The Federal Environmental Protection Authority

Environmental Impact Assessment Guideline
On
Pesticides

NOT FOR CITATION

This guidelines is still under development and shall be binding after consensus is reached between the Environmental Protection Authority and the Environmental Units of Competent Sectoral Agencies

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List of Acronyms

ADLI	Agricultural Development Lead Industrialization
CO	Carbon Monoxide
EC-	Emulsihable Concentrate
EIA	Environmental Impact Assessment
EPA-	Environmental Protection Authority
ESPRP	Ethiopian Sustainable Poverty Reduction Program
FAO	Food Agricultural Organization
GDP-	Great Domestic Production
IPM-	Integrates Pest Management
ISO	International Standards Organization
IVM-	Integrated Vector Management
LD50	Lethal Dosage that kill 50% of the total animal
MOA-	Ministry of Agriculture
PIC-	Prior Informed Consent
POPs -	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PRC-	Pesticide Registration and Control
RSPM	Respiratory Suspended Particular Matter
SPM	Suspended Particular Matter
SO_2	Sulfur Dioxide
ULV	Ultra Low Volume
WHO-	World Health Organization

Glossary

Biologically amplification– (also called biological magnification)- the amplification of pesticides concentrations in the fatty tissues of organisms in a progressively highly increased amount in food chains.

Bioaccumulation –is the process of retention or building up of non-biodegradable or slowly biodegradable chemicals, especially pesticides in the body of an organism.

Cleaner production- is application of an integrated pollution prevention environmental strategy to processes, products and services to increase over all efficiency and reduce the risk to humans and the environment.

Disposal-any operation to recycle, neutralizing, destruct, or isolate products

Environmental impact: The degree of change in an environment resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organization's activities or may be indirectly caused by them.

Environmental impact assessment (EIA) for short is a formal study process used to predict the environmental consequences of a proposed major development project

Environmental management – a management approach to reduce over all environmental impacts

Hazardous waste -any discarded materials that contains one or more of 39 toxic ,carcinogenic ,mutagenic ,or teteratognic compounds at levels that exceed established limit flammable reactive or unsuitable enough to explode or release toxic fumes capable of corroding metal containers such as tanks ,drams, and barrels.

Hazardous Chemical-chemicals that can cause harm because it is flammable or explosive, or that can irritate (such a strong acids or alkaline substances or cause allergic reactions on the immune system

Integrated pest management (IPM) combined a better pesticide application regime with biological control and other ecological and biological crop protection techniques.

Integrated Vector Management (IVM): represents the use of alternatives pesticides, targeted pesticide use, and non-pesticide vector control methods.

Obsolete Pesticide: are defined as stocked pesticides that can no longer be used for their original purpose or any other purpose that are also hazardous and therefore require disposal.

Persistent Organic Pollutants (POPs): chemical compounds that are highly toxic, persist in the environment, bio-accumulate in fatty tissues of living organisms, travel long distances and naturally migrate toward colder climates.

Pesticide: any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plant or animals causing harm during or other wise interfering with the production, processing, storage transport, or marketing of food, agricultural commodities, wood and wood products or animal foodstuffs, or which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies.(FAO,1990)

Pest: Any animal, plant or pathogen, which causes damage of annoyances to man, his animals, crops or possessions.

Pest management: The reduction of pest problems through the calculated economic use of control methods in correspondence with the characteristics of the pest organism and environmental interests.

Toxic chemical-Chemical that is fatal to humans in low dose or fatal to over 50% of test animals at stated concentration

Vector: A carrier, such as an insect, that transmits a pathogen from a diseased plant or animal to a health one.

1 INTRODUCTION

Chemical pesticides was discovered six decades ago and considered as the miracle to turn modern farming around; it was assumed that, for developed world, great profits would be made and for the less developed continents hunger would become a thing of that past, as a mass production of food becomes a reality. Since their initial introduction six decades ago, a vast range of chemicals pesticides have been developed, and distributed through out the world.

How ever, the miracle had a limited life span, and would have far-reaching and devastating consequences.

In developing countries lack of awareness and proper management, trained man power, disposal facility etc has resulted in adverse impacts on human health and the environment.

Agriculture as the dominant sector of the Ethiopian economy, accounts for about 50% of GDP and 85 % of export revenue, and providing livelihood for 85 % of the population. As it is evident from the current development strategies and policies, such as Development-Led-Industrialization (ADLI) policy, ESPRP, etc., one can envisage that agriculture will continue to dominate the economy for a long time in the future.

It is thus, obvious that productivity of, agriculture sector, especially small holder agriculture largely depends on substantial in puts of chemical pesticides. Besides, chemical pesticides are being used in domestic, health and industrial uses.

However, in Ethiopia, Impacts of pesticides to a given locality /environment has not been clearly identified, assessed and compiled. There is no system for risk monitoring and communication. It is therefore essential to put in place mechanisms by which concerned and affected community members could understand the impacts of pesticides and their containments to their surrounding environment and health.

This is an imperative to introduce guidance for safe use and managements of pesticides.

Assessing impacts of pesticides on the environment and people involved in the production, use and disposal of pesticides within Ethiopia will support to identify and predict possible impacts and mitigation measures.

Therefore providing guidance to producers and users of pesticide become an urgent need to the country.

Therefore the objectives of this guideline are to:

Indicate major impacts and possible mitigation measures of pesticides,
Guide people on safe production, use, handling and disposal of pesticides,
Support various pesticides based sectoral development packages of the country, such as agriculture, Health, industries, etc.

Ensure the safe management of pesticides in the country, especially the implementation of IPM, IVM and CP strategies.

The main contents of this environmental impact assessment guideline on pesticide use are the Introduction part which tries to give brief overview about the initial discovery of pesticides and the likely out come of pesticide use in different economic sectors. A background section discusses about the importation, local formulation and the possible impacts observed in Ethiopia. Section 3 assess national policy and regulatory frame work developed within the country as well as about the different environmental obligations which the country is signatory to. Major environmental impacts of pesticide, general consideration to minimize the impact of pesticides, as comprehensive guide to users are presented in section four. At last essential information that ought to be relevant to the guideline is annexed in the guideline document.

2 Background

The introduction of pesticide in Ethiopia date back to 1960.pesticides is mostly introduced to Ethiopia for agricultural purposes.

2.1 Pesticide Import, Production and use in Ethiopia

Ethiopia is one of the African countries that use different kinds of pesticides for agricultural, industrial and health care purposes. In most cases pesticides are imported to Ethiopia. However there is one factory that formulates pesticides within the country.

2.1.1 Pesticide importation

Pesticides are mainly imported for agricultural purposes while some amounts of pesticides are imported for health care and industrial purposes. Both public and private enterprises are engaged in pesticide importation business. Currently, about 20 organizations are actively involved in importation and sale of pesticides.

Large quantities of pesticides are imported annually to Ethiopia. In this regard, over 3000 tons of various types of pesticides that are worth more than USD 20 million are imported annually.

2.1.2 Local pesticide formulation

There is one local pesticide formulation plant in Adami Tulu**.** The plant has a capacity to formulate 1500 tons of dust and the same quantity liquid formulations every year. Major pesticide formulated include, Malation, (Ethiolation 5% Dust and Ethiolathion50%EC), Endosulfan (Ethiosulfan 25% ULV), Diazinon (Ethiozinone 60% EC), and Fenithrothion (Ethiothrothion 50% EC)). The plant imports active ingredients and solvents from foreign countries, mostly from Italy and Israel.

2.1.3 Pesticide use pattern

Commercial farmers are the major users of pesticides in Ethiopia. They are accounted for use of about 80%of the pesticides imported into the country. The remaining 20% of the total import is used for small scale farming, for household, health and industrial purposes. The use

of pesticides in the individual smallholder farmers is very low, except for 2,4 –D herbicide that is used to control herbs in the farmland.

2.2 Major causes of pesticides impact on the Environment

Ethiopian farmers found pesticides to be supportive input for there agricultural production, however, its improper use in the past has shown that small scale peasant farming and some large scale mechanized agriculture have caused an impact on air, water, soil and human beings. Some of the underlining causes are outlined hereunder:

- *Lack of awareness*
  - Inadequate training,
  - Lack of appropriate and timely information about the proper use and management of pesticides,
  - Inappropriate use of Personal Protective Equipment (PPE),
  - Wrong notion that pesticides is the best solution to pest problems,
  - Poor guidance about the safe use and handling,
  - Lack of standard safety practice, etc.
- *Improper use of pesticides*
  - Wrong mix of different types of pesticides,
  - Use of pesticides for unintended purposes,
  - Use of pesticides containers for domestic uses,
  - Wrong trade and Sectoral motives, etc
- *Weak enforcement*
  - Absence or late issuance of regulations and guidelines,
  - In adequate implementation of the issued regulations,
  - Weak monitoring or a follow-up activities,
  - Lack of well defined incentive or punitive structure, etc.
- *Lack of Integration, weak institutional setup, and poor networking and exchange of information among key stakeholders.*
- *Obsolete pesticide accumulation- large quantities of obsolete pesticides can be accumulated due to:*
  - Inaccurate prediction of the occurrence of pests,
  - Poor pesticides management
  - Un suitable products or packaging

- Banning of products
- Donations or purchases in excess or requirements
- Commercial interest of the pesticide industry and hidden factors.
- Weak institutional framework.

At present, there are large amount of obsolete pesticides accumulated in different countries these are:

- *100,000 tons in developing countries*
- 15000 tons in Africa
- 5,000-10,000 tons in Asia,
- 3000 tons Ethiopia

- ***Disposal problems-*** *t*here is no disposal facility in Africa due to the cost of disposal per ton of obsolete pesticide is high. The cost for disposal for a tone of obsolete pesticides is estimated between $3,500 and $5000.

- **wing to Nature of pesticides**
  - ***Biologically amplification***– (also called biological magnification) - the amplification of pesticides concentrations in the fatty tissues of organisms in a progressively highly increased amount in food chains. (see fig 1) .

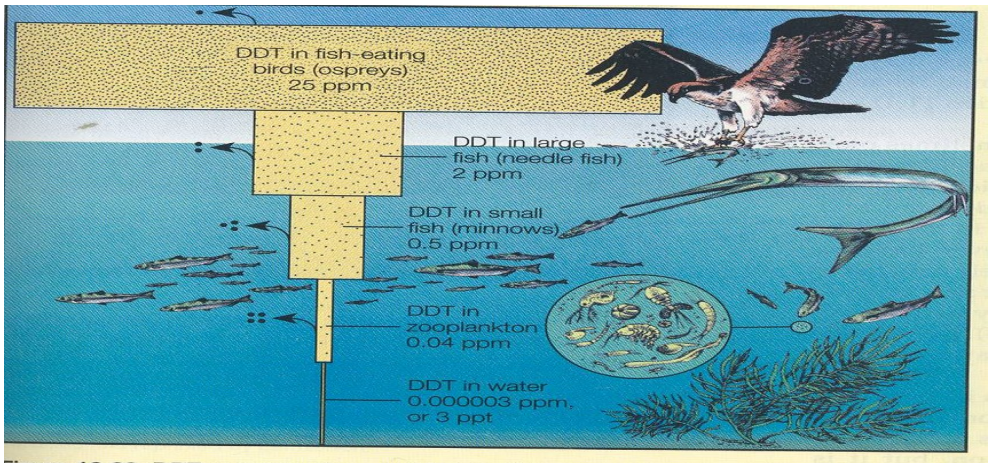

Figure 16-22 DDT concentrations in the fatty tissues of organisms were biologically amplified about 10 million times in this food chain of an estuary near Long Island Sound. Dots represent DDT, and arrows show small losses of DDT through respiration and excretion.

FIG.1

- ***Creating Resistant Pests, Super pests and New Pests***

  Spraying a field with a pesticide kills most of the pests. However, a few individuals of the target species survive to reproduce because they were missed, received fewer doses or because they have genes that protect them from that poison. Each time the resistant survivors are sprayed, the next generation contains a higher percentage of resistant organisms as a result of natural selection. Thus these groups of pests will develop resistant to the pesticides.

Fig1. Biomagnifications

- **Pesticide Residues**

  In most cases, residue of used pesticide create serious problem for the environment. For instance the presence of appreciable level of Organo chlorine insecticides residues, such as DDT, lindane and dieldrin in human blood and milk, and cow milk will result in adverse effects on human health when the accumulation reaches at the level of damage.

- **Absence of ideal type of pesticides**

  Unfortunately no known pesticide meets all these criteria, and most don't even come closer to be effective, environmentally friendly and less costly due to lack the ability to:

  - Kill only the target pest,
  - Harm no other species, non target species,
  - Disappear or break down into something harmless after doing its job,
  - suppress resistance development in target organisms, and
  - Be cheaper than doing nothing

2.3 Types, Categories and classification of pesticides

In this section the types and category and classification of pesticides are made according to their chemical formulation, use, level of hazard and status.

2.3.1 Types of pesticides according to chemical formulation

- **Chlorinated hydrocarbons**
  - this group are broad spectrum pesticides, include DDT, Aldrin, Dieldrin, Toxaphene, Lindane, Chlordane, Methooxychlor, Kepone.
  - their persistence in the environmental media range between 2 and15 years.

- **Organophosphate**
  - include broad and narrow spectrum pesticides such as Malathion, Parathion, Methyl parathion, Diazinon.
  - their persistence in the environment is generally low to moderate (normally 1to12 weeks). Some can last several years. Organophosphate can easily contaminate water supply because they are water-soluble.
  - don't have characteristics of bioaccumulation and amplification.
  - highly toxic to human and other animals. Malathion is less toxic to mammals than other Organophosphates.

- **Carbamates**
  - are broad and narrow spectrum agents. Examples include: carbaryl, (sevin), propoxur carbo furan,aldicarb, maned zineb and methomyl.
  - are less persistence (days to weeks)
  - don't bioaccumulate and are not biologically amplified
  - their toxicity for humans and other animals are from low to high unfortunately they are highly toxic to honeybees.
- **Botanical**
  - are group of broad and narrow spectrum agents produced naturally by plants or by chemical modifications of such natural substances. Examples of natural botanicals include rotenone, pyrethrum and camphor.

- are low persistence (day to week) are effective at a low dose, do not bioaccumulate, are not biologically amplified.
- have low to moderate toxicity to humans and animals .
- Most are expensive.

- **Microbotanicals**
  - these are diverse array of microorganisms, including bacteria , fungi, and protozoan,
  - selectively kill insects, usually by producing certain toxins. Examples include Bacillus, Popilliae (beetles),
  - have low persistence (day to weeks) are effective at a low dose,
  - do not bioaccumulate, are not biologically amplified, and
  - have low toxicity to humans and other animals.

2.3.2 Types according to use

Pesticides according to their use can be classified into Insecticides,

- Insecticide -for control of insects
- Acaricides-for the control of mites and ticks
- Herbicides- for the control of weeds
- Avicidescides- for the control of birds
- Fungicides- for the control of fungus
- Nematocides- for the control of nematodes
- Molllucides- for the control of snails and slugs
- Rodenticides – for the control of rodents

2.3.3 Classification of pesticides according to hazard *(Based on WHO Classification, 1996)*

According to the World Health Organization (WHO) pesticides have been classified into four categories: That are extremely hazardous, highly hazardous. moderately hazardous, slightly hazardous, depending on their acute oral and dermal LD50 .Values for solids in both oral and dermal tests is always lower in all four categories of acquit toxicity levels. In the same way solid pesticides have lower acquit toxicity than liquid pesticides.(See table. 1.

Table 1. LD_{50} Based hazardous classification

Class		LD_{50} for the rat (mg/Kg body weight)			
		Oral		**Dermal**	
		Solids	Liquids	Slids	Liquids
1a	Extremely hazardous	5 or less	20 or less	10 or less	40 or less
1b	Highly hazardous	5-50	20-200	10-100	40-100
II	Moderately hazardous	50-500	200-2000	100-1000	100-4000
III	Slightly hazardous	500-2000	2000-3000	Over 1000	Over 4000

Source: Guide line to classification2000-2002

2.3.4 Category of pesticides

Pesticides are generally categorized into three groups. Those are:

- **Unbanded-** used or registered.
- **Banded-** a pesticide for which all registered uses have prohibited by final government regulatory action for health or environmental reasons.
- **Obsolete-**that can no longer used for original purposes.

3 Policies and Legal Frame Work

Understanding the over all importance of issues associated with pesticides, the government of Ethiopia has reacted in so many ways to address the problems.

Accordingly, the Federal Democratic Republic government of Ethiopia has developed policies and legal frameworks related to safe production and use of pesticides.

Ethiopia has also accepted different international agreement related to pesticides. The following is the highlights of major policies and legal frameworks, which required considerations in safe management of pesticides.

3.1 National Policies

3.1.1 Environmental Policy of Ethiopia

The country has approved an environmental policy in 1997. The overall policy goal is to improve and enhance the health and quality of life of Ethiopians through sound management of natural resources and with objective of sustainable development.

The policy calls among other things for prevention of pollution.

In the sectoral environmental policies that relates to Soil Husbandry and Sustainable Agriculture the emphasis is on:

- the use of biological and cultural methods in an integrated manner to control pest and diseases,
- to safe guard human and environmental health by adequately regulate the agricultural chemicals.

3.1.2 The Draft Agricultural Policy

Objective

- to sustainablly enhance the production and productivity of agricultural sector for improvement of the living conditions of the people,
- to conserve and rational utilization of natural resource for sustainable agricultural development,
- Policy elements on crop protection focus on non –migratory and Migratory pests. The policy statements include:

    - urging the farmers to control non –migratory pests before they move to the nearby farm areas,
    - If these pest population increases and beyond the control of farmers ,government should support these farmers,
    - Importation and handing over of crop protection technologies should be based on testing their effectiveness,
    - spraying pesticides considered as effective control of Migratory pests,

- the need for the establishment of plant quarantine system to prevent intrusion of exotic pests or move out of the country,
- Development of pesticide registration and control system, etc.

3.2 Legal issues

3.2.1 Applicable National Legal Instruments

The following is the highlight of some of the National Legal instruments that are related to pesticides use and managements.

3.2.1.1 Proclamation of the Constitution of the Federal Democratic Republic of Ethiopia (Proclamation No 1/1995)

In the constitution of Ethiopia has captured the most important aspects of sustainable development. This has been sufficiently reflected in the provisions govern the right to development (art. 43), where peoples right to:

- improved living standards and to sustainable development,
- consultation and participation regarding matters that may affect their wellbeing,
- sustainable development, and
- enhanced capacity for development and meet their basic needs provided for; as well as Environmental right (art.44),where peoples right to:
- clean and healthy environment, and
- proper compensation are recognized.

It is to be noted that any undertaking related to pesticide should cognizant of these broad right enshrined in the constitution.

3.2.1.2 Special decree for Pesticides Registration (Proc.20/1990)

This decree:

- Covers agricultural, household, public health, and industrial pesticides;
- Provides registration and control responsibilities to Ministry of Agriculture;
- seeks to promote safer pesticide handling and use in the country;
- Requires that all pesticides should be registered on the basis of demonstrated product effectiveness and safety for humans, non-target organisms and the environment;

- Prohibits importation of highly hazardous, severally restricted or banned pesticides (including most organochlorines); and
- Obliges that all pesticides must display labels that meet specific MoA label requirements.
- requires data on:
    - Specification;
    - Common name of the active ingredient, according to ISO standard;
    - Chemical name;
    - Empirical and molecular weight;
    - Chemical and physical properties of the active ingredients;
    - the formulation products; and
    - Efficacy data to make the registration complete.

The decree also includes requirements for consideration for acceptance, testing procedure and t*he content of report and information for recommendation to be filled by the researcher.*

3.2.1.3 Applicable Environmental Proclamations

- ***Environmental impact assessment proclamation (Proclamation No 299/2002)***

  This proclamation requires that major development programme, plans and projects of the private and public sectors are subject to EIA before their approval. This proclamation also provides a legal base to harmonize and integrate environmental economic, cultural and social considerations into the planning and decision making process and there by promotes sustainable development.

3.2.1.4 The Environmental Pollution Control proclamation (No 300/2002)

This proclamation aims at eliminating or when not possible, to mitigate pollution as undesirable consequence of social and economic development activities. It further requires among other things for:

- *control of pollution,*
- *management of hazardous waste, chemical and radioactive substances,*
- *Respect of environmental standards,*
- *Punitive and incentive measures etc. are included in the proclamation*

3.2.2 Sect oral legal requirements

- ***Labor proclamation (42/93)***

The Labour proclamation obliges that an employer shall take the necessary measures to adequately safeguard the health and safety of the workers.

- **Public health proclamation (200/2000)**

This proclamation:

- Prohibits discharging of untreated liquid waste generated from septic tanks, seepage pits and industries into water bodies, or water convergences
- Prohibits the disposal of solid or liquid or any other waste in a manner which contaminates the environment or affect the health of the society, etc.

3.2.3 Provisional standards for industrial pollution control in Ethiopia

- The country has provisional effluent and emission standards which specially contains pesticide formulation and production standards.

3.3 International Agreement

Ethiopia has ratified four international conventions that have importance in pesticides managements. Consideration of these conventions is therefore essential. These conventions include:

- ***Rotterdam convention, Prior Informed Consent (PIC)***
  - *Ethiopia has* ratified this convention in July 2002, by means of proclamation No.278/2002.
  - The objective of the convention is to promote shared responsibility and cooperative efforts among parties in the international trade of certain banned or severely restricted hazardous chemicals and severely hazardous pesticides formulations in order to protect human health and the environment from potential harms.(see annex)
- ***Basel convention*** -

- Ethiopia ratified the Convention in April 2000 by means of proclamation No 357/2002.Its amendment was ratified through proclamation No. 356/2002.
- Objective of the convention include ensuring environmentally safe transfer, disposal of hazardous wastes, and limiting “Toxic trade” in hazardous wastes.

- ***Stockholm convention*** (POPs,)
  - Ethiopia ratified the convention in May 22, 2002 by means of proclamation No.279/2002.
  - The objective of this convention is to protect human health and the environment from persistent organic pollutants (see annex---- for list of these chemicals).
- ***Bamako Convention*** (1991)
  - Ethiopia has ratified the convention by means of proclamation No 355/2002.
  - The convention refers to" the Ban Of The Import Into Africa And The Control Of Transboundary Movement And Management Of Hazardous Wastes Within Africa"
  - The general obligation in the convention include:
    - Hazardous Waste Import Ban,
    - Ban on Dumping of Hazardous Wastes at Sea and Internal Waters ,
    - Parties required further action consistent with the convention in controlling Waste Generation

Note: *A person who will be engaged in pesticide production and use should take note of provisions of these conventions and national instruments developed to implement them.*

4 Major Environmental Impact of Pesticides Use

Pesticides once entered to the environment will have negative impacts on air, water, soil, human beings and animals.

It is important to take note of the following impacts that possibly emanate from production, use, handling, and disposal etc. of pesticides in order to come up with a proactive workable Environmental management system.

4.1 Impacts on water

Pesticide residue in water can cause serious pollution; both of ground water as well as surface water and may resulted in:

- the death of fish and also have other ecological impacts;
- change in the organoleptic properties of water (its odor, taste);
- negative effect on the process of oxygen formation by phytoplankton, on the vital activities of the inhabitants of the water ecosystems;
- impacts that transmitted along the food chains, and accumulate in food products;
- direct toxic action (acute or chronic toxicity) and indirectly (dimensioning of the content of oxygen dissolved in the water, a change in the chemical composition of water, extermination of water insects, etc);
- disturbing aquatic ecology; and
- Adverse effects on wetlands aquatic flora, etc.

4.2 Impacts on the air

The following table shows some pesticides related air pollutants and their effects on health.

Name of pollutant	Health impacts
RSPM	Respiratory illness, including chronic bronchitis and asthma; heart diseases.
SO_2	Heart diseases; respiratory problems including pulmonary emphysema, cancer, eye burning, headache, etc.
NO_2	Lung irritation, viral infection, airway resistance, chest tightness, etc.
SPM	Pneumoconiosis, restrictive lung diseases, asthma, cancer, etc.
Benzene	It causes immunotoxicity, carcinogenicity, asthma, anemia, unconsciousness etc.
Ozone	Impaired lung function, chest pains, coughing, irritation of eyes, nose etc.
CO	CO poisoning cause cherry lips, unconsciousness, death by asphyxiation etc.
Lead	It causes decreased hemoglobin synthesis, anemia, damage the nervous and renal

	(kidney) systems etc.

4.3 Impacts of pesticides in the soil

Pesticides are introduced into the soil for destroying soil dwelling pests, nematodes, and the pathogens of bacterial and fungal disease. Herbicides are widely introduced into the soil. Pesticides also get into the soil after treatment of the green organs of plants. They are washed off by atmosphere precipitation and carried off by the wind.

Pesticides may get into soil in the form of their residues contained in leaves, roots, etc.

- Depending on the conditions poisonous chemicals may remain in the soil unchanged and retain their toxicity for a more or less prolonged time.
- Persistent use of DDT and its related chemicals can thoroughly undermine the productivity of the soil over time by destroying the microorganisms and nutrients that nourish crops. This decreases agricultural productivity of land and makes it vulnerable to desertification.

4.4 Impacts on human health

Use of pesticides creates substantial health impacts in all parts of the World. Pesticides effects can be decided broadly into two categories:

- Acute effects, which appear immediately or very soon after exposure and
- Chronic effects, which may manifest themselves many years later and whose origins are often difficult to trace.

Each year in the world, an estimated 500,000 humans are poisoned by pesticide with 10,000 fatal (WHO 1996). Pesticide health related impacts may include**:**

- Headache, irritability, dizziness, loss of appetite, nausea, muscle twitching, convulsion, loss of consciousness, and possible death.
- Carcinogenic effects,
- Neurobehavioral effect,
- Reproductive deficits,
- Diabetes and others.

4.5 Impact on wild life and livestock (non-target species)

Pesticides are designed to kill pest organisms and may be also harm non-target species, and resulted in:

- population decline through the use of pesticides over large areas;
- Reproductive effect such as egg shell thinning , deformity and birth defects;
- Metabolic changes;
- tumors and cancer;
- behavioral changes;
- abnormally functioning thyroid glands;
- Sub-lethal or lethal poisoning of mammals and other vertebrate;
- through extinction of the pest population -losses of food sources for many birds; particularly migratory species;
- toxicity to bees which are pollinators, with adverse effects on the production of certain crops;
- long-term negative effects on the reproductive processes of birds of prey and aquatic species of certain insecticides eg DDT);
- high mobility and biological amplification of persistent pesticides.

4.6 Socio-Economic Impact

- ***Positive socio-economic impacts include:***
  - Increased income and/or security of yield for farmers;
  - Increased employment opportunities; and
  - Improved food supply.
- **Negative socio-economic impacts include:**
  - Risk of human contamination to dealers, formulators, applicators and farmers; Health risks and associated economic impacts from contamination of surface; and ground potable water supplies contaminated by pesticides containing wastes;
  - Acute health effects resulting from contamination of food and water stored in pesticide containers, from the transportation of pesticide and food stuffs in the same vehicle;
  - Health risks from pesticide residues remaining on a crop after application,
  - Loss of revenue from cash crops if these cannot be sold on world markets
  - because of illegal residue levels;

- Crop losses due to the emergence of new and/or more resistant pests (insects, plant pathogenic fungi, bacteria), spread of disease vectors and emergence of a 'pesticide treadmill', whereby farmers obliged to pay more and more for a control program that does less and less good.

  Note Short term benefit long term side effect

5 General considerations to minimize the impacts of pesticides

To avert the impacts of pesticides there are a number of reactive and proactive ways. The following outline only key measures to be considered.

5.1 *Use of Environmental Management Tools*

- **Environmental Impact Assessment (EIA)**- EIA can be used as a method of predicting in advance the potential impacts of pesticides production use handling, disposal and indicating an appropriate management measures.
- **Integrated Pest Management (IPM)-** uses combinations of approaches to control pest. The approaches include cultural, mechanical, biological and chemical controls in an integrated manner. In this approach each crop and its pest are evaluated as an ecological system. The overall aim of IPM is not to eradication of pest population but maintenance at just below economically damaging levels.
- **Integrated Vector Management (IVM)**-is tool for integrated disease prevention and management. Integrated Disease Management (IDM) includes a mix of disease control elements, such as vaccines, case detection and drug treatment, public education campaigns, and integrated vector management. Integrated vector control methods include the use of alternatives non-pesticide measures, similar to environmental management, targeted pesticide use and alternative pesticide use.
- **Cleaner production (CP)**-is defined by UNEP as the continuous application of an integrated preventive environmental strategy to processes and products to reduce risk to humans and the environment.
  - ***For production processes*** CP includes conserving raw materials and energy, eliminating toxic processing materials and reducing the quantity and toxicity of all emissions and wastes before they entered into the production process.

- **For products**, the approach focuses on the reduction of environmental impacts along the entire life cycle of a product that is from raw materials extraction to the ultimate disposal of the product.

- The order of preference in decision making on design and operation of CP strategies can follow the following steps: fallows:

    - Prevention of generation of waste
    - Recycling
    - Treatment
    - Safe disposal

Cleaner production does not always require new technologies and equipment. Some examples of practical cleaner production techniques include Good house keeping and operating procedure, material substitutions, etc.

5.2 Application of different Cultivation Practices

Some of the useful practices in crop cultivation are:

- Rotating crops- changing crops planted in a field each year so that one crop's pests don't have time to multiply uncontrollably;
- Planting rows of hedges or trees in and around crop fields. These hinder insect invasions and provide habitats for their natural enemies;
- Adjusting planting times- ensure that major insect pests either starve or get eaten by their natural predators;
- Growing crops in areas where their major pests do not exist;
- Switching from monocultures to modernized versions of intercropping, agroforestry, and polyculture. Plant diversity helps control pests;
- Removing diseased or infected plants and stalks and other crop residues that harbor pests;
- Using photodegradable plastic to keep weeds from sprouting between crop rows;
- Using denser planting patterns. This crowds out weeds among some crops;
- Mowing weeds instead of using herbicides;
- Using vacuum machines that gently remove harmful bugs from plants;

5.3 Building in Resistance

Plants and animals that are genetically resistant to certain pest insects, fungi, and diseases can be developed. However, needs careful considerations.

5.4 Use of Natural Enemies Predators and pathogens

Disease-causing bacteria and viruses can be encouraged or imported to regulate pest populations.

5.5 Use of Bio pesticides

Use of Botanicals such as extract from neem trees, Microbes for example, *Bacillus thuringensis* (Bt) toxin.

5.6 Application of Birth Control

Males of some insect pest species can be sterilized by then released in hordes in an infested area to mate unsuccessfully with fertile wild females.

5.7 Use of Insect Sex Attractants, pheromone

Insect sex attractants/pheromone can be used to lure pests into traps or to attract their natural predators into crop fields (usually the more effective approach).

5.8 Use of Chemical alternatives to pesticide

Different alternatives are mentioned for all 8 POPs pesticides. **See annex--**-

5.9 Education and information

Educating farmers, consumers, policy makers, and company's owners is critical to help reduce improper production, unnecessary pesticide use and resulting economic loss as well as risks to human health, wildlife and ecosystems.

5.10 Implementation of Environmental Management System (EMS)

Environmental Management system Is an integrated approach to overall management system designed based on findings of environmental issues involving, in our case sustainable pesticide management. As an inbuilt system, EMS as appropriate may defines or includes:

- the environmental policy of the organization;
- the necessary organizational structure and responsibilities;
- the required human resources and training needs;

- monitoring activities, including defined methods,, parameters and time frame for action;
- reporting and communication strategies;
- education, awareness and information;
- policy on occupational health and safety;
- practices and procedures for good house keeping; etc.

5.11 Other important consideration for sustainable pesticides management

The following are important aspects of pesticides management that require special safety considerations at various stages of the project life cycle. These include:

5.11.1Choosing site

- ***Site should be:***
  - far away from residential, and ecologically sensitive areas,
  - located in an area not prone to flooding,
  - inaccessible to any nearby surface water source or located in an area that has a high water table, etc.

5.11.2 Labeling procedure

- ***Labels should specifically indicates:***
  - Trade or brand Name,
  - Ingredient statement,
  - Common or chemical name,
  - Type of formulation,
  - Net content of the package,
  - Name and address of manufacturer, distributor,
  - Registration or license number,
  - Warning or signal words,
  - Hazards to humans and domestic animals,
  - Environmental hazards,
  - Physical and chemical hazards,
  - Statement of practical first aid treatment,
  - Re-entry statement,
  - Storage and disposal directions,
  - Warranty statement,

Note must be attached to or printed on the side of the container and must be included the phrase approved by in both English and the official local languages

5.11.3 General packaging requirement

Pesticides product and their formulations shall be packed in suitable, clean and dry containers which will not be affected by the product they contain in size given in Table 2 & 3.

Table 2. Packaging size for solid pesticides

Range of size	Pack size
50 gm up to 1 kg	50 g ,100g,250g,500g,1kg
Above 1 kg up to 5 kg	2.5kg,5kg
Above 5 kg up to 25 kg	10 kg,25kg
Above 25 kg up to 200 kg	50 kg,100kg,200kg

Table 2 Pack sizes for liquid pesticides

Range of sizes	Pack sizes
100 ml up to 1 l	100 ml,250ml,500ml,1l
Above 1 l up to 10 l	5 l, 10 l
Above 10 l up to 200 l	25 l, 100 l and 200 l

- The container for the product, shall be of sufficient strength and shall provide all the necessary protection against compaction, atmospheric moisture, oxidation, loss by evaporation and contamination to ensure that the product suffers no deterioration under normal conditions of transit and storage, etc. (please follow specific pesticides packaging requirements of working draft guidelines, WD 4496:2002).

5.11.4 Storage requirements

- All pesticide storage areas must be securely fenced to prevent unauthorized access,
- All doors and gates should be efficiently locked or padlocked,
- In case of fire, the address of the person(s) holding the keys should be fixed to the gate or door, etc.

- ***The building:***
  - Should be constructed of fire-resistant materials such as concrete block or metal,

- Should be well ventilated preferably by natural wind flow to minimize temperature increases and keep fumes from accumulating,
- Should be surrounded by a ditch to keep any liquid spills from draining away,
- Should be constructed to allow tight security. (Locking doors, barred windows),
- Should be well lit by sunlight or electric lights,
- Have a water supply for spill decontamination, etc.

- ***Managing pesticide stores:***
  - "First in first out" procedure should be followed to minimize the deterioration of pesticides and pesticide containers,
  - Different types of pesticides should be stored separately to prevent possible cross- contamination. Herbicides should never be stored next to insecticides and fungicides as cross-contamination is likely,
  - Pesticide should be stored on pallets to avoid dampness, this is specially true for dry formulations such as dusts, granules and wet table powders which will damp and lose their efficacy if they get wet,
  - No food, drink or animal feed should be stored in pesticide store,
  - Protective clothing should not be stored in the same room with pesticide,
  - All pesticides should be labeled, etc.

5.11.5 Transportation requirements

- Use well maintained vehicles to avoid accidents and delays,
- Use open vehicles covered with tarpaulins to decrease any possible build-up of heat or vapors and to protect the pesticide from rain,
- Make sure that drivers are aware of the dangers associated with the materials transporting,
- Vehicles transporting pesticides should never be left unattended,
- Containers should be well secured in the bed of the vehicles with ropes, chocks, etc.
- Never transport leaking or badly deteriorated containers,
- Do not transport food, beverages or animal feed together with pesticides,
- Load and unload pesticides very carefully to minimize the chance of dropping containers. Pesticides can be off-loaded by rolling containers onto used types, etc.

5.11.6 Pesticide application methods

To achieve the best result, it is essential that the right amount of pesticides should reach the target. Too much chemicals can damage crops and cause excessive chemical pollution on the environment. Too little is also will not eliminate the pest. Therefore accurate matching of different chemicals and spraying techniques to crop and the environment is very important.

There are a variety of techniques for the application of different pesticides depending up on the type of pesticide , formulation and size.

Type of Sprayer

The name given to the equipment used for applying pesticide is sprayer (sprayer system).A wide range of spraying equipment is available on the market to suit small, medium and large targets. The most common sprayer equipment used by small- scale farmers are:

- Manual hydraulic knapsack sprayer
- Ultra Low Volume(ULV)sprayer
- Motorized Knapsacks Mist Blowers
- Vehicle Mounted Sprayer

Aerial application

Pilot should hold the appropriate license /permit/authority to apply the particular pesticide and be able to demonstrate his competence in the use of the pesticide chosen with respect to:

- Suitability for the particular operation
- Application rate
- Effects on the target area
- Hazards to man, and effects they may have on non-target vegetation and animals , and special precautions to be taken. (for detail please refer Ethiopian Standard Authority's working draft WD 4499: 2002).

5.11.7 Health and Safety Measures

Before starting mixing, loading and applying pesticides, and after understanding the label directions, make certain you have taken the following precautions:

- Have detergent or soap and an adequate supply of water available,

- Know the early symptoms of poisoning for the pesticide you are using,
- Know the first aid procedures and make certain that materials and supplies are available,
- Be certain that materials are available to handle spills,
- Make certain that all equipment is functioning properly,
- Do not work alone; be sure help is available if you get into trouble,
- Have all the recommended protective clothing and equipment.
- Double-check that the respirator fits properly and has the correct canister cartridge,
- Never eat, drink, smoke, or go the bathroom while working with pesticides, without first washing your hands,

5.11.7. 1 Mixing and Loading

To begin mixing and loading:

- Reread the label and follow the directions; pay special attention to the warnings and precautions,
- Make sure only authorized mixers, loaders and/or supervisors are in the mixing and loading area. No other people or animals should be there,
- Work only in a well-ventilated, well-lighted area,
- Pesticide containers should be in a secure position when opening, to prevent any spillage. Be sure everyone is wearing the proper personal protective device,
- Mix and pour concentrated pesticides down low, preferably below waist level. Never pour pesticides at eye level. A spill or splash could be disastrous. Always remove clothing and wash yourself and your clothing thoroughly, immediately (within two minutes), if pesticides are spilled or splashed on you,
- Stand with your back to the wind -- upwind -- so that any fumes or dusts are blown away from you,
- Pour the pesticide into water, never water into the pesticide,
- If stirring is necessary, use a stir stick, never your hands,
- Mix and load on a concrete slab where spills can be contained. Avoid mixing or loading near surface water or near the mouth of well,

- Never pour pesticide directly into a spray tank. Always mix and dilute in a small container,
- When pouring, keep your head well above the spray tank, to prevent pesticides from splashing in your face. Protect your eyes with splash-proof goggles,
- Never overflow a spray tank. The cleanup could be an all-day, all-night task - costly and dangerous, etc.

During Mixing and Loading

Mixing and loading pesticides are among the most dangerous tasks involving work with these products, because it is at this time that people are working with open containers of concentrated pesticides. For this reason:

- Perform this activity after being well-informed of the dangers,
- Under the supervision of a properly certified, licensed applicator whenever handling "Restricted-Use Pesticides."
- Mixing and loading should never be done without a full understanding of the pesticide label and with the use of all recommended personal protective equipment.
- The label should clearly identify the dangers involved and
- The precautions to follow may indicate the signs and symptoms of poisoning and recommend first aid practices, should one be exposed to the product.

After the mixing-loading task has been completed :

- Securely close pesticide containers immediately after use. Return unused pesticide to its proper storage,
- Clean up all spills, no matter how small the amount,
- Wash mixing and loading pails, measuring devices and stirring equipment or tools in strong detergent water, rinse in clear water, air-dry and store,
- Wash your personal protective equipment in detergent, rinse and hang to air-dry,
- The wash and rinse water used in steps 3 and 4 can best be disposed of by pouring it into the spray tank. Do not overfill the spray tank; leave room for the rinse water,

- Remove your clothing and launder separately with heavy-duty liquid detergent and hot water. DO NOT USE BLEACH as it could cause a dangerous chemical reaction. Line-dry the clothing where it is exposed to sunlight,
- Take a hot shower using detergent-type soap. Do not forget to wash your hair. Put on clean clothing, etc.

5.11.7.2 During and after application

During application

- Wear recommended protective clothing, even if it is not or uncomfortable,
- if a nozzle gets clogged do not try to below it out with your mouth; use a fine wire or stick,
- Never eat, drink or smoke,
- Avoid pesticide application:
  - When the wind velocity is greater than 4m/second,
  - During hottest part of the day,
  - If rain is expected with in next 12 hours,
  - If pesticide spills on workers, etc.

After application

- Make sure that you have used all the pesticides in your sprayer,
- Never leave empty containers at the application site. Store them until they can be properly disposed off,
- Do not re-enter or allow others to re-enter the treated area before 24 hours after the application,
- Remove your protective clothing and wash them separately from all other clothes,
- Wash your body with soap and water,
- Do not wash up in a river stream or lake, as this contaminates the water source,
- Evaluate the effectiveness of the treatment,
- Keep all necessary records of the treatment operation, etc.

5.11.8 Action in case of pesticide poisoning

- Pay attention to breathing, give artificial respiration if required.
- Remove patient from contaminated area.

- Act calmly; keep patient comfortable and safety at rest.
- Remove contaminated clothing, wash exposed skin and eyes, thoroughly.
- Use large quantities of water to remove pesticide from the body. If no water is available, dub or gently wipe the skin with clothes or paper which could then be destroyed.
- Lay patient on his side.
- If material is highly toxic and has been swallowed , induce vomiting (only in conscious patients)
- Seek medical advice

5.11.9 Instruction of cleaning up spills and leaked pesticides

- First read the instructions on the product of label or material safety data sheet.
- Unauthorized persons should be kept away from the contaminated area .
- The store should be ventilated immediately as much as possible.
- Work in team of at least two persons. All person involved in the clean –up were appropriate protective clothing , Eyewash , soap and plenty of water should kept at hand.
- In the event of leakage: contain the leaking drum. In an over drum , or pump its contents into another drum. As a very temporary “first aid” measure, it is often possible to stop leakage by rolling the drum into a position so that the leak is on top.
- Mop up the leaked product with observant material (special soil control material , sawdust , earth or lime), sweep up and pack the material .Lay a ring (small dike) of absorbent material around the contaminated area . Wet the area with a detergent solution.(e.g 10% sodium carbonate solution , or 5 percent caustic soda solution). Into the ring of absorbent material .Remove the material after all liquid has been absorbed .Repeat if necessary. Clean equipment with detergent solution.
- Contaminated materials (e.g soil, soft floor material, absorbent materials) are regarded as hazardous waste and should be carefully packed and properly labeled for disposal or temporary storage until disposal can be carried out.

5.11.10 Disposal

Products that cannot be used for their intended purpose (s) or permitted alternatives, and that cannot be reformulated to become useable again, should be considered for disposal.

- **Treatment / Disposal Methods**

Disposal methods that may be acceptable, depending on the type of product and local circumstances include:

- High temperature incineration,
- Chemical treatment,
- Specially engineered landfill (for immobilized materials, incinerator ash and slag),
- Long term storage, etc.

Disposal methods unsuitable for bulk quantities of pesticides are:

- Open burning ,
- Burying or landfill disposal,
- Discharge to sewers,
- Solar evaporation,
- Land farming superficial application,
- Deep well injection, etc.

Promising new developments in waste disposal that can be used for pesticides waste disposal:

- Plasma energy pyrolysis,
- Gas-phase chemical reaction,
- Molten salt oxidation process,
- Metallurgical –based treatment process (molten metal method),

6 Annex

6.1 Annex 1.List of Prior Informed Consent (PIC) Chemicals subject to the prior informed consent procedure

Chemical	Relevant CAS number(s)	Category
2,4,5-T	93-76-5	Pesticide
Aldrin	309-00-2	Pesticide
Captafol	2425-06-1	Pesticide
Chlordane	57-74-9	Pesticide
Chlordimeform	6164-98-3	Pesticide
DDT	50-29-3	Pesticide
Dieldrin	60-57-1	Pesticide
Dinoseb and dinoseb salts	88-85-7	Pesticide
1,2-dibromoethane (EDB)	106-93-4	Pesticide
Fluoroactetamide	640-19-7	Pesticide
HCH (mixed isomers)	608-73-1	Pesticide
Heptachlor	76-44-8	Pesticide
Hexachlorobenzene	118-74-1	Pesticide
Lindane	58-89-9	Pesticide
Mercury compounds, including inorganic mercury compounds, alkyl mercury compounds and alkyloxyalkyl and aryl mercury compounds		Pesticide
Pentachlorophenol	87-86-5	Pesticide
Monocrotophos (soluble liquid formulations of the substance that exceed 600 g active ing redient/1)	6223-22-4	Severely hazardous pesticide formulation
Methamidophos(soluble liquid formulations of the substance that exceed 600 g active ingredient/1)	10265-92-6	Severely hazardous pesticide formulation
Phosphamidon (soluble liquid formulations of the substance that exceed 1000g active ingredient/1)	13171-21-6 (mixture,(E)&(Z) isomers) 23783-98-4 ((Z)-isomer) 297-99-4 ((E)-isomer)	Severely hazardous pesticide formulation
Mehyl-paraghion (emulsifiable concentrates (EC) with 19.5%, 40%, 50%,60% active ingredient and dusts containing 1.5%, 2% and 3% active ingredient)	298-00-0	Severely hazardous pesticide formulation
Parathion (all formulations-aerosols,dustable powder (DP), emulsifiable concentrate (EC), granules (GR) and wettable powders (WP) of this substance are included, except capsule suspensions (CS))	56-38-2	Severely hazardous pesticide formulation
Crocidolite	12001-28-4	Industrial
Polybrominated biphenyls (PBB)	36355-01-8 (hexa-)	Industrial
Polychlorinated biphenyls (PCB)	1336-36-3	Industrial
Polychlorinated terphenyls (PCT)	61788-33-8	Industrial
Tris (2,3-dibromoprophyl) phosphate	126-72-7	

6.1.1 Annex 2. Lists of Persistent Organic Pollutants (POPs) and its suggested alternatives

. Alternatives to aldrin

Crop	Pest	Alternatives
Maize	Soil pests	Chlorpyrifos
		Sarbaryl (carbamate)
Tree nurseries	Termites	Carbosulfan (carbamate)
		Carbofuran (carbamate)
		Chlorpyriphos
		Cypermethrin
Grain storage	Microfungi	Pirimiphos-methyl
		Pyrethrum
		sand
		ashes
Sugarcane	Termites	Carbofuran (carbamate)
Rice	Microfungi (several sp.)	Carbaryl (carbamate)
		Malathion
Pine	Leafcutting ant	Resmethrin
Wheat	Termites	Chlorpyrifos
		Lindane

alternatives to dieldrin

Use	Pest/disease	Alternative
Crops	Locusts	Chlorpyriphos
		Deltamethrin
		Fenitrothion
		Malathion
Grasslands	Termites	Bromophos
		Endosulfan
Groundnuts	Termites	Carbofuran

Alternatives to chlordane

Use	Pest	Alternative
Sugarcane and maize	Termites	carbofuran (carbamate)
		chlorpyriphos (organophosphate)
		Carbaryl (carbamate)
Eucalyptus	Termites	carbosulfan (carbamate)
		carbofuran (carbamate)
		phorate (organophosphate)
Building construction	Termites	bendiocarb (carbamate)
		carbaryl (carbamate)
		carbosulfan (carbamate)
		chlorpyriphos (organophosphate)
Wheat	Termites	chlorpyriphos (organophosphate)
		lindane (organochlorine)
Sugarcane	White grubs	carbofuran (carbamate)
		diazinon (organophosphate)
		fenithion (organophosphate)
Protection of buildings	Ants	Petroleum oils
		lindane (organochlorine)
		endosulfan (organochlorine)
		(biological control using baculoviruses

Alternatives to DDT

Use	Pest/disease	Alternative
Crop pests	Termites	Pyrethroids
		Organophosphates
		Carbamates
Public health sanitation	Mosquito-borne virsus; yellow fever and Dengue control	see chapter 2
	Malaria	alphacypermethrin (synthetic pyrethroid)
		Bendiocarb (carbamate)
		Cyfluthrin (synthetic pyrethroid)
		Lambda-cyhalothrin (synthetic pyrethroid)
		deltamethrin (synthetic pyrethroid)
		Lindane (organochlorine)
		Etofenprox (synthetic pyrethroid)
		Fenitrothion (organophosphate)
		Malathion (organophosphate)
		Permethrin (synthetic pyrethroid)
		Pirimiphos-methyl (carbamate)

Examples of alternatives to endrin

Use	Pest/effect	Alternative
Crops (maize, rice, cotton and sugarcane)	Lepidopteran pest	Chlorpyriphos
		Carbaryl
		Endosulfan
Mice and voles	Anticoagulants in baits	Co, CO_2, traps

Examples of alternatives to hetachlor

Use	Pest/disease	Alternative
Buildings	Termites	bendiocarb (carbamate)
		carbaryl (carbamate)
		carbosulfan (carbamate)
		chlorpyriphos (organophosphate)
		Alternative solutions, see chapter 2
Crops, nurseries and forest plantations	Termites	carbofuran (carbamate)
		chlorpyriphos (organophosphate)
		carbaryl (carbamate)
		phorate (organophosphate)
		Alternative solutions, see chapter 2
Crops	Cutworms	Acephate
		Carbofuran
		Chlorpyriphos

Examples of alternatives to mirex

Use	Pest/disease	Alternative
Crops	Termites	Alternative solutions, see chapter 2
		Sulfuramid
		Carbaryl
Forest plantation, nurseries	Leafcutter ants	Alternative solutions, see chapter 2
		Diazinon
		deltamethrin
		Diflubenzuron
		Sulfuramid

Examples of alternatives to toxaphene

Use	Pest/disease	Alternative
Cotton	Insects, boll weevil	Demethoate
		Chlorpyriphos
		Alternative solutions, see chapter 2
Soybeans	Cassia obtusifolia	Trifluralin
		Metribuzin
		Alachlor
Vegetables	Sogartodes orizicola	Demethoate
		Chlorpyriphos

6.2 Annex 3. Provisional effluent standards for pesticide formulation and Production

PESTICIDE MANUFACTURE

Emission Limit Values for Discharges to water

Constituent Group or parameter	Limit Value mg/1
Temperature	40^0C
PH	6-9 pH units
BOD_5at 20^0C	>90% removal or 50 mg/1
COD	>75% removal or 200 mg/l
Total Phosphorus (as P)	>90% removal or 5 mg/1
Total Nitrogen (as N)	>90% removal or 30 mg/1
Suspended Solids	20
Oils,Fats, and Greases	15
Chromium (as total Cr)	1
Chromium (as Cr Vl)	0.1
Phenols	1
Copper (as Cu)	1
Mercury (as Hg)	0.01
Active ingredient (each)	0.05

Emission Limit Values for Emissions to Air

Substance	Concentration (mg/Nm^3
Total Particulates	50 10 where very toxic compounds are present
Volatile Organic Carbon compounds	50
Hydrogen Chioride (as HC1)	20
Chlorine (or chloride)	5

PESTICIDE FORMULATION

Emission Limit Values for Discharges to Water

Constituent Group or Parameter	Limit Value mg/l
Temperature	40^0C
PH	6-9 pH units
COD	>75% removal or 250 mg/l
Total Phosphorus (as p)	>90% removal or 5 mg/l
Total Nitrogen (as N)	>90% removal or 30 mg/l
Suspended Solids	30
Oils,Fats, and Greases	15
Adsorbable or halogen compounds (A)X)	2
Organochlorines	0.1
Nitroorganics	0.1
Pyrethroids	0.1
Phenoxy compounds	0.1
Active ingredient (each)	0.05
Arsenic (as As)	0.2
Chromium (as total Cr)	1
Chromium (as Cr Vl)	0.1
Phenols	1
Copper (as Cu)	2
Mercury (as Hg)	0.01

6.3 Checklist on pesticides production and use

The following checklist could guide people involved in pest management and control.

- Are chemical pesticides suggested for the project?
- Have all pest management options been considered?
- Are alternative pesticides available that are relatively safer to use?
- Are there plants with pesticides properties, which could be used? Are they locally available?
- Are the pesticides to be used in the project recommended for use on these particular crops by the manufacturers, by the government?
- Are similar pesticides being used locally for health purposes, such as malaria control?
- Can a species-specific pesticide be used?
- Does the project design recognize the possibility that target species will develop resistance to the pesticide and larger quantities may be required each year to control the pest?
- It is possible to change pesticides to reduce the likelihood of target spices developing resistance to an important pesticide? If so, can a schedule for implementation be developed?
- Is the pesticide persistent in soil? Will it tend to accumulate in the soil?
- Might the pesticide the pesticide suggested for use kill beneficial soil microorganisms?
- Is there a risk on non-target animals (such as pollinators, other beneficial insects, birds etc) and plants what mitigation measures are considered?
- Are methods of handing, application, storage and disposal of pesticides considered strictly to void risks on humans and the environment?
- Will the environmental conditions (climate, wind conditions, rainfall, and humidity)
- Are the impacts of pesticides on flora and fauna and vulnerable ecosystems?
- Does the pesticide tend to bioaccumuluted (biologically increase) or biomagnified (biologically grown) in organisms? If so, which organisms would it affect in the immediate area, if any?

- Is there a body of water nearby? If so, are people downstream highly dependent upon aquatic resources such as fisheries, aquaculture, and drinking water which might be contaminated by an accidental discharge of pesticides because of the project? What effect would contamination of the water have on health, finances, and other?
- Is it likely that erosion will carry pesticides into downstream water bodies? If so, could such pesticides affect fisheries, aquaculture projects, and domestic water use?
- Have adequate precaution been taken to protect workers from pesticide poisoning during transport, storage, and application of pesticides? Are instructions available in local languages with culturally sensitive symbols?
- Can pesticide applications be times to avoid rapid loss to wind and rain?
- Is it possible to develop plans that can be put into effect easily and simply in case of an emergency, such as accidental pesticide pollution or physical contact?
- What alternative project designs could be used at the site to minimize environmental impacts from pesticide use?
- Will the environmental conditions (climate, wind conditions, rainfall, humidity) increase the risk of spreading by air?

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