulsion, staggering, narrow pupils, excessive salivation, death.	Dead before treatment: incident reported by brother
32	Man (35)	Endosulfan (25% EC) and Novacron (36% SL)	Incident occurred in 2005 during application in the field. Protective clothing not worn during application.	Dizziness, hand tremor, convulsion, excessive salivation, nausea/vomiting.	No treatment or hospitalisation.
Indonesia, Wonosobo – 6 incidents					
33	Man (31)	Curzate (cymoxanil 8.36%) Dithane (mancozeb 80%) Provikur (propor-nokarbhidroklorida [local spelling] 722 g/l) Matador (lambda-cyhalothrin 1%) Spontan (dimelipo 400 g/l)	Application in field, mixing/loading, re-entry to treated field. "He [was] ordered to hold pipeline and squirt mixed pesticides to the field of potato toward harvest time. Three days later, he felt dizzy, queasy, blurry vision, hand trembled and vomiting."	Dizziness, headache, blurred vision, hand tremor and nausea/vomiting.	Treatment given: "Rested himself, took medicine for headache from small shop near home."

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
34	Woman (23)	Curzate (cymoxanil 6.36%) Trineb (mancozeb 66.64%) Acrobat 50 WP (dimethomorph 50%); Pilaram 80 WP (maneb 80%); Curacron 500 EC (profenofos 500 g/l)	Application in field, re-entry to treated field. Wearing long-sleeved shirt, long pants, hat. Additional information: • Pesticides dosages used approximate, there was no appropriate measurement. • Hand sprayer with diesel resulting high pressure spraying. • Not using complete PPE, only use long-sleeve shirt, long pant, and hat.	2 incidents: a. miscarriage year 2004 b. unconscious after spraying pesticides: year 2007	Treatment: "Drank young coconut water, milk and then took a break/ rest."
35	Man (]19)	Curzate (cymoxanil 8.36%) Trineb (mancozeb 66.64%) Daconil (chlorothalonil 75%) Matador (lambda-cyhalothrin 1%)	"Mixing four pesticides brands together in the house, took to the field and spraying his potato cultivation. He used pail, drum, and wood stick as mixer stuff." No PPE "never used protective cloths/equipment before, feels uncomfortable and sultry when use" "He usually mixed pesticides in field. Because it [was] rain[ing], he mixed at home. … After two hours from mixing pesticides, he felt dizzy, [had] headache, blurred vision, queasy and vomiting."	Dizziness, headache, blurred vision, nausea/vomiting, tottering.	Treated and hospitalised: "Went to paramedic, told to rest at least for three days, got injection and medicines."

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
36	Man (26)	Gramoxone (paraquat dichloride 276 g/L)	Application in field, mixing/loading. No PPE worn (only hat) "feels uncomfortable and sultry when use … After spraying weeds in fields, sprayer tank opened, containing Gramoxone solution. When opened, waste solution in tank sprayed straight to his face."	"After [being] struck by waste pesticide that sprays out from tank, he [felt burnt] in his face and face skin scorched" "The face was scorched for about a month."	No treatment or hospitalization: "Took a rest/ break"… "Didn't go to the doctor, just self-cured at home."
37	Man (30)	Matador (lambda-cyhalothrin 25 g/L)	Backpack application in field for potato cultivation, mixing loading, re-entry. Wearing boots/shoes, long-sleeved shirt, long pants. "Pesticide (Matador brand) added by water and mixed [in] a pail, then put on backpack sprayer tank. Wore long-sleeves shirt, long pant, boot and hat.	Headache, blurred vision, nausea/vomiting, unconscious	Treatment given: yes.
38	Woman (30)	Curacron 500 EC (profenofos 500 g/l), Dithane M-45 80WP (mancozeb 80%), Agrimec 18 EC (abamectin 18.4 g/l), Mesurol 50 WP (methiocarb / mercaptodi-methur 50%)	Application; re-entry to treated field. Wearing gloves, long-sleeved shirt, long pants, face mask. "Spraying with tank sprayer using diesel pump. She [was] helping to arrange the sprayer pipeline." Additional details: • Pesticides dosages used approximately, there was no appropriate measurement. • Hand sprayer with diesel used for high pressure spraying.	• miscarriage, abnormal/unsuitable menstruation. • dizziness, headache, blurred vision, nausea/vomiting, unconscious, pain on muscle and low heart impulse.	Treatment given: yes. "Drank coconut water, milk and then took a break/rest."

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
Sri Lanka – 22 incidents					
39	Man (52)	Sindak (bensulfuron-methyl, metsulfuron-methyl); Nominee Nomini (bispyribac sodium)	Application in field, mixing loading. No protective clothing worn (too expensive, not available) to treat weeds	Dizziness, headache, blurred vision, hand tremor, staggering, And "fever, stomach, eye redness, vomiting, eye tearing".	Treated and hospitalised. Was "given first aid and after saline with medicine".
40	Man (40)	Sindak (bensulfuron-methyl, metsulfuron-methyl); Nominee (bispyribac sodium)	Application in field, mixing loading. No protective clothing worn (too expensive, not available) to treat weeds	Dizziness, headache, blurred vision, hand tremor, convulsion, staggering, narrow pupils/miosis, nausea/vomiting	"He was given first aid [paracetamol] and after [was] given saline."
41	Woman (36)	Thiacloprid	Mixing and loading backpack sprayer to treat rice thrips	Dizziness, headache, blurred vision, staggering	Treated, hospitalised "Doctor gave first aid"
42	Man (54)	Carbofuran	Application in field. Not wearing PPE (uncomfortable and expensive). Using bucket and brush, hand.	Dizziness, headache, convulsion, excessive salivation, nausea/ vomiting	"He was given first aid at home and immediately taken to the hospital."

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
43	Man (55)	Maneb	Application in field/ mixing loading for onion, blossom blight.	Dizziness, headache, blurred vision, staggering	Treated and hospitalised. Immediately given first aid
44	Woman (43)	Speed (mancozeb)	Application in field using backpack spray, no protective clothing ("it is not considered a necessity")	Dizziness, headache, blurred vision, excessive sweating, staggering	Treated and hospitalised: "was given first aid and prescribed medication"
45	Woman (42)	Carbofuran	Mixing and loading. Wearing gloves, long-sleeved shirt. To treat cut worms in cabbage.	Dizziness, headache, staggering	Treated and hospitalised: given medicine.
46	Woman (35)	Speed (mancozeb)	Application in field, mixing/loading. No PPE ("considers wearing protective clothing as useless") to treat onion, purple blotch	Dizziness, headache, blurred vision, staggering	"First aid was given by a doctor after being [hospitalised]"
47	Woman (45)	Pyriban 40 (chlorpyrifos 400 g/L)	Mixing/loading pesticide. Wearing long-sleeved shirt. Using pesticide to treat bean-pod borer	Dizziness, headache, blurred vision, staggering	Treated and hospitalized, given medicine.

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
48	Woman (24)	Maneb	Mixing/loading pesticide to treat chilli blossom blight. No protective clothing worn (too expensive and not available)	Dizziness, headache, hand tremor, staggering	"Was given medicine after being hospitalised."
49	Woman (52)	Carbofuran	Application in field, mixing/loading. No PPE worn (too expensive, not available). Used to treat alternaria blight in cabbage	Dizziness, headache, excessive sweating, staggering	"After being hospitalised, the patient was treated by a doctor."
50	Woman (42)	Curatter (carbofuran)	Application in field to treat brown plant hopper. No protective clothing worn	Dizziness, headache, nausea/vomiting	Treated and hospitalised
51	Man (60)	Speed (mancozeb 80%)	Application in field, mixing/loading. Wearing protective clothing (gloves, face mask, boots/shoes, long-sleeve shirt, long pants).	Dizziness, headache, blurred vision	Treated and hospitalized, given medicine.
52	Woman (36)	Propineb	Application in field, mixing/loading; treating thrips. No PPE (not available, too expensive).	Dizziness, headache, blurred vision	Treated and hospitalised: given the medicine.
53	Woman (35)	Propineb	Mixing/loading, re-entry to field. To treat carrot thrips.	Skin rash	Treated and hospitalised: given medicine

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
54	Woman (24)	Speed (mancozeb)	Application in field. Not wearing protective clothing (considers wearing protective clothing as useless). To treat potato.	Dizziness, nausea/ vomiting, skin rashes.	Treated and hospitalised: First aid was given by a doctor after being hospitalised
55	Man (47)	Polyram M (maneb)	Application in field, mixing/loading. No PPE (not available). To treat downy mildew on bean	Dizziness, headache.	Treated and hospitalised: "Immediately gave first aid."
56	Man (25)	Calypso (thiacloprid)	Application in field to treat rice thrips.	Dizziness, headache, blurred vision, staggering.	Treated and hospitalised: given medicine.
57	Man (53)	DADAS 400 (chlorpyrifos)	Application in field (backpack spray) to treat potato root eating and white grubs	Dizziness, headache	Treated and hospitalised: given paracetamol and saline.
58	Man (26)	Nominee (bispyribac-sodium)	Application in field, mixing/loading.	Dizziness, headache, nausea/vomiting, fever	He was given first aid and after has given saline.

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
59	Man (43)	Sindak-(bensulfuron-methyl / metsulfuron-Methyl) –nominee bispyibac-sodium	Application in field, mixing/loading. No protective clothing worn (too expensive, not available) to treat broad leaved weed and sedges	Dizziness, headache, nausea/vomiting.	Treated and hospitalised.
60	Man (63)	Speed (mancozeb)	Application in field (backpack spray) to treat alternaria blight. No protective clothing worn ("too expensive")	Dizziness, headache, nausea/vomiting.	Treated and hospitalised: He was given first aid and after saline with medical.
Vietnam – 9 incidents					
61	Woman (45)	Bassa	Backpack spraying in rice field to treat brown plant hopper (wearing gloves and face-mask) over 3-4 days	Headache, "tired, sick"	Took medicine for headache, went to Health Station, then private clinic for radiograph
62	Man (37)	Bassa, Trebon	Backpack spraying to treat brown plant hopper, no protective clothing worn ("feel uncomfortable; don't have it")	Dizziness, excessive sweating, staggering and vomiting	None: only "drank water with sugar"

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
63	Man (52)	Bat Dang, Regent, and "other things"	Backpack spraying in rice field, no PPE ("the protective clothing is not ready. I hesitate to use it, it's uncomfortable"), very hot conditions	Dizziness, headache, "itching of back and swelling of shoulder"	"Went back home to wash and treat myself by using water morning glory…"
64	Woman (44)	Bassa, Confai (imidacloprid), Valivithaco (validamycin), (gibberellic acid)	Backpack spraying in rice field: "the pesticide gushes in the face. It was in the face, eyes, soak into the face mask to touch the mouth, nose, shoulder".	Dizziness, headache, blurred vision, hand tremor, staggering, "rash, pain of shoulder and scruff of the neck"	"Wiped face with cloth and gargled with water"
65	Woman (56)	Fastac, Valivithaco (validamycin)	During weeding. No protective clothing worn during this activity. "… the neighbour is spraying the field very close to me. I sniff at the pesticide. I feel dizzy, vomit and I turn back to house to lie. I'm tired."	Dizziness, headache, vomiting, blurred vision, staggering.	Went to the doctor at the health station "I use vinphastu, Vitamin. After 1 night, I felt better."

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
66	Woman (32)	Mixing Bassa and Rigent (6 kinds), and validamycin	Spraying in field for 3-4 hours over 2-3 days. Wearing face mask and gloves, but no raincoat.	Dizziness, headache, excessive sweating, staggering.	Bought medicine at health station; then showed label to the doctor. "He gave me drugs… I stayed in the hospital for two days."
67	Man (75)	Don't know/don't remember	Application in field for plant hopper. No protective clothing worn ("subjective").	Swelling of ankle	Unknown
68	Woman (25)	Mixing Rigent and Fastac	Backpack application in rice field, over 1.5 hours	Dizziness, headache, nausea/vomiting, "cholera"	"Went to health station, was injected and got transmitted with 6 bottles of liquid into body. Stayed there 1 day; 23 days after felt normal."

#	Sex (age)	Name of the Pesticide	Comments	Nature of illness	Treatment
69	Woman (44)	Mixing Bassa (fenobucarb), Con fai (imidacloprid), others unknown, vimogreen (gibarellic acid),	Application in field. Wearing only facemask. "during spraying, the tap of spray backpack… failed. I tried it but it do not run but suddenly, the spray backpack runs- the pesticide gushed on my face. And then I removed my clothes to wipe the face and I can open the eyes."	Dizziness, headache, blurred vision, hand tremor, staggering, and "pain of the scruff of the neck, itching"	None: "I just used the clothes to absorb the pesticide in the face and rinse the mouth and then got back home to take a bath."

Appendix 4. Highly Hazardous Pesticides: criteria and listing

1. Criteria drawn up by the FAO/WHO Panel of Experts on Pesticide Management for identifying HHPs

See: Report of the FAO/WHO Joint Meeting on Pesticide Management, Rome, 22–26 October 2007 http://www.fao.org/ag/agp/agpp/pesticid/Code/expmeeting/Report07.pdf

'… it was stressed by participants that pesticides which had shown repeated and severe adverse effects on human health or the environment, but might not be classified as potentially high risk compounds through international hazard classification systems, might still need to be included on the list of HHPs. The Panel requested that WHO, FAO and UNEP develop criteria for inclusion of such pesticide formulations.

Based on its discussions, the Panel concluded that HHPs are defined as having one or more of the following characteristics:

- pesticide formulations that are included in classes Ia or Ib of the *WHO Recommended Classification of Pesticides by Hazard;*
- pesticide active ingredients and their formulations that are included in carcinogenicity Categories 1A and 1B of the GHS [Globally Harmonised System of Classification and Labelling of Chemicals], or are included accordingly in the *WHO Recommended Classification of Pesticides by Hazard;*
- pesticide active ingredients and their formulations that are included in mutagenicity Categories 1A and 1B of the GHS or are included accordingly in the *WHO Recommended Classification of Pesticides by Hazard;*
- pesticide active ingredients and their formulations that are included in reproductive toxicity Categories 1A and 1B of the GHS or are included accordingly in the *WHO Recommended Classification of Pesticides by Hazard;*
- pesticide active ingredients listed by the *Stockholm Convention* in its Annexes A and B;
- pesticide active ingredients and formulations listed by the *Rotterdam Convention* in its Annex III;

- pesticides listed under the *Montreal Protocol;*
- pesticide formulations that have shown a high incidence of severe or irreversible adverse effects on human health or the environment.

2. Criteria for classification, measure and references to identify HHPs drawn up by PAN International, 2009

- For background and references on the development of PAN International criteria, and for the list of classification of HHPs, as updated when necessary, see: http://www.pan-germany.org/download/PAN_HHP-List_090116.pdf. The active ingredients currently listed as HHPs (April 2010) are under point 3 below.
- For table detailing reasons for listing each active ingredient see: http://www.pan-germany.org/download/PAN_HHP_List_Annex1_090929.pdf
- PAN Germany has developed guidance to assist in the implementation of the Code of Conduct, see: http://fao-code-action.info/action_centre.html

Criteria	Measure and reference point
High acute toxicity	‘*Extremely hazardous’* (Class Ia) or ‘*highly hazardous’* (Class Ib) according to WHO Recommended Classification of Pesticides by Hazard ‘*Very toxic by inhalation*’ (R26) according to EU Directive 67/548 5
Long term toxic effect at chronic exposure	‘*Human carcinogen*‘ according to IARC, US EPA ‘*Known to be carcinogenic to humans’* according to EU Directive 67/548 (Category 1) ‘*Probable/likely human carcinogen’* according to IARC, US EPA *Sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer* (Category 2) according to EU Directive 67/548 ‘*Possible human carcinogen/ ‘Suggestive evidence of carcinogenic potential*’ according to IARC, US EPA ‘*Substances which cause concern for humans owing to possible carcinogenic effects*’ (Category 3) according to EU Directive 67/548
	‘*Substances known to be mutagenic to man*’ (Category 1) according to EU Directive 67/548 ‘*Substances which should be regarded as if they are mutagenic to man*’ (Category 2) according to EU Directive 67/548
	‘*Substances known to impair fertility in humans*’ (Category 1) according to EU Directive 67/548 *‘Substances which should be regarded as if they impair fertility in humans’* and/or *‘Substances which should be regarded as if they cause developmental toxicity to humans*’ (Category 2) according to EU Directive 67/548
	Endocrine disruptor or potential endocrine disruptor according to EU Category 1 and Category 2
	Categories 1A and 1B of the GHS for carcinogenicity, mutagenicity, and reproductive toxicity will be used for the PAN HHP list as soon as it is available

Criteria	Measure and reference point
High environmental concern	Stockholm Convention: Pesticides listed in Annex A & B
	Ozone depleting according to the Montreal Protocol
	'*Very bioaccumulative*' according to REACh criteria as listed by FOOTPRINT (BCF >5000)
	'*Very persistent*' according to REACh criteria as listed by FOOTPINT (half-life > 60 d in marine- or freshwater or half-life >180 d in marine or freshwater sediment)
	Hazard to ecosystem services – '*Highly toxic for bees*' according to US EPA as listed by FOOTPRINT data (bee toxicity: LD_{50}, µg/bee < 2)
Known to cause high incidence of severe or irreversible adverse effects	Rotterdam Convention: Pesticides listed in Annex III
	Incidents to be documented

3. PAN International list of Highly Hazardous Pesticides, with listing of registration status in the US (as of April 2010)

CAS Number	Pesticide	EPA registered
288-88-0	1,2,4-triazole	no
542-75-6	1,3-dichloropropene	yes
93-76-5	2,4,5-T	no
93-80-1	2,4,5-T, butyric acid	no
95-95-4	2,4,5-trichlorophenol	no
88-06-2	2,4,6-trichlorophenol	no
94-75-7	2,4-D	yes
94-82-6	2,4-DB	yes
120-83-2	2,4-dichlorophenol	no
28631-35-8	2,4-DP, isooctyl ester	yes
2008-58-4	2,6-Dichlorbenzamid	no
149-30-4	2-Mercaptobenzothiazole	no
101-10-0	3-CPA	no
71751-41-2	Abamectin	yes
30560-19-1	Acephate	yes
34256-82-1	Acetochlor	yes
62476-59-9	Acifluorfen, sodium salt	yes
101007-06-1	Acrinathrin	no
107-02-8	Acrolein	yes
15972-60-8	Alachlor	yes
116-06-3	Aldicarb	yes
309-00-2	Aldrin	no
584-79-2	Allethrin	yes
319-84-6	alpha-BHC	no
96-24-2	Alpha-chlorohydrin	yes
20859-73-8	Aluminum phosphide	yes
150114-71-9	Aminopyralid	yes
33089-61-1	Amitraz	yes
61-82-5	Amitrole	yes

CAS Number	Pesticide	EPA registered
62-53-3	Aniline	no
90640-80-5	anthracene oil	no
7778-39-4	Arsenic acid	yes
1303-28-2	Arsenic pentoxide	yes
3337-71-1	Asulam	no
1912-24-9	Atrazine	yes
68049-83-2	Azafenidin	no
35575-96-3	Azamethiphos	no
2642-71-9	Azinphos-ethyl	no
86-50-0	Azinphos-methyl	yes*
103-33-3	Azobenzene	no
41083-11-8	Azocyclotin	no
131860-33-8	Azoxystrobin	yes
68038-70-0	Bacillus subtilis GBO3	yes
22781-23-3	Bendiocarb	no
1861-40-1	Benfluralin	yes
17804-35-2	Benomyl	yes
25057-89-0	Bentazone	no
177406-68-7	Benthiavalicarb-isopropyl	no
68359-37-5	Beta-cyfluthrin	yes
82657-04-3	Bifenthrin	yes
485-31-4	Binapacryl	no
111-44-4	Bis(chloroethyl) ether	no
188425-85-6	Boscalid	yes
56073-10-0	Brodifacoum	yes
314-40-9	Bromacil	yes
28772-56-7	Bromadiolone	yes
63333-35-7	Bromethalin	yes
1689-84-5	Bromoxynil	yes
116255-48-2	Bromuconazole	yes
69327-76-0	Buprofezin	yes
23184-66-9	Butachlor	no

CAS Number	Pesticide	EPA registered
34681-10-2	Butocarboxim	no
34681-23-7	Butoxycarboxim	no
75-60-5	Cacodylic acid	yes*
95465-99-9	Cadusafos	no
2425-06-1	Captafol	no
133-06-2	Captan	yes
63-25-2	Carbaryl	yes
10605-21-7	Carbendazim	yes
1563-66-2	Carbofuran	yes*
2439-01-2	Chinomethionat	no
57-74-9	Chlordane	no
19750-95-9	Chlordimeform hydrochloride	no
54593-83-8	Chlorethoxyphos	yes
122453-73-0	Chlorfenapyr	yes
470-90-6	Chlorfenvinphos	no
24934-91-6	Chlormephos	no
510-15-6	Chlorobenzilate	no
67-66-3	Chloroform	no
3691-35-8	Chlorophacinone	yes
76-06-2	Chloropicrin	yes
1897-45-6	Chlorothalonil	yes
15545-48-9	Chlorotoluron	no
2921-88-2	Chlorpyrifos	yes
5598-13-0	Chlorpyrifos-methyl	yes
64902-72-3	Chlorsulfuron	yes
1861-32-1	Chlorthal-dimethyl	yes
84332-86-5	Chlozolinate	no
67-97-0	Cholecalciferol	yes
142891-20-1	Cinidon-ethyl	no
105512-06-9	Clodinafop-propargyl	yes
82697-71-0	Clofencet	yes
74115-24-5	Clofentezine	yes

CAS Number	Pesticide	EPA registered
210880-92-5	Clothianidin	yes
68603-42-9	Coconut diethanolamide	yes
56-72-4	Coumaphos	yes
5836-29-3	Coumatetralyl	no
8001-58-9	Creosote	yes
99485-76-4	Cumyluron	no
420-04-2	Cyanamide	yes
21725-46-2	Cyanazine	no
68359-37-5	Cyfluthrin	yes
13121-70-5	Cyhexatin	no
65731-84-2	Cypermethrin	yes
67375-30-8	Cypermethrin, alpha	yes
94361-06-5	Cyproconazole	yes
66215-27-8	Cyromazine	yes
1596-84-5	Daminozide	yes
50-29-3	DDT	no
52918-63-5	Deltamethrin	yes
919-86-8	Demeton-S-methyl	no
333-41-5	Diazinon	yes
1194-65-6	Dichlobenil	yes
79-43-6	Dichloro acetic acid	no
97-23-4	Dichlorophene	no
15165-67-0	Dichlorprop-P	yes
62-73-7	Dichlorvos	yes
51338-27-3	Diclofop-methyl	yes
115-32-2	Dicofol	yes
141-66-2	Dicrotophos	yes
60-57-1	Dieldrin	no
56073-07-5	Difenacoum	yes
119446-68-3	Difenoconazole	yes
104653-34-1	Difethialone	yes
87674-68-8	Dimethenamid	yes

CAS Number	Pesticide	EPA registered
55290-64-7	Dimethipin	no
60-51-5	Dimethoate	yes
828-00-2	Dimethoxane	yes
39300-45-3	Dinocap	no
88-85-7	Dinoseb	no
1420-07-1	Dinoterb	no
82-66-6	Diphacinone	yes
85-00-7	Diquat dibromide	yes
298-04-4	Disulfoton	yes*
330-54-1	Diuron	yes
534-52-1	DNOC	no
2980-64-5	DNOC ammonium salt	no
5787-96-2	DNOC potassium salt	no
2312-76-7	DNOC, sodium salt	no
23214-92-8	Doxorubicin	no
17109-49-8	Edifenphos	no
115-29-7	Endosulfan	yes
72-20-8	Endrin	no
106-89-8	Epichlorohydrin	no
2104-64-5	EPN	no
133855-98-8	Epoxiconazole	no
28434-00-6	Esbiothrin	yes
66230-04-4	Esfenvalerate	yes
55283-68-6	Ethalfluralin	yes
29973-13-5	Ethiofencarb	no
64529-56-2	Ethiozin	no
26225-79-6	Ethofumesate	yes
13194-48-4	Ethoprophos	yes
106-93-4	Ethylene dibromide	no
107-06-2	Ethylene dichloride	no
75-21-8	Ethylene oxide	yes
96-45-7	Ethylene thiourea	no

CAS Number	Pesticide	EPA registered
80844-07-1	Etofenprox	yes
52-85-7	Famphur	no
22224-92-6	Fenamiphos	yes
60168-88-9	Fenarimol	yes
120928-09-8	Fenazaquin	no
114369-43-6	Fenbuconazole	yes
13356-08-6	Fenbutatin-oxide	yes
122-14-5	Fenitrothion	yes
72490-01-8	Fenoxycarb	yes
39515-41-8	Fenpropathrin	yes
55-38-9	Fenthion	yes
900-95-8	Fentin acetate	no
76-87-9	Fentin hydroxide	yes
51630-58-1	Fenvalerate	no
120068-37-3	Fipronil	yes
90035-08-8	Flocoumafen	no
158062-67-0	Flonicamid	yes
69806-50-4	Fluazifop-butyl	no
79622-59-6	Fluazinam	yes
70124-77-5	Flucythrinate	no
131341-86-1	Fludioxonil	yes
103361-09-7	Flumioxazin	yes
2164-17-2	Fluometuron	yes
239110-15-7	Fluopicolide	yes
640-19-7	Fluoroacetamide	no
85509-19-9	Flusilazole	no
117337-19-6	Fluthiacet-methyl	yes
66332-96-5	Flutolanil	yes
133-07-3	Folpet	yes
68157-60-8	Forchlorfenuron	yes
50-00-0	Formaldehyde	yes
22259-30-9	Formetanate	no

CAS Number	Pesticide	EPA registered
98886-44-3	Fosthiazate	yes
65907-30-4	Furathiocarb	no
98-01-1	Furfural	yes
121776-33-8	Furilazole	no
81591-81-3	Glyphosate trimesium	no
69806-40-2	Haloxyfop-methyl (unstated stereochemistry)	no
76-44-8	Heptachlor	no
1024-57-3	Heptachlor epoxide	no
23560-59-0	Heptenophos	no
118-74-1	Hexachlorobenzene	no
67-72-1	Hexachloroethane	no
79983-71-4	Hexaconazole	no
86479-06-3	Hexaflumuron	yes
608-73-1	Hexchlorocyclohexane	no
78587-05-0	Hexythiazox	yes
67485-29-4	Hydramethylnon	yes
302-01-2	Hydrazine	no
35554-44-0	Imazalil	yes
81335-37-7	Imazaquin	yes
81335-77-5	Imazethapyr	yes
138261-41-3	Imidacloprid	yes
173584-44-6	Indoxacarb	yes
74-88-4	Iodomethane	yes
1689-83-4	Ioxynil	no
36734-19-7	Iprodione	yes
140923-17-7	Iprovalicarb	no
78-59-1	Isophorone	no
34123-59-6	Isoproturon	no
82558-50-7	Isoxaben	yes
141112-29-0	Isoxaflutole	yes
18854-01-8	Isoxathion	no
65277-42-1	Ketoconazole	no

CAS Number	Pesticide	EPA registered
143390-89-0	Kresoxim-methyl	yes
77501-63-4	Lactofen	yes
91465-08-6	Lambda-cyhalothrin	yes
58-89-9	Lindane	yes*
330-55-2	Linuron	yes
103055-07-8	Lufenuron	yes
121-75-5	Malathion	yes
8018-01-7	Mancozeb	yes
12427-38-2	Maneb	yes
94-74-6	MCPA	yes
94-81-5	MCPB	yes
7085-19-0	MCPP	yes
2595-54-2	Mecarbam	no
16484-77-8	Mecoprop-P	yes
110235-47-7	Mepanipyrim	no
55814-41-0	Mepronil	no
7487-94-7	Mercuric chloride	no
21908-53-2	Mercuric oxide	no
7439-97-6	Mercury	no
2425-06-1	Merpafol cis isomer	no
108-39-4	Meta-cresol	yes
108-62-3	Metaldehyde	yes
137-42-8	Metam sodium, dihydrate	yes
137-41-7	Metam-potassium	yes
137-42-8	Metam-sodium	yes
125116-23-6	Metconazole	yes
18691-97-9	Methabenzthiazuron	no
10265-92-6	Methamidophos	yes
950-37-8	Methidathion	yes*
2032-65-7	Methiocarb	yes
16752-77-5	Methomyl	yes
72-43-5	Methoxychlor	no

CAS Number	Pesticide	EPA registered
74-83-9	Methyl bromide	yes
556-61-6	Methyl isothiocyanate	yes
75-09-2	Methylene chloride	no
9006-42-2	Metiram	yes
51218-45-2	Metolachlor	yes
220899-03-6	Metrafenone	no
21087-64-9	Metribuzin	yes
443-48-1	Metronidazole	no
7786-34-7	Mevinphos	no
7786-34-7	Mevinphos (stereochemistry unspecified)	no
136-45-8	MGK 326	yes
2385-85-5	Mirex	no
2212-67-1	Molinate	yes*
71526-07-3	MON 4660	no
6923-22-4	Monocrotophos	no
2163-80-6	MSMA	yes
88671-89-0	Myclobutanil	yes
54-11-5	Nicotine	yes
1929-82-4	Nitrapyrin	yes
25154-52-3	Nonylphenol	no
27314-13-2	Norflurazon	yes
1113-02-6	Omethoate	no
213464-77-8	Orthosulfamuron	yes
19044-88-3	Oryzalin	yes
19666-30-9	Oxadiazon	no
77732-09-3	Oxadixyl	no
23135-22-0	Oxamyl	yes
301-12-2	Oxydemeton-methyl	yes
42874-03-3	Oxyfluorfen	yes
76738-62-0	Paclobutrazol	yes
106-46-7	Para-dichlorobenzene	yes
1910-42-5	Paraquat dichloride	yes

CAS Number	Pesticide	EPA registered
56-38-2	Parathion	no
298-00-0	Parathion-methyl	yes
106-47-8	P-chloroaniline	no
87-86-5	PCP	yes
40487-42-1	Pendimethalin	yes
219714-96-2	Penoxsulam	yes
52645-53-1	Permethrin	yes
26002-80-2	Phenothrin	yes
2597-03-7	Phenthoate	no
298-02-2	Phorate	yes
732-11-6	Phosmet	yes
13171-21-6	Phosphamidon	no
7803-51-2	Phosphine	yes
1918-02-1	Picloram	yes
1918-02-1	Picloram, diethanolamine salt	no
51-03-6	Piperonyl butoxid	yes
23103-98-2	Pirimicarb	yes
32289-58-0	Polyhexamethylene biguanidine	yes
299-45-6	Potasan	no
67747-09-5	Prochloraz	no
32809-16-8	Procymidone	no
29091-21-2	Prodiamine	yes
139001-49-3	Profoxydim	no
7287-19-6	Prometryn	yes
1918-16-7	Propachlor	yes
709-98-8	Propanil	yes
2312-35-8	Propargite	yes
139-40-2	Propazine	yes
31218-83-4	Propetamphos	yes
60207-90-1	Propiconazole	yes
114-26-1	Propoxur	yes
75-56-9	Propylene oxide	yes

CAS Number	Pesticide	EPA registered
23950-58-5	Propyzamide	yes
52888-80-9	Prosulfocarb	no
123312-89-0	Pymetrozine	yes
129630-19-9	Pyraflufen-ethyl	yes
365400-11-9	Pyrasulfotole	yes
108-34-9	Pyrazoxon	no
121-21-1	Pyrethrin I	no
53112-28-0	Pyrimethanil	yes
123343-16-8	Pyrithiobac-sodium	yes
13593-03-8	Quinalphos	no
2797-51-5	Quinoclamine	no
124495-18-7	Quinoxyfen	yes
82-68-8	Quintozene	yes
119738-06-6	Quizalofop-p-tefuryl	no
10453-86-8	Resmethrin	yes
78-48-8	S,S,S-tributyl phosphorotrithioate	yes
28434-00-6	S-Bioallethrin	yes
175217-20-6	Silthiofam	no
122-34-9	Simazine	yes
87392-12-9	S-Metolachlor	yes
13464-38-5	Sodium arsenate	no
128-04-1	Sodium dimethyl dithio carbamate	yes
62-74-8	Sodium fluoroacetate (1080)	yes
168316-95-8	Spinosad	yes
148477-71-8	Spirodiclofen	yes
57-24-9	Strychnine	yes
141776-32-1	Sulfosulfuron	yes
3689-24-5	Sulfotep	no
21564-17-0	TCMTB	yes
107534-96-3	Tebuconazole	yes
119168-77-3	Tebufenpyrad	yes
96182-53-5	Tebupirimifos	yes

CAS Number	Pesticide	EPA registered
79538-32-2	Tefluthrin	yes
335104-84-2	Tembotrione	yes
149979-41-9	Tepraloxydim	yes
13071-79-9	Terbufos	yes
886-50-0	Terbutryn	no
2593-15-9	Terrazole	yes
22248-79-9	Tetrachlorvinphos	yes
112281-77-3	Tetraconazole	yes
7696-12-0	Tetramethrin	yes
148-79-8	Thiabendazole	yes
111988-49-9	Thiacloprid	yes
153719-23-4	Thiamethoxam	yes
117718-60-2	Thiazopyr	yes
59669-26-0	Thiodicarb	yes
39196-18-4	Thiofanox	no
640-15-3	Thiometon	no
23564-05-8	Thiophanate-methyl	yes
62-56-6	Thiourea	no
137-26-8	Thiram	yes
731-27-1	Tolylfluanid	yes
210631-68-8	Topramezone	yes
8001-35-2	Toxaphene	no
87820-88-0	Tralkoxydim	yes
43121-43-3	Triadimefon	yes
55219-65-3	Triadimenol	yes
2303-17-5	Tri-allate	yes
82097-50-5	Triasulfuron	yes
24017-47-8	Triazophos	no
101200-48-0	Tribenuron methyl	yes
52-68-6	Trichlorfon	yes
95-95-4	Trichlorophenol	no
3380-34-5	Triclosan	yes

CAS Number	Pesticide	EPA registered
41814-78-2	Tricyclazole	no
81412-43-3	Tridemorph	no
1582-09-8	Trifluralin	yes
126535-15-7	Triflusulfuron-methyl	yes
26644-46-2	Triforine	yes
131983-72-7	Triticonazole	yes
83657-22-1	Uniconazole	yes
2275-23-2	Vamidothion	no
50471-44-8	Vinclozolin	yes
81-81-2	Warfarin	yes
52315-07-8	zeta-Cypermethrin	yes
12122-67-7	Zineb	no
137-30-4	Ziram	yes
297-99-4	Z-Phosphamidon	no

* Currently registered but actively being phased out (see text).

Appendix 5. Results from PAN North America Drift Catcher projects, 2003-2009

No.	Project / Year / State / No. of DCs	Site description	Pesticides of interest	Findings (LOC – 'levels of concern')	Policy outcomes
1	'Molinate' / 2003 and 2004 / California. DCs: 4	Drift Catchers were set up near rice paddies in various small towns in the Sacramento Valley.	Molinate (a herbicide used on rice)	Molinate was found more frequently from sites sited close to application.	**Molinate banned.** DC results submitted to EPA review as evidence of drift from rice into neighbouring communities. EPA subsequently cancelled molinate.
2	'Santa Cruz' / 2004 / California DCs: 4	Residents concerned about drift from a large Brussels sprout field between their homes and the ocean.	OPs	No pesticides found. Probably too windy.	While no air sample evidence, engagement at the site led to court testimony in organic farm winning $1m settlement from applicators.
3	'Residential' / 2004/ California DCs: 1	Moraga: Set up in yard next to house where perimeter being treated by professional exterminator for ants.	Permethrin & Cypermethrin (pyrethoid insecticides)	No pesticides found. This is probably not the best situation for looking for drift.	None – process experiment

4	'Verde Elementary'/ 2005 / California DCs: 1	A DC was set up an elementary school in Richmond, CA, near a commercial nursery.	Unspecified fungicides	No pesticides found in 12 samples— unclear whether pesticides used during four-week sampling period.	None – process experiment engaging elementary school students
5	'Biodrift I' / 2004–2006 / California DCs: 4 to 6, depending on the year. In the final year, urine samples were also collected	Set up in people's yards throughout Lindsay, California, in the San Joaquin Valley. Houses, schools and business are surrounded by and in between orange groves. Sampling took place in summer, when orchards are sprayed with insecticides.	Chlorpyrifos, an OP insecticide	Chlorpyrifos was found in almost all samples every year, frequently in excess of health based LOC. Elevated levels were also observed in the urine samples.	Buffer zones established in Tulare County, protecting schools from aerial applications of restricted use pesticides (including chlorpyrifos). Community groups are not "exporting" the buffer zones to other counties.
6	'Grayson' / 2005–2007 / California DCs: 2	Grayson, CA, is similar to Lindsay, except with almond trees instead of oranges. DCs were set up at people's homes.	Chlorpyrifos, an OP	Chlorpyrifos found in many samples (~30-50% /yr) but not exceeding LOC. Trifluralin was detected in many samples in 2007.	None — but served as site for filming DC work for PBS 'Now' feature

7	'Parlier' / 2005–07 / California DCs: 2 in 2005, 1 in 2006	Stone fruits are predominant crop; DCs stationed at migrant farmworker housing and also health clinic.	Chlorpyrifos, Telone	Chlorpyrifos found in most samples—often in amounts exceeding LOCs. Telone found in all but one of health clinic samples.	Helped kick-start air monitoring by State, and confirmed PAN's DC evidence equivalent to that collected by the state.
8	'Huron' 2006–2007 California DCs: 3 in 2006; 2 in 2007	Huron is a small, low-income community in Fresno County that is surrounded by cotton and tomato fields. DCs deployed at homes close to fields.	OPs	Pesticides found in most samples: chlorpyrifos, naled, sulfur, chlordane, DDE, endosulfan, chlorothalonil. Most in low levels. In 2006 exceeded LOCs for chlorpyrifos and naled for a few days.	None locally but helped maintain pressure on State to start pesticide air monitoring.
9	'North Carolina' / 2005 / North Carolina 10DCs: 1	Near a golf course and later near cotton fields	Herbicides	Nothing found, but unclear whether an application took place. No samples were collected near cotton field, because grower switched from aerial application to ground sprays.	Local cotton grower switched from aerial spraying to ground sprays, a less drift prone application method.

10	'Maine', 2005–2006 / Maine DCs: 2	Near blueberries	Azinphos-methyl, hexazinone	Nothing found. DC was probably too far away the first year, or upwind during the second year. The target pesticides are also less volatile than OP pesticides that have been successfully found before.	Drift Catcher activity, while producing no evidence, helped build momentum for voluntary halt to aerial spraying of pesticides.
11	'Indiana', 2005–2006, Indiana DCs: 6	Housing development ½ mile from corn and soybeans.		Nothing found. Probably too far away, and these herbicides are not very volatile	Some, perhaps temporary, behavioural changes observed in the grower. He applied by backpack sprayer and worked 'more carefully' than in the past.
12	Alaska, 2005 DCs: 2	DCs were not deployed; the original target was forestry herbicide spraying.	Herbicides	Threat of monitoring caused the company to cancel spraying; no DC samples were collected.	Scheduled forestry spraying was cancelled.

13	Farmworker Pesticide Project / 2006 / Washington DCs: 5	The Farmworker Pesticide Project sited DCs at homes next to apple and pear orchards in the Yakima Valley.	Chlorpyrifos and azinphos-methyl, OP insecticides	Chlorpyrifos found at both sites in April in all samples. Levels exceed LOCs 1/3 of time. June sampling found azinphos-methyl and chlorpyrifos in most samples, but not exceeding LOCs.	In addition to generating significant press, the results of this project helped win a bill charging the Health Dept. with setting up its own pesticide air monitoring program.
14	Hastings / 2006–present / Florida DCs: 1	This site is a home next to an elementary school in Hastings, FL, near St. Augustine. The home and school are surrounded by fields of Chinese cabbage.	OPs and	Endosulfan, diazinon, and trifluralin were found in almost all samples from 2006, often in amounts exceeding LOCs. In 2007 chlorothalonil was found in addition. LOCs were often exceeded. The analysis of the samples from the 2008–09 growing season is still underway.	In response, Florida Dept of Agriculture and Consumers Services issued new recommendations: potential exposure to agricultural pesticides to be considered when choosing a school site. The school was selected for state-sponsored 'Good Neighbor Program' to promote cooperation between pesticide users and neighbours. Results submitted to CA Dept of Pesticide Regulation contributed to declaration of endosulfan a Toxic Air Contaminant. The EPA is using data generated from this study in its work to mitigate volatilization drift.

15	'Mosquito Spray' / 2006–2007 / Colorado DCs: 2	The target of this monitoring was weekly mosquito abatement spraying in Paonia, CO.	Malathion and permethrin	Malathion detected in first year only during and immediately after spraying: levels drop after application. Year two both pesticides detected, despite Mosquito Control Board claim that malathion would not be sprayed.	The detection of malathion in the second year —when it was allegedly not being used—led to community mistrust of the Board, and ultimately the election of new, more progressive Board.
16	'Minnesota' / 2006–present / Minnesota DCs: 4	Various sites in rural central Minnesota (near Browerville and Frazee), mostly near potato fields.	Fungicides and Herbicides	Several pesticides found at sites. Chlorothalonil, a fungicide used on potatoes, is ubiquitous, and found in most samples most years, but below LOCs.	Early results became part of a campaign to win right to know legislation in the state. PANNA presented data to Department of Agriculture. No real change yet.
17	'CART' / 2006 / California DCs: 1	High school students from Fresno's CART magnet school collected DC samples near a vineyard.	Unknown	Nothing found, but we were unsure whether pesticides where applied during the sampling period.	None – process experiment engaging high school students

18	‘White Earth’ / 2007–2008 / Minnesota DCs: 2	Sites were: elementary school opposite a bean field; homes near potato and wheat fields; and a day care. All sites are on the White Earth Indian Reservation in northern Minnesota.	Fungicides and Herbicides	Similar the results from the other MN project, chlorothalonil emerged as a ubiquitous low-level contaminant.	See ‘Minnesota’ 2006-present, above.
19	‘Farm Worker Association of Florida’/ 2007–present DCs: 2	Sampling is near ferneries in central Florida. Farmworker Association of Florida is the partner.	OPs	Chlorpyrifos, with a few samples above LOCs, and trace amounts of endosulfan.	None yet, project is ongoing.
20	‘Biodrift II’ / 2008–present / California DCs: 4	Sampling at homes near walnut trees in Farmersville in 2008 and in Lindsay near oranges in 2009.	OPs	Chlorpyrifos found in almost all 2008 samples, but always in low levels, so sampling moved to Lindsay in 2009.	Project still underway, through March 2010; likely to influence CA state biomonitoring program
21	‘Sisquoc’ / 2008 / California DCs: 4	Sampled at homes in Sisquoc CA adjacent to a field being fumigated with chloropicrin and methyl bromide.	Chloropicrin	High levels of chloropicrin detected, and the average level for the entire sampling period exceeds the LOC for short-term exposure.	Influenced federal Fumigant mitigation rules from Fumigant Cluster Assessment

22	'Maluia' / 2008–present / Hawaii DCs: 2	Homes near a school near a field owned by Monsanto where crops are grown for seed.	Various	No samples; possible case were the threat of DC sampling prevented applications.	Pesticide spraying stopped, at least temporarily.
23	'Big Valley' / 2009–2010 / California DCs: 1	The Big Valley, Indian reservation. DC not begun; will be near sprayed orchards (off reservation).	Various	No samples taken yet.	Project about to start

- Since its launch in 2003 the Drift Catcher has been involved in 27 projects in ten States.
- 69 drift catchers have been deployed to date, some used in more than one project.
- Significant data has been collected in homes, schools, reservations and other areas in five states: California, Colorado, Florida, Minnesota and Washington. DCs were provided in five other states: Alaska, Hawaii, Indiana, North Carolina and Maine.
- In 11 instances the Drift Catcher use led directly or indirectly to local, State or federal policy change. The fact that communities can detect pesticides at levels of concern helped impact policy development.

Appendix 6. Registration status of Highly Hazardous Pesticides in the United States

Despite considerable investment in pesticide regulation and enforcement, highly hazardous pesticides continue to be widely used under conditions that cause significant health hazards in the US. Of the 395 PAN International HHPs (see Appendix 4), 248 (63%) are currently registered for use in the United States,[1] though at least six (azinphos-methyl,[2] cacodylic acid,[3] carbofuran,[4] disulfoton,[5] methidathion[6] and molinate[7]) are actively being phased out, and a seventh, lindane,[8] is only registered for pharmaceutical use.

Many of the 248 HPPs are used only in the agricultural sector, i.e. there are no residential or home and garden uses for these products. For example, endosulfan can only be used in agriculture, its home uses having been cancelled in 2001.[9] Similarly, almost all home uses of organophosphate and carbamate insecticides have been cancelled, though the use of many continues in agriculture. Furthermore, many HHPs are 'restricted use' only, meaning they can be applied only by licensed pesticide applicators. For example, all formulations of endosulfan and the soil fumigants chloropicrin, dazomet, 1,3-dichloropropene, metam potassium, metam sodium, methyl bromide, and methyl iodide[10] are (or will soon be) restricted use products.

Use of HHPs in the US

The fact that a pesticide is still registered in the US does not necessarily mean it is commonly used, or that it is used at all. To determine how large of a role HHPs play in pest control in the US, national level pesticide use statistics were consulted. The most recent statistics, compiled by the US EPA in *Pesticides Industry Sales and Usage 2000 and 2001 Market Estimates*,[11] show that some 907 million lbs of pesticides were used in the agriculture sector in 2001. This includes 675 million lbs of conventional pesticides and 232 million lbs of sulphur, petroleum oil, and "other miscellaneous chemicals produced largely for non-pesticidal purposes."

The report only provides estimates of use for only the top 25 conventional pesticides, but these 25 active ingredients account for the majority of the use of conventional pesticides used in 2001 (472 to 565 million lbs out of the total of 675 million lbs). Twenty one are HHPs, and together their use amounts to 369 to 449 million lbs, which constitutes about 80% of the use of these top 25 active ingredients. One of these 21 HPPs, sulfosate (glyphosate trimesium), is no longer registered for use.

Of the 232 million lbs of 'non-conventional' pesticides applied in US agriculture in 2001, 172 million lbs was sulphur and petroleum distillates, neither of which are HHPs. The report does not breakdown the remaining 60 million lbs by chemical, but only says that this category "includes sulphuric acid, insect repellents, zinc sulfate, moth control chemicals (e.g. paradichlorobenzene and naphthalene), and other miscellaneous chemicals produced largely for non-pesticidal purposes." Of those chemicals specifically mention, only paradichlorobenzene is an HHP.

Considering only the top 25 conventional pesticide plus sulfur and petroleum oil, HPPs constituted 369–449 million lbs out of the 644–737 million lbs applied, or 57–61% of use. The report also shows that from 1985 to 2001, organophosphates—the most of which are HHPs—consistently comprised between 64 and 72% of total insecticide usage.

Use of HHPs in California

The State of California has more comprehensive and up-to-date pesticide use data than is available on the national level or for other states, and the state ranks as one of the top for pesticide use. According to state statistics for 2008,[12] 172 million lbs of pesticide active ingredient were applied. This figure includes all agricultural use as well as public health uses, structural pesticide control use, and certain municipal uses. Not included are home and garden uses. The top 100 pesticides account for 153 million lbs, or 89% of this total. Forty three of these top 100 pesticides are HHPs and their use totals 53 million lbs, or 34% of the top 100. The most used pesticides in the state in 2008 were sulphur and crop oil, neither of which are HHPs. In fact sulphur and most types of crop oil can be used in organic agriculture. The pesticides ranked fourth through eighth are all fumigant pesticides. All are restricted use.

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1 US registration status was determined via querying http://www.pesticideinfo.org

2 http://www.epa.gov/oppsrrd1/registration_review/azm/azm-status.pdf

[3] http://www.epa.gov/fedrgstr/EPA-PEST/2009/September/Day-30/p23319.htm

[4] http://www.epa.gov/oppsrrd1/reregistration/carbofuran/carbofuran_noic.htm

[5] http://frwebgate5.access.gpo.gov/cgi-bin/TEXTgate.cgi?WAISdocID=278885514177+0+1+0&WAISaction=retrieve

[6] http://edocket.access.gpo.gov/2010/2010-7508.htm

[7] http://www.epa.gov/fedrgstr/EPA-PEST/2008/July/Day-30/p17475.htm

[8] http://www.epa.gov/pesticides/reregistration/lindane/

[9] http://www.epa.gov/pesticides/reregistration/REDs/endosulfan_red.pdf

[10] http://www.epa.gov/pesticides/reregistration/soil_fumigants/index.htm

[11] http://www.epa.gov/oppbead1/pestsales/01pestsales/market_estimates2001.pdf

[12] http://www.cdpr.ca.gov/docs/pur/pur08rep/08_pur.htm

Appendix 7. Acronyms

a.i.	Active ingredient
AP	Andhra Pradesh
CBM	Community based monitoring
CILSS	Comité permanent Inter-Etats de Lutte contre la Sécheresse (Permanent Inter-State Committee for Drought Control in the Sahel)
Code of Conduct	International Code of Conduct on the Distribution and Use of Pesticide
CPAM	Community Pesticide Action Monitoring
CPR	Californians for Pesticide Reform
CRLAF	California Rural Legal Assistance Foundation
DC	Drift catcher
EDC	Endocrine disrupting chemical
EPA	Environmental Protection Agency
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GAO	Government Accountability Office (US)
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
HHP(s)	Highly Hazardous Pesticide(s)
IARC	International Agency for Research on Cancer (within WHO)
ICCM	International Conference on Chemicals Management
LD	Lethal Dose
LOC	Levels of concern
n/a	not available
n/k	not known
NGO	Non-Governmental Organisation
NIOSH	National Institute for Occupational Safety and Health
NPC	National Poisons Centre
OC	Organochlorine
OP	Organophosphate
PAN	Pesticide Action Network
PAN AP	PAN Asia and the Pacific
PANNA	PAN North America
PIC	Prior Informed Consent

PPE	Personal Protective Equipment
R26	EU Risk phrase 26 – toxic by inhalation
RAPAL	PAN Latin America (Red de Acción en Plaguicidas y sus Alternativas de América Latina)
SAICM	Strategic Approach to International Chemical Management
UFW	United Farm Workers of America
UNEP	United Nations Environment Programme
WHO	World Health Organisation

This report presents the results of a wide-ranging survey of how pesticides are used in the field by communities around the world. It shows that hazardous pesticides are routinely used in unsafe situations, and supports the call by international agencies for more assertive action on pesticide hazards. The report illustrates the urgent need for significant investment and policy support for agroecological approaches to food, feed and fibre production.

Pesticide Action Network (PAN) groups in Africa, Asia and Latin America carried out surveys in 21 areas of 13 countries, based on community monitoring strategies. PAN groups in the United States monitored the air for the presence of pesticides. The material presented from Africa, Asia and Latin America is based on interviews with 2220 women and men from farming communities, agricultural workers and rural communities affected by spray drift.

Since its founding in 1982, PAN has worked to replace the use of hazardous pesticides with ecologically sound and socially just alternatives. An important basis and tool of PAN's work has been monitoring the distribution, use and disposal of pesticides. The latest result of PAN monitoring initiatives is this report. It documents that pesticides still cause wide-ranging hazards, risks and poisoning Africa, Asia and the Americas.

PAN

Pesticide Action Network International

Pesticide Action Network (PAN) International is a global network of more than 600 organizations in over 90 countries that has been working for 28 years to protect health, the environment and livelihoods by eliminating the use of highly hazardous pesticides and promoting resilient, regenerative agriculture and food sovereignty.

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