

Ministry of Agriculture



Regional Pastoral Livelihoods Resilience Project (RPLRP)

Integrated Pest Management Framework

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ACRONYMS

ADLI	Agricultural Development-Led Industrialization
AGP	Agricultural Growth Project
AGP-CU	Agricultural Growth Project - Coordinating Unit
AGP-FSC	Agricultural Growth Project -Federal Steering Committee
AGP-RSC	Agricultural Growth Project - Regional Steering Committee
BOARD	Bureau of Agriculture and Rural Development
BOEPLAUA	Bureau of Environmental Protection and Land Use Administration
CRC	Compensation and Resettlement Committee
DA	Development Agent
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EPE	Environmental Policy of Ethiopia
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
FPCU	Federal Program Coordination Unit
GoE	Government of Ethiopia
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
KAC	Kebele Advisory Committee
KDC	Kebele Development Committee
MoA	Ministry of Agriculture
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PIM	Project Implementation Manual
PMP	Pest Management Plan
PVC	Property Valuation Committee
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
RPLRP	Regional Pastoral Livelihood Resilience Project
SKDC	Sub-Kebele Development Committee
WAC	Woreda Advisory Committee
WDC	Woreda Development Committee
WOARD	Woreda Agriculture and Rural Development

GLOSSARY OF TERMS

Cumulative Impacts/Effects: The total effects on the same aspect of the environment resulting from a number of activities or projects.

Developer/Proponent/Sponsor: the entity – person/ company/agency – proposing to develop/implement/install a new project/sub- project or expand an existing project under the RPLRP Project.

Direct Impacts: An effect on the environment brought about directly by the RPLRP project activities.

Disclosure: Information availability to all stakeholders at all stages of the development of projects.

Environmental and Social Impact Assessment (ESIA): A comprehensive analysis of the project and its effects (positive and negative) on the environment and a description of the mitigation actions that will be carried out in order to avoid or minimize these effects.

Environment: physical, biological and social components and processes that define our surroundings.

Environmental Monitoring: The process of examining a project on a regular basis to ensure that it is in compliance with an Environmental and Social Management Plan (ESMP) as will be approved by EPA after ESIA study.

Involuntary Resettlement: The forceful loss of land resources that requires individuals, families and / or groups to move and resettle elsewhere.

Impact: A positive or negative effect that a project has on an aspect of the environment.

Indirect impact: A positive or negative effect that a project indirectly has on an aspect of the environment.

Lead Agency: The agency with primary responsibility for the protection of the environment. For instance, the lead agency for environment matters in Ethiopia is the Environmental Protection Authority (EPA).

Mitigation Measures: The actions identified in an ESIA to negate or minimize the negative environmental impact that a project may have on the environment.

Pollution: contamination altering the state of purity.

Project and Sub-Project: a set of planned activities designed to achieve specific objectives within a given area and time frame. With respect to RPLRP Project, the terminology can be confusing. The project in World Bank terms in the RPLRP project; and all proposals subject to intermediary loans are subprojects.

Project Brief An outline of the planned development giving brief background on the project in terms of in-puts, activities to be undertaken and likely impacts.

Scoping: The initial stage in an environmental assessment that establishes the extent of the development and its likely environmental and social parameters that will be affected

Screening: An initial step in which, a project will be considered for environmental assessment and conducted by WDC, WAC, and WOARD Natural Resource Management Department.

Significance: Level or scale of importance.

Significant effect: An impact with a magnitude on the environment.

Stakeholder: Any person, group, institution or agency that has an interest in the project, and the environmental effects that the project may bring about.

EXECUTIVE SUMMARY

Introduction

The Government of Ethiopia (GoE) has received assistance from technical consortium (composed by FAO and ILRI) and the development partners to finance the preparation of the proposed Regional Pastoral Livelihoods Resilience Project which is going to be implemented in Ethiopia, joining Kenya and Uganda, which were supported during the first phase of the program. In Ethiopia, the project preparation is under the overall responsibility of Ministry of Agriculture (MoA). The overall Project Development Objective is *to enhance livelihood resilience of pastoral and agro-pastoral communities in cross-border drought prone areas of selected countries and to improve the capacity of the selected countries' governments to respond promptly and effectively to an eligible crisis or emergency.*

Project Components

The project focus will be on natural resource management, livelihoods support, market access and trade and early warning systems. The project will focus on building and strengthening linkages between regional and national institutions to address the issues that affect communities in the project areas. The AF will target 21 Woredas of the Oromiya, the Southern Nations Nationalities and Peoples (SNNPR) National Regional States bordering Kenya, as well as of Somali and Afar National Regional States in Eastern Ethiopia. The selected project districts are more prone to prolonged droughts, water stress for animals, land degradation due to overgrazing, high density of animals and seasonal movement of animals in search for water and pasture. The areas are also characterized by civil conflicts due to scarcity of natural resources. These districts have areas with the highest proportion of households owning cattle as source of livelihood. The five components are detailed below:

1. **Component 1: Natural Resources Management (AF of US\$22.9 million).** This component aims at enhancing the secure access of pastoral and agro-pastoral communities to sustainably managed pastoral-related natural resources.

- Under sub-component 1.1 (*Water Resources Development*), the AF will support the design, construction, and/or rehabilitation of additional water resources access facilities within Ethiopia (ponds, community water micro-dams, small sand dams, boreholes and wells) which will be strategically placed along trans-boundary livestock movement routes.
- Under sub-component 1.2 (*Sustainable Land Management in pastoral and agro-pastoral areas*), the AF will add about 8,000 ha in Ethiopia to the 3,420¹ ha in Kenya and Uganda with rangeland rehabilitation and management improvement.
- Under sub-component 1.3 (*Securing Access to pastoral-related Natural Resources*), the AF will assist in disseminating strategies and approaches in conflict prevention, management and resolution, and support the development of policy and legal frameworks for secured access to natural resources.

¹ 2,480 ha in Kenya and 940 ha in Uganda.

2. Component 2: Market Access and Trade (AF of US\$14.6 million). This component aims at improving the market access of the agro-pastoralists and pastoralists to the intra-regional and international markets of livestock and livestock products.

- Under sub-component 2.1 (*Market Support Infrastructure and Information Systems*), the RPLRP in Ethiopia will build or rehabilitate primary markets, and support the installation of pilot holding/auction rings and the rehabilitation of quarantine systems and facilities.
- Under sub-component 2.2 (*Improving Livestock Mobility and Trade of Livestock and Livestock Products*), the AF will seek to improve and harmonize trade regulation and standards systems affecting livestock trade from the Ethiopian ASALs, strengthen quality control (animals and by-products), labeling and packaging in selected livestock-related cross-border value chains related to the Ethiopian ASALs, and scale up activities in livestock identification and traceability currently piloted by FAO and AGP-Livestock Market Development (LMD).

3. Component 3: Livelihood Support (AF of US\$19.6 million). This component aims at enhancing the livelihoods of pastoralist and agro-pastoralist communities.

- Under sub-component 3.1 (*Livestock Production and Health*), RPLRP will strengthen national veterinary systems and laboratory networks, promote the production of vaccines for selected trans-boundary livestock diseases.
- Under sub-component 3.2 (*Food and Feed Production*), the RPLRP will promote increased food and feed production among agro-pastoralists in the Ethiopian ASALs through the introduction of drought tolerant food crop and fodder species in agro-pastoral areas and expansion of small scale irrigation.²
- Under sub-component 3.3 (*Livelihoods Diversification*), the RPLRP, will promote viable livelihoods for pastoral households and alternatives for the people moving out of pastoralism. It will encourage the emergence of cooperatives and pastoral common-interest groups around alternative livelihoods.

4. Component 4: Pastoral Risk Management (AF of US\$3.7 million). This component aims at enhancing drought-related hazards preparedness, prevention and response at the national and regional levels.

5. Component 5: Project Management and Institutional Support (AF of US\$8.7 million).

- Under the sub-component 5.1 and 5.2, RPLRP will enhance the coordination and management capacity of relevant institutions to deliver the project in Ethiopia.

Project financing

The RPLRP costs are based on an IDA allocation for an estimated budget of US\$ 75 million over a five years period in the proportion of one-third from the National and two-third from the Regional IDA. The

² This will include research grants to selected research centers for adaptive research. Specific guidelines for management of such grants are elaborated in the PIM.

Government's contributions is expected to cover part of the operating costs, including staff related costs in RPLRP coordination and implementation, and beneficiaries contributions for the construction and operating costs of small scale infrastructures. GoE will also provide complementary funding for the salaries of all project staff at FPCU not directly hired by the project. In addition GoE will provide project office spaces at the Ministry and in the 21 priority Woredas and may provide land for the construction of new cattle markets, check point, laboratories, water dams, holding grounds and weather information collection centers.

Objective of IPMF

In World Bank-financed projects, whenever the use of pesticides is envisaged then a critical requirement of developing Integrated Pest Management Plans (IPMPs) for each investment is mandatory. In World Bank-financed agriculture operations, pest populations are normally controlled through IPM approaches, such as biological control, cultural practices, and the development and use of livestock and crop varieties that are resistant or tolerant to the pest. The Bank may finance the purchase of pesticides when their use is justified under an IPM approach.

Justification for the IPMF

An Integrated Pest Management Framework (IPMF) is the principal tool and instrument to ensure initial project safeguards as regards pesticide use at this stage principally because the exact locations, scope, designs and nature of the proposed investments remains unknown. This IPMF is aimed at ensuring that implementing institutions in this project use it in order to ensure that the WB's pest management safeguard policies as outlined in Operational Policy (OP) 4.09 are adequately complied with.

The purpose of this document is to provide a strategic framework for the integration of pest management considerations in the planning and implementation of the activities to be implemented within the Regional Pastoral Livelihoods Resilience Project (RPLRP) specifically on sub projects that will involve use of fertilizers and pesticides for fodder production and treatment of livestock.

Use of pesticides in livestock health disease control and in livestock fodder production can constitute increased risks to human health and environment for reasons including the following:

1. Absence of effective pesticide regulation and enforcement;
2. Scarcity of, and or lack of Personal Protective Equipment (PPE);
3. Failure to implement good plant health, soil health, and water management practices;
4. Little or no understanding of IPM theory or principles;
5. Inability to read or comprehend pesticide labels and safety warnings due to illiteracy;
6. Inability to properly identify pests, their population levels, and economic thresholds;
7. Inadequate knowledge about pesticides and their dangers;
8. Porous national borders likely to encourage illegal entry and trade in pesticides

These are among the reasons that World Bank requires preparation of and compliance with an IPMF containing restrictions on the pesticides procured or facilitated recommendations for Integrated Pest Management, and specific recommendations for safety training and use of safety equipment. The

primary goals are to reduce risk and to change attitudes and behaviors toward a more comprehensive approach to Good Agricultural Practices (GAP).

The purpose of the IPMF is:

- Establish clear procedures and methodologies for IPM planning, design and implementation of investment to be financed under RPLRP
- Develop monitoring and evaluation systems for the various pest management practices of the pest management plans (PMPs)
- To assess the potential economic, environmental and social impacts of the pest management activities within the proposed investment
- To mitigate against negative impacts of crop protection measures
- To identify capacity needs and technical assistance for successful implementation of the IPMF
- To identify IPM research areas in RPLRP
- To propose a budget required to implement the IPMF

This IPMF was developed through a combination of literature review of relevant documents including previous projects involving pest management in Ethiopia, as well as consultation and engagement of stakeholders specifically MoA and the local governments at the 21 priority Woredas. This IPMF as is the requirement with all WB safeguard documents will be locally disclosed and also forwarded to the Bank for disclosure at its Public Information Center (PIC) of the country and at the Bank's Infoshop.

Environmental and Social-Economic Impacts of Pesticides

Potential Adverse Impacts

The potential adverse effects of pesticide use within the related sub projects under the RPLRP will include among others:

- Pollution and contamination of surface and underground water bodies
- Pollution and contamination of soil
- Impact on aquatic life due to pollution of water resources
- Impact on terrestrial fauna due to contamination
- Human and animal health related hazards due to indiscriminate exposure to pesticides

All the pesticides banned or under restriction in Ethiopia will not be used in the RPLRP. Wherever possible, non-chemical means of pest control will be exercised, in keeping with the policy of the bank to promote Integrated Pest Management (IPM). IPM can in some cases facilitate seed crop pest protection without the application of chemical based pesticides. Some IPM tactics that could be considered by RPLRP sub projects that reduce pest risk are relatively simple agriculture best management practices (BMPs), such as:

- Biological control methods
- Natural physical methods, such as picking of ticks
- Mechanical/manual control of pests

- Breeding of pest resistant livestock

Recommendations

The Federal Program Coordination Unit (FPCU – already established reporting to the State Minister of Livestock Development sector within the MoA and which will coordinate RPLRP implementation) will work closely with the MoA and other relevant national agencies such as the Ministry of Environment protection and Forest Development and NGOs to access and promote relevant country level authorization, support, or consent it may need to implement the program. Key components include:

- a) Ensure compliance with national and international regulations and guidelines on pesticide procurement and importation. In the event that national regulations are less stringent than WB regulations, then WB regulations will take precedence.
- b) Establish quality assurance for commodity procurement (application equipment, and Personal Protective Equipment (PPE)) to minimize risks to human health and the environment. This will include ensuring legitimate procurement sources and verifiable chain of custody for commodities, as well as inspection of packaging and labeling upon receipt.
- c) Provide adequate storage facilities compliant with FAO standards to minimize pilferage and contamination and ensure that the storage facilities are not poorly sited. Ensure strict controls and inventory of all pesticide stock purchased, with records kept of all related transactions (purchase, distribution, issue, use, return, and disposal).
- d) Train relevant categories of workers involved in the RPLRP related operations from partner implementing agencies (Ministries and departments) to private sector (e.g. program managers/coordinators, storekeepers, pesticide transporters, and supervisors) on best practices in accordance with recommendations and regulations from the WB and World Health Organization (WHO) as well as the conditions imposed by this IPMF. Criteria will be established for corrective action if recommended practices are not used in the field, including relieving from duty workers who intentionally or repeatedly violate regulations and/or fail to follow recommendations.
- e) Undertake Information, Education and Communication (IEC) activities for targeted communities to reduce adverse exposure related incidents.
- f) Enforce protection of pregnant and breast feeding women against exposure. Pregnant women and breast-feeding mothers will be excluded from any handling of pesticides (e.g. livestock spraying and dipping, PPE washing, store room operations).
- g) Ensure use of appropriate personal protective equipment and best practices, including effective supervision of operations, for adequate protection of operators and other handlers of pesticides.
- h) Establish strict practices to reduce environmental contamination. This will include comprehensive auditing of pesticide stocks and usage, and enforcing best practices related to the washing of clothing and equipment, such as progressive use of contaminated/wash water, and ultimate disposal of waste and leftover pesticides.

- i) Train health workers in the pesticide-specific treatment of poisoning, and provide the required medical supplies. This will include designation of County and sub County hospitals within the target areas for appropriate treatment of insecticide poisoning, guidelines on recognition of symptoms and required response, and pesticide-specific treatment of known or suspected exposures.
- j) Perform effective compliance inspections of related sub projects that use pesticides within the RPLRP in the field.

Reporting and Performance Review Requirements

The MoA through the FPCU will prepare project specific quarterly progress reports on pesticide use for all sub projects, including Integrated Pesticide Management Plans (IPMPs) for submission to the Bank specific for identified sub projects during the feasibility study phase of the project following detailed screening.

Environmental and Social Safeguards Technical Assistance to the RPLRP in regard to pesticide use and application will be provided by the FPCU's Social and Environmental specialists (to be recruited under the project) who will screen all sub-projects to determine if they trigger the need for IPMPs and prepare ToRs when such determinations are made. These reports will be submitted to the RPLRP and the World Bank's implementation support mission.

Capacity Building and Training

The GoE and the World Bank recognizes that safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in developing countries, including Ethiopia.

In this regard, training of pesticide users and applicators will be a vital component of capacity building in this program. The program will, using the resources available from the RPLRP prepare a comprehensive training manual on pesticide use and management, targeting different actors within the program, ranging from extension service providers, actual farmers, loaders, mixers, transporters, government staff among others.

The RPLSP sub projects especially those in component **1, 2, 3 and 4** should also run extensive training programs for farmers, extension workers, and stockists. These training programs should if possible be further amplified by training that is being undertaken by other institutions such as MoA and various Non-Governmental Organizations (NGOs), pesticide wholesalers, etc.

The RPLRP should adopt a strategy where extension services stress usage of a few basic pieces of protective clothing and then working into more complete coverage after the first few have been adopted. Communities will be encouraged to form professional spray teams that would be certified and hired to apply pesticides after training. These could be more efficiently trained to wear protective equipment.

The estimated cost of capacity building and other support to implement the IPMF is given an approximate budget of USD 350,000 and the breakdown is summarized as follows:

1. Training workshops/ seminars
2. Public awareness creation/ communication plans
3. Monitoring and evaluation exercises
4. Coordination

Project Implementation

Implementation of the project will rely on existing GoE structures and the implementation will be decentralized with Regional and Woreda Bureaus/Offices of Afar (BoPAD), Somali (LCRDB), Oromia (PC) and SNNPR (BoPA) assuming primary responsibility for execution of the program. Accordingly, overall responsibility for the project lies with the MoA. Federal implementing agencies will provide guidance and support to regions, spearhead most institutional capacity building activities and undertake monitoring, evaluation and communication activities. The project federal implementing institutions include various directorates of MoA, the National Veterinary Institute and the Central Statistics Agency. Thus RPLRP will be under taken and managed through a high level steering committee at the federal and regional levels for overall oversight and decision making on major issues; and, Pastoral Drought Resilience and Sustainable Livelihoods program (PDRSLP) coordination units at the federal and regional levels as well as dedicated focal persons at the zonal and Woreda levels for day to day management. Implementation will be decentralized with Regional Bureaus and Woreda Offices of Agriculture and Rural Development assuming primary responsibility for execution of the program. Accordingly, overall responsibility for the program lies with the MoA.

MoA has a well-diversified experience of working different projects. In early 2009, the EPA delegated safeguard review authority to 7 technical line ministries, and MoA was one of them. Hence, the overall responsibility of implementing the IPMF lies on the Ministry itself.

Thus at the federal level the FPCU through its safeguard specialist, is the responsible body for the implementation of safeguards instruments, including IPMF, while at regional and Woreda level the natural resource management core process and natural resource management coordinator respectively are responsible for the implementation of IPMF. Similarly the DAs are responsible for day to day activities at Kebele and sub Kebele level. In the regional as well as Woreda technical committee environmental protection land use and land administration authority/office is the major stakeholder and responsible institution in implementing the IPMF.

1. INTRODUCTION

GoE has requested the World Bank's support to prioritize, prepare, and finance development in Arid and semi-Arid Lands (ASALs) in the target areas and thus increase resilience. The proposed Regional Pastoral Livelihoods Resilience Project – which was agreed between the World Bank and GoE, responds to this request.

The proposed Project is expected to be financed with a **US\$75 million** credit and will be implemented over a period of five years.

1.1 Pesticide Use under RPLRP

Some of the RPLRP activities and components will utilize pesticides and trigger the Pest Management Policy (OP 4.09). To guide sustainable implementation of these activities, RPLRP has developed an IPM Framework because the specific sub projects are still evolving.

The RPLRP agriculture related sub projects for fodder production are likely to use fertilizers to increase productivity. At the same time, livestock health interventions (including quarantine systems, vaccines etc.) are likely to use pesticides and biological products (vaccines, acaricides) for control of pests normally associated with diseases to livestock. There will be no use of chemicals for controlling pests that attack fodder. Livestock diseases and their control methods (chemical and non-chemical control measures) are also highlighted in Annex 1.

1.2 Purpose of the IPMF

The World Bank's OP 4.09 indicate that when a project includes assistance via use of pesticides then an IPMF and IPMPs should be prepared and used in evaluating the economic, social and environmental risks and benefits of the planned pesticides to be used to determine whether the use may result in significant environmental and social impacts.

Livestock and livestock fodder are generally infested, attacked and damaged by pests and weeds to varying degrees, often causing economic loss. The damage from pests and weeds is potentially serious to fodder and livestock. If uncontrolled, or not controlled effectively, livestock and fodder loss can occur as a result of pest infestation, posing serious obstacles to the achievement of the objectives of the RPLRP. It is expected that pesticide usage would be embedded within IPMPs, which stress alternative practices to pesticides as well as safety and decision guidelines for their effective usage. Fodder production will however not use chemical pest control method other than application of fertilizers for boosting productivity.

This IPMF is expected to provide guidelines for safer pesticide use in livestock production under the RPLRP and judicious fertilizers application in fodder production. The term 'pest' in this document is generic, referring not just to insects. Likewise, 'pesticides' is a generic term.

1.3 Rationale for the IPMF

Specific sub projects that may include use of pesticides have not been clearly identified at this stage; hence need for an IPMF, which provides a general impact identification framework to assist RPLRP to institute measures to address adverse pesticide use, related environmental and social impacts. The specific information on countrywide sub project locations, project types and whether pesticides will be used, bio-physical features etc., when known at a later stage, will trigger the preparation of IPMPs for each sub project.

1.4 Approach for the preparation of IPMF

This IPMF has been prepared in accordance with applicable World Bank safeguard policies related to pest management, and which involved the following activities, among others:

- Literature/ Data Gathering and Review;
- Public consultations and discussions with relevant sector institutions;
- Data collation and analysis, consisting of literature reviews; Determination of potential impacts; Identification of impact mitigation measures; Preparation of a Pesticide Management Plan; and Preparation of sub-project guidelines;
- Review of comments from stakeholders.

1.5 Project Description

Project beneficiaries and targeting approach

The project target population is comprised of pastoral and agro-pastoral households who depend on livestock as dominant livelihood and agro-pastoral households with small herds and flocks and who, to some extent, depend upon cropping. Pastoral communities have rich customary laws used for many centuries for political and social administration of the rangelands and their people. Building on such laws, pastoral communities have developed traditional institutions and networks that have been serving their people in solving their various economic, social and political matters. The dominant social capital or customary institutions involve social support mechanisms, natural resources management systems, social security systems, and conflict resolution systems. The project intervention areas are characterized by water shortage, frequent drought, shortage of grass/fodder, outbreak of human disease (particularly, malaria), livestock disease and gender disparities in access to productive assets are the main sources of vulnerability. Besides, they are characterized by poor infrastructure developments, very limited social services (and therefore low education and literacy levels), susceptibility to natural hazards, poor resource endowments, increasing competition for scarce resources and limited livelihood opportunities.

Hence, the RPLRP is designed to improve access to community demand-driven social and economic services for the targeted communities.

Project Purpose

The aim of the project is to mitigate the impact of droughts at the Woredas, national and regional levels by introducing regional interventions in complement to existing national initiatives. It will build

capacities in the Government of Ethiopia and among pastoral and agro-pastoral communities from target Woredas in Afar, Oromiya, SNNPR and Somali regional states. It will increase resilience of pastoral communities to address medium- and long-term climate-related vulnerabilities, like droughts, resource conflicts, and food insecurity.

Project Areas

Pastoralists and agro-pastoralists of Ethiopia are estimated to be about 10 million which is 12% of 84 million people. They are herding their livestock in the arid and semi-arid lowlands that constitute about 63% of the country's land mass. These areas are prone to rainfall variability, extreme drought and flash floods. In order to avert such periodic disaster hazard, IGAD member countries and development partners have committed for a long-term investment that could bring long-lasting solutions and improve pastoralists' livelihoods in a regional context.

The overall goal of the regional Drought Resilience and Sustainable Livelihoods program (DRSLP) is to contribute to poverty reduction, food security and accelerated sustainable economic growth in the Greater Horn of Africa (HoA). The medium and long-term objective is to improve livelihoods and resilience of the pastoral production system in view of recurrent climatic crises.

Based on the aforementioned fact Ethiopia's Country Programming Paper (CPP) for the "Drought Resilience and Sustainability Initiative" have been prepared with the overarching objective to improve food and nutrition security and enhance resilience to external shocks with particular focus on the ASAL communities in Ethiopia. Following this under the frame work of the country program paper the African development bank is committed to invest a regional operation under ADF 12 to address drought in the countries of the Horn of Africa, of which Ethiopia is one. The first phase of the program will cover 15 Woredas in two regional states of Ethiopia, namely Afar and Somali.

The Government of Ethiopia currently working hard to get additional resources from World Bank and other development partners. This "Regional Pastoral Livelihood Resilience Project (RPLP)" document as the name implies prepared to enhance resilience to external shocks with particular focus on the ASAL communities in Ethiopia.

The detail location of 21 Woredas targeted by the project is: **Oromiya:** Dilo, Dire, Teltele, Moyale, Yabelo and Miyo; **SNNPR:** Dasenech, Niyangatom, Hammer and Surema; **Somali:** Jigjiga, Shilabo, Marsin, Gashamo, Moyale and Qubi; **Afar:** Afambo, Tiru, Yallo, Semurobi and Bidu.

Project Components

The Government of Ethiopia has received assistance from technical consortium and the development partners to finance the preparation of the proposed Regional Pastoral Livelihoods Resilience Project – RPLRP to be implemented in Ethiopia, Kenya and Uganda. In Ethiopia, the project preparation is under the overall responsibility of MoA. The overall Project Development Objective is *to enhance livelihood resilience of pastoral and agro-pastoral communities in cross-border drought prone areas of selected countries and to improve the capacity of the selected countries' governments to respond promptly and effectively to an eligible crisis or emergency.*

The project will have five components:

- 1) Natural Resource Management (NRM);
- 2) Market Access and Trade (MAT);

- 3) Livelihood Support (LS);
- 4) Pastoral Risk Management (PRM); and
- 5) Project Management and Institutional Support (PMIS).

6. **Component 1: Natural Resources Management (AF of US\$22.9 million).** This component aims at enhancing the secure access of pastoral and agro-pastoral communities to sustainably managed pastoral-related natural resources.

- Under sub-component 1.1 (*Water Resources Development*), the AF will support the design, construction, and/or rehabilitation of additional water resources access facilities within Ethiopia (61 ponds with capacity above 10,000m³, 4 community water micro-dams, 3 small sand dams, 16 boreholes, 90 wells) which will be strategically placed along trans-boundary livestock movement routes.
- Under sub-component 1.2 (*Sustainable Land Management in pastoral and agro-pastoral areas*), the AF will add about 8,000 ha in Ethiopia to the 3,420³ ha in Kenya and Uganda with rangeland rehabilitation and management improvement, including area closure, control of invasive plants, reseeded of degraded areas with forage grasses, dry land forest development, and physical and biological soil conservation (eye-row, bunds, micro-basin, check-dam, etc.). This sub-component will also support the establishment of nursery sites.
- Under sub-component 1.3 (*Securing Access to pastoral-related Natural Resources*), the AF will assist in disseminating strategies and approaches in conflict prevention, management and resolution, and support the development of policy and legal frameworks for secured access to natural resources. The Kebele Development Committees (KDC) will be the main interface on these aspects. Upstream training on Natural Resources Management in a conflict-sensitive approach will also be supported through Pastoral Field Schools (PFS).

7. **Component 2: Market Access and Trade (AF of US\$14.6 million).** This component aims at improving the market access of the agro-pastoralists and pastoralists to the intra-regional and international markets of livestock and livestock products.

- Under sub-component 2.1 (*Market Support Infrastructure and Information Systems*), the RPLRP in Ethiopia will add 20 primary markets, and support the installation of pilot holding/auction rings and the rehabilitation of quarantine systems and facilities. The AF will also strengthen 10 existing market centers along trade routes and build capacity in market management including establishment of Market Center Management Committee and livestock certification. According to a needs assessment, the AF may support the strengthening of the Livestock Marketing Information System (LMIS) under the Ministry of Trade.
- Under sub-component 2.2 (*Improving Livestock Mobility and Trade of Livestock and Livestock Products*), the AF will seek to improve and harmonize trade regulation and standards systems affecting livestock trade from the Ethiopian ASALs, strengthen quality control (animals and by-products), labeling and packaging in selected livestock-related cross-border value chains related to the Ethiopian ASALs, and scale up activities in livestock identification and traceability currently piloted by FAO and AGP-Livestock Market Development (LMD).

³ 2,480 ha in Kenya and 940 ha in Uganda.

8. Component 3: Livelihood Support (AF of US\$19.6 million). This component aims at enhancing the livelihoods of pastoralist and agro-pastoralist communities.

- Under sub-component 3.1 (*Livestock Production and Health*), RPLRP will strengthen national veterinary systems and laboratory networks, promote the production of vaccines for selected trans-boundary livestock diseases, purchase stock of vaccines against main TADs for vaccination campaigns in case of emergency, identify and help address gaps in private veterinary service provision and, where applicable, support Community Animal Health Worker (CAHW) networks through training, supply of equipment, and assistance to link them with the public and private veterinary service providers and drug suppliers as well as through a revolving fund.⁴
- Under sub-component 3.2 (*Food and Feed Production*), the RPLRP will promote increased food and feed production among agro-pastoralists in the Ethiopian ASALs through the introduction of drought tolerant food crop and fodder species in agro-pastoral areas and expansion of small scale irrigation.⁵
- Under sub-component 3.3 (*Livelihoods Diversification*), the RPLRP, will promote viable livelihoods for pastoral households and alternatives for the people moving out of pastoralism. It will encourage the emergence of cooperatives and pastoral common-interest groups around alternative livelihoods, providing financial support through a revolving fund⁶ to develop Income Generating Activities (IGAs) including along the value chains and cross-border trade.

9. Component 4: Pastoral Risk Management (AF of US\$3.7 million). This component aims at enhancing drought-related hazards preparedness, prevention and response at the national and regional levels.

Under sub-components 4.1, 4.2 and 4.3 RPLRP will enhance the capacity of Ethiopian actors, in addition to stakeholders in Kenya and Uganda, to respond to drought related risks faced by pastoralists in a timely and appropriate manner. Coordination with other initiatives related to Early Warning Systems and other projects' specific flexible funds for emergency responses to crisis will be done at the cross-pillars (DRM, Livestock and NRM) task force under RED&FS.

10. Component 5: Project Management and Institutional Support (AF of US\$8.7 million).

Under the sub-component 5.1 and 5.2, RPLRP will enhance the coordination and management capacity of relevant institutions to deliver the project in Ethiopia.

Project financing

The expected cost of the proposed AF for Ethiopia is US\$75 million equivalent, which will be financed through an IDA allocation over a five years period. This AF will add to the existing IDA funding of US\$122 million equivalent allocated for the activities in Kenya, Uganda and IGAD during the first phase. Regarding the budget contingencies, the budget for this AF builds on an 8 percent as base costs for

⁴ Revolving funds will be managed by available grassroots financial institutions such as MFIs or financial cooperatives for a fee through a contractual agreement. Modalities for the management of the revolving fund are elaborated in the PIM.

⁵ This will include research grants to selected research centers for adaptive research. Specific guidelines for management of such grants are elaborated in the PIM.

⁶ As in the case of revolving funds that avail credit to CAHWs, revolving funds for cooperative credit will be managed by available grassroots financial institutions such as MFIs or financial cooperatives for a fee through a contractual agreement. Modalities for the management of this revolving fund are elaborated in the PIM.

contingencies – 5 percent physical and 3 percent price. Table 1 provides a summary of the AF project costs by component.

Table 1: Additional Financing Cost and Financing

Component /Sub-component	Project cost (US\$ '000)		% IDA Financing
	Total Project Costs	TOTAL IDA Financing	
1. Natural Resources Management	22,903.3	22,903.3	100%
1.1 Water Resources Development	9,509.9	9,509.9	
1.2 Sustainable Land Management	11,184.2	11,184.2	
1.3 Access to Natural Resources	2,209.2	2,209.2	
2. Market Access and Trade	14,553.6	14,553.6	100%
2.1 Market Support Infrastructure and Information System	5,883.9	5,883.9	
2.2 Improving Livestock Mobility and Trade in livestock and livestock products	8,669.7	8,669.7	
3. Livelihood Support	19,623.6	19,623.6	100%
3.1 Livestock Production and Health	13,551.2	13,551.2	
3.2 Food and Feed Production	4,861.6	4,861.6	
3.3 Livelihoods Diversification	1,210.8	1,210.8	
4. Pastoral Risk Management	3,692.7	3,692.7	100%
4.1 Pastoral Risk Early Warning and Response System	3,255.0	3,255.0	
4.2 Drought Disaster Risk Management	437.7	437.7	
4.3 Contingency Emergency Response (ZERO budget)	0.0-	0.0-	
5. Project Management and Institutional Support	8,685.9	8,685.9	100%
5.1 Project Management, M&E, Learning, Knowledge Management & Communication	7,829.4	7,829.4	
5.2 Regional and National Institutions Support	856.5	856.5	
Total BASELINE COSTS	69,459.1	69,459.1	100%
Physical Contingencies (5%)	3,216.6	3,216.6	
Price Contingencies (3%)	2,325.0	2,325.0	
TOTAL PROJECT COST (Ethiopia)	75,000	75,000	100%

1.6 Project Coordination Unit (PCU)

The Federal Program Coordination Unit (FPCU – already established to coordinate the implementation of the national Drought Resilience and Sustainable Livelihood Initiative (DRSLI) and reporting to the State Minister of Livestock Development sector within the MoA) will also coordinate the implementation of the RPLRP. It will comprise of the National Coordinator, 4 project component heads (including an Environmental Safeguards Specialist), M&E officer, community development Specialist, procurement specialist and the project Financial Accountant. The FPCU will oversee the project implementation by backstopping and facilitating the project implementation teams at counties and sub-counties to access the project resources based on the approved activities.

1.7 Organization Structure of RPLRP

The project will be implemented through existing government structures by various institutions at different levels of government (Federal, Regional states, Zonal and Woreda). The MoA will be the lead executing agency with the overall responsibility for coordinating all aspects of the project including contributions by the different key ministries/ agencies under the five components of the project.

RPLRP's oversight will be performed at Federal, Regional states, Zonal and Woreda levels by, respectively, a Federal Steering Committee (FSC), Regional Steering Committees (RSCs), Zonal Steering Committees (ZSCs) and Woreda Steering Committees (WSCs). Across the different project levels, Steering Committees' key roles and functions will include: (i) review of project's progress towards the PDO, based on performance reports, (ii) validation of Annual Work Plans and Budgets (AWP&Bs) submitted by the respective Program coordination Units (PCUs), and (iii) provide oversight and strategic guidance. The MoA has established a FSC comprised of key officials from relevant line ministries, agencies and various stakeholders to oversee the implementation of the Drought Resilience and Sustainable Livelihood Initiative (DRSLI), to which RPLRP contributes: the Federal Drought Resilience Initiative Steering Committee (FDRISC) with the Federal Program Coordinator (FPC) as secretary. The FSC will ensure RPLRP's oversight. The FDRISC is chaired by the State Minister of Livestock Development Sector of the MoA. It includes the relevant Directorates of the Ministry, namely the Natural Resources Management Directorate, the Planning and Programming Directorate, the Women Affairs Directorate, the Emerging Regions Support Coordination Directorate, the Extension Directorate, the Animal Health Directorate, the Animal Husbandry and Feed Production Directorate, the Pastoral Livestock Development Directorate, the Rural Land Administration Directorate and the Disaster Risk Management and Food Security Directorate. Heads (or their representatives) of other line ministries, such as (i) the Ministries of Federal and Foreign Affairs, (ii) the Federal Cooperatives Agency (FCA), (iii) the Ministry of Finance and Economic Development (MoFED), (iv) the Ministry of Trade (MoT), (v) the Ministry of Water, Irrigation and Energy, and (vi) the Federal Road Authority are also be part of the FSC. Given RPLRP's support to adaptive research and cooperatives promotion, the Director General of the Ethiopian Institute of Agricultural Research (EIAR) and the Federal Micro and Small Enterprise Development Agency (FeMSEDA) will also be active members of the FSC. The FSC will include relevant regional institutions (Heads of Regional Bureaus of Pastoral Development/Agriculture in Afar, Oromiya, SNNP and Somali regions), representatives from IGAD, the World Bank and other key development partners (AfDB, IDC, KfW, GiZ, EU) whose projects are also aligned on the Ethiopia Country Programming Paper (CPP).

To coordinate activities under the national Pastoral Drought Resilience and Livelihood Program (PDRLP meant to implement the CPP) with the support of various projects, including the African Development Bank (AfDB)-funded Drought Resilience and Sustainable Livelihoods Project (DRSLP), the German and IDC initiatives, the MoA has established the Federal PDRLP Unit accountable to the State Minister of the Livestock Development Sector. The implementation of the RPLRP will also be coordinated by this Unit. The PDRLP National Coordinator will serve as RPLR project coordinator. To fill gaps, the project will recruit one DRM specialist, one rangelands management specialist, one safeguards specialist, one FMS and an accountant, one Procurement Specialist and one Livestock Specialist.

Regional Coordination Units have also been established in Afar and Somali Regions already (within the Bureau of Pastoral and Agricultural Development (BoPAD) and Bureau of Livestock, Crop and Rural Development (BoLCRD) respectively) and will be used by RPLRP. In addition, Regional PCUs and Woreda PCUs will be created in Regions (Oromiya and SNNPR) and Woreda where such structures haven't been

created at the moment of inception of the RPLRP. As needed, same staff (excepted safeguards specialists) will be recruited in each of the Regional PCUs. These units will be supporting all pastoral resilience-related projects of the DRSLP and will be responsible for: coordination, annual planning, follow-up and reporting on project activities, fiduciary management and reporting, liaison with federal stakeholder groups, project communication, overall knowledge management, M&E and learning, strategic staff capacity-building and mobilization. At the regional level, the bodies involved in the implementation and oversight are: the BoPAD in Afar region; the BoLCRD in Somali region; the Bureau of Pastoral Affairs (BoPA) in Southern Nations, Nationalities and Peoples region; and Pastoral Commission (PC) in Oromiya region.

At the zonal level, 8 mobile support teams (MST) will be established and staffed with one coordinator, one procurement specialist, one infrastructure specialist and one administrative assistant. At the local level, the Steering Committee (SC), chaired by the Woreda Administrator, will oversee the project at the Woreda in Ethiopia. The participating Woreda Offices of Agriculture in the four regions will have the primary responsibility for the execution of the program.

At Woredas level, the project will recruit one project leader, one accountant and one administrative secretary.

Technical advisory committees will be established at Federal, Regional, Zonal⁷ and Woreda levels. Across the different project levels, the Technical Committees' role will include: (i) reviewing, providing recommendations and advise on improving the AWP&Bs submitted by the respective PCUs, (ii) providing technical advisory services on implementation modalities, (iii) providing institutional capacity building to PCUs and to relevant implementation entities and, (iv) ensuring coordinated implementation between the various "resilience projects" in pastoral areas, and (v) reviewing and analyzing all documents prepared under the project's responsibilities providing recommendations and advising on improvement.

1.8 Project Institutional and Implementation Arrangements

It is the responsibility of the FPCU to prepare IPMPs during the feasibility study and to submit to the World Bank to be implemented with the sub-project and during its operation. These documents are reviewed by the World Bank and EPA and must receive a no-objection from the World Bank and approval of EPA before the sub-project can be implemented.

1.9 Requirements for Public Disclosure

This IPMF will be disclosed in line with the World Bank requirements through posting on the MoA website and on the World Bank's external website. The final version will be publicly disclosed through the Bank's Infoshop.

2. METHODOLOGY AND CONSULTATION

2.1 Detailed & In-depth Literature Review

Review on the existing baseline information and literature material was undertaken and helped in gaining a further and deeper understanding of the proposed project. A desk review of the Ethiopian

⁷ Only in the SNNP and Oromia Regions.

legal framework and policies related to pesticide use was also conducted in order to the relevant legislations and policy documents that should be considered during project implementation. Among the documents that were reviewed in order to familiarize and further understand the project included:

World Bank Related Documents

- World Bank Project documentation for RPLRP
- Aide Memoire for the RPLRP
- World Bank RPLRP Draft Project Appraisal Document (PAD)
- World Bank Safeguards Policy OP 4.09
- World Bank IPMF documents for other agricultural projects

National Laws and Regulations

- Federal Democratic Republic of Ethiopia, 1994
- Environmental policy, 1997
- Biodiversity policy, 1998
- Pesticide Registration and Control Proclamation No 674/2010 from Aug 25, 2010
- The Environmental Impact Assessment Proclamation (Proc. No. 299/2002)
- Environmental Pollution Control Proclamation No. 300/2002
- Environmental Impact Assessment Proclamation No. 299/2002
- Environmental Protection organs Establishment proclamation No.295/2002
- Ethiopian Water Resources Management Proclamation, No. 197/2000
- Environmental Impact Assessment Guideline, May, 2000
- Environmental and Social Management Plan Preparation Guideline, Nov. 2004

International Conventions

- Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Done at Aarhus, Denmark, On 25 June 1998
- Cartagena Protocol on Bio-Safety to the Convention on Biological Diversity
- Convention on Biological Diversity, Rio, 5 June, 1992
- Kyoto Protocol to the United Nations Framework Convention on Climate Change
- United Nations Convention to Combat Desertification
- UN Framework Convention on Climate Change
- Convention for the Protection of the World Cultural and Natural Heritage Paris, 23 November 1972

2.2 Interactive Discussions

Stakeholder consultation formed part of the methodology in preparing this IPMF where a list of the entire project interested and affected stakeholders was prepared and stakeholder engagement was undertaken through a workshop. The stakeholder consultation was significant to the preparation of this IPMF and formed the basis for the determination of potential project impacts and design of viable mitigation measures.

2.3 Preparation of IPMF

Preparation of the IPMF included the following stages:

- Collation of baseline data on agriculture, livestock and pesticide use in Ethiopia in general;
- Identification of positive and negative economic and environmental and social impacts of pesticide use under RPLRP;
- Identification of environmental and social mitigation measures.

3. INTEGRATED PEST MANAGEMENT

3.1 History of IPM

In the early years of the last century, different crop and livestock protection practices were integral parts of any cropping system. However, with increased world human population, the demand for more food was eminent. This also coincided with increased pest problem and advent of pesticides. From the 1940's to the 1970's, a spectacular increase in yield was obtained with the aid of an intensive development of technology, including the development of a variety of agro-pesticides. In many countries this advancement was coupled with the development of education of farmers and efficient extension services. However, in many developing countries, pesticides were used without adequate support systems. Agro-pesticides were often used injudiciously. Misuse and over-use was stimulated by heavy subsidies on agro-chemicals. Livestock and crop protection measures were often reduced to easy-to-use pesticide application recipes, aimed at immediate elimination of the causal organism. In places where the use of improved varieties was propagated, packages of high-yielding varieties with high inputs of agro-pesticides and fertilizers made farmers dependent on high external inputs. Since then, it has been realized that this conventional approach has the following drawbacks:

- a) Human toxicity; poisoning and residue problems
- b) Destruction of natural enemies and other non-target organisms
- c) Development of resistance in target organisms
- d) Environmental pollution and degradation
- e) Pesticides are expensive and good management of their use requires skills and knowledge

Because of the drawbacks of reliance on pesticides, livestock and crop protection approach is needed that is focusing on local farmer needs that are sustainable, appropriate, environmentally safe and economic to use. Such approach is called Integrated Pest Management (IPM).

There are many different definitions that have been fronted over the years to describe IPM. In 1967, FAO defined IPM as ***“a pest management system that in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible manner as possible, and maintains the pest population at levels below those causing economic injury”***.

The requirement for adoption of IPM in farming systems is even emphasized in the WB OP 4.09, which supports safe, effective, and environmentally sound pest management aspects, such as the use of biological and environmental friendly control methods.

The following are key preconditions for an IPM approach, which will be adopted by all the sub projects within RPLRP that will be screened and found to require pesticide use:

- a) Understanding of the ecological relationships within a farming system (livestock, crop, plant, pests organisms and factors influencing their development)
- b) Understanding of economic factors within a production system (infestation: loss) Understanding of socio-cultural decision-making behavior of the farmers (traditional preferences, risk behavior)
- c) Involvement of the farmers in the analysis of the pest problems and their management
- d) Successive creation of a legislative and agricultural policy framework conducive to a sustainable IPM strategy (plant quarantine legislation, pesticides legislation, pesticide registration, price policy)

This IPMF for RPLRP has been developed following and applying the key elements of IPM program namely:

1. Ensuring that sub projects under RPLRP use available, suitable, and compatible methods which includes resistant varieties, cultural methods, biological control, safe pesticides etc. to maintain pests below levels that cause economic damage and loss
2. Ensuring that sub projects under RPLRP conserve the ecosystem to enhance and support natural enemies and pollinators
3. Ensuring that sub projects under RPLRP integrate the pest management strategies in the farming system
4. Ensuring that sub projects under RPLRP conduct analysis based on pests and crop loss assessments

3.2 IPMF in RPLRP Sub Project Investments

This Integrated Pest Management Framework (IPMF) addresses the RPLRP's need to promote ecosystem approach in pest management where sub projects will entail the use of pesticides.

The RPLRP sub projects that are likely to use pesticides are specifically those that will include livestock health management. They include prevention or treatment of livestock from diseases and pests common in the project areas.

Fodder production for livestock will not use pesticides for control of diseases and pests.

Therefore, this IPMF will ensure that sub projects yet to be identified apply the elements of IPM as described above and the preconditions for the same in order to minimize the adverse impacts associated with pesticide use in the agriculture and livestock sector. It is for this reason, that every sub project that is screened and found that pesticides use is certain, an Integrated Pest Management Plan (IPMP) will be developed as a mandatory requirement.

This approach will benefit the RPLRP sub projects in terms of enhancing good human and environmental health, and improving economic wellbeing of the farmer. Finally the IPMF has been designed with focus on the general principles of IPM and every sub project that will have components of pesticide use will be required through enforcement, monitoring and review to follow these principles namely; -

1. Adequate methods and tools must be used to monitor harmful organisms adequate where available. Such adequate tools should include observations in the field as well as scientifically sound warning, forecasting and early diagnosis systems, where feasible, as well as the use of advice from professionally qualified advisors.
2. Based on the results of the monitoring, the users have to decide whether and when to apply protection measures. Robust and scientifically sound threshold values are essential components for decision-making. For harmful organisms, threshold levels defined for the region, specific areas, livestock and particular climatic conditions must be taken into account before treatment, where feasible.
3. Sustainable biological, physical and other non-chemical methods must be preferred to chemical methods if they provide satisfactory pest control.
4. The pesticides applied shall be as specific as possible for the target and shall have the least side effects on human health, non-target organisms and the environment.
5. The professional user should keep the use of pesticides and other forms of intervention to levels that are necessary, e.g. by reduced doses, reduced application frequency or partial applications, considering that the level of risk in vegetation is acceptable and they do not increase the risk for development of resistance in populations of harmful organisms.

4. POLICY AND REGULATORY FRAMEWORK FOR IMPLEMENTING THE IPMF

The impacts of pesticides on human health and the ecosystem have triggered concerns both at national and international levels. Cognizant of the hazardous associated with pesticide production, imports, storage and application, Ethiopia has made some efforts to formulate policies and legislations that help to avoid and/or reduce the negative impacts of pesticides on humans and the ecosystem. These policies and legislations are briefly reviewed below.

4.1 National policy on pesticides

As yet there is no specific policy instrument that deals with the production, storage and distribution and use of pesticides in Ethiopia. However, there is a general provision in the Environmental Policy of Ethiopia that highlight on the need for precaution measures with regard to hazardous chemicals, in which pesticides are also included. The most relevant provisions with regard to pesticides in the Environmental Policy Ethiopia are:

- a. To provide adequate regulation of agriculture (crop and livestock) chemicals and micro-organisms;

- b. To formulate and implement a country-wide strategy and guidelines on the management of wastes from the medical, agriculture and other sectors that may use potentially hazardous biological organisms, their fragments or chemicals, and to issue the necessary regulations to enforce them;
- c. To establish a system for monitoring compliance with land, air and water pollution control standards and regulations, the handling and storage of hazardous and dangerous materials, mining operations, public and industrial hygiene, waste disposal, and water quality;
- d. To maintain an up-to-date register of toxic, hazardous and radioactive substances, and to make the information available on request;
- e. To create by law an effective system of control, distribution, utilization and disposal after use of expiry of chemicals, biological organisms or fragments of organisms that could be hazardous but are required for use;
- f. To hold as legally liable an employer who deploys employees in using or handling hazardous materials without adequately training them on how to deal with the hazard and without adequate equipment to protect each one of them from physical harm or disease that is caused by working conditions whether the harm or disease starts in the place of work or away from it; and
- g. To foster better understanding of the dangerous effects of chemicals and organisms and their fragments through the provision of information in a form understandable to users, and provide or enforce the provision of information on the appropriate methods and technologies for the treatment and disposal of wastes.

4.2 Laws and legislation on pesticides

Ethiopia has issued a Special Decree on pesticide registration and control (Special Decree no. 20/1990) in order to lay a scheme of control which would make it possible to minimize, to extent realizable, the adverse effect that utilization of pesticides might cause to humans, animals, plants and the environment. This Special Decree requires not only for pesticide registration and control but also promotes safer pesticide handling and use. As per the Special Decree, pesticide importers should obtain, from the Ministry of Agricultural and Rural Development, a license upon fulfillment of certain requirements including trained personnel, proper storage facilities, and safety devices. The Regional Agricultural and Rural Development Bureaus issue licenses to pesticide dealers and distributors with delegated authority from the Ministry.

The Special Decree also requires that pesticide may not be allowed to enter the country unless it is packed and labeled as per the requirement. Furthermore, pesticide samples are taken and analyzed to confirm that the products meet the required quality standard.

4.3 International Pest Management Requirements

International conventions

Ethiopia is party to four international conventions, which directly or indirectly deal with pesticides production and use. These include:

- i. Persistent Organic Pollutants of Stockholm Convention, which tries to completely eliminate organochlorine and other equally dangerous organohalogen chemicals from the earth.
- ii. Bamako Convention, which prohibits the importation of hazardous wastes into, and their movement in, Africa.
- iii. Basel Convention, which strictly regulates the movement of hazardous waste globally. Recently, it has incorporated the prohibition of the importation of hazardous wastes into developing countries from the Bamako Convention.

- iv. The first Prior Informed Consent or Rotterdam Convention, which tries to ensure that anybody buying a chemical has complete and accurate information about the nature and impacts of that chemical before he/she decides and notifies his/her consent in writing to the exporter.

World Bank Operational Policy on Pest Management, OP 4.09

The Bank uses various means to assess pest management in the country and support integrated pest management (IPM) and the safe use of agricultural pesticides, economic and sector work, sectoral or project-specific environmental assessments, participatory IPM assessments, and adjustment or investment projects and components aimed specifically at supporting the adoption and use of IPM. In the Bank-financed agriculture operations, it advocates pest populations reduction through IPM approaches such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest.

4.4 National Capacity to Develop and Implement IPM/ICM (IPPM)

The Ethiopian Government is committed to increasing food production and improving food security. Amongst the different governmental organizations for the execution of the food security objectives, the Ministry of Agriculture is one that has lines share. There are four technical Departments namely, the Agricultural Extension, Input Marketing, Investment and Animal and Plant Health & Quality Control.

The Department of Agricultural Extension is responsible for the delivery of extension advice through the regional offices to farmers. The Department ensures the inclusion of IPM component within the crop production packages for major crop in the country. The packages promote particular crop varieties and levels of fertilizers and agro-chemical use as well as the timing of various crop husbandry activities.

Plant Health and Quality Control department is responsible for pesticide and the control of migratory pests and the policy framework for crop protection and production. The Plant Health Clinics located at different regions are involved in identification of pests/disease material and offering assistance or advice to field staffs at the respective regions. The Department has a major role in policy formulation and regulation:

Accordingly:

In 1990 a proclamation was issued with respect to the registration of pesticides in Ethiopia (pesticide Registration and Control Special Decree No. 20) (GOE, 1990). To prevent the entry of new pests into a new eco-system a Quarantine Decree was issued in September 1997 and a Plant Quarantine Registration was issued in October 1992 (GOE, 1971).

There has been an effort made by the Government to place a crop protection policy and strategy through the involvement of different government organizations. Concurrently, it was believed that IPM should be well addressed in the envisaged policy. Currently, the Department is working on IPM framework rather than formulating, an independent policy on IPM as it is included in the newly developed Agricultural Development Policy.

4.5 Classification of Pesticides

The WHO bases its toxicity ratings on the lowest published rat oral LD50, the lethal dose (in milligrams of substance per kilogram of body weight) that kills 50% of the test animals in a standard assay (WHO, 2010). WHO gives a hazard ranking of Ia (Extremely Hazardous) to the most hazardous pesticide active ingredients. While the WHO ratings generally reflect acute toxicity, they also take into account other toxic effects such as reproductive and developmental toxicity. WHO does not evaluate the fumigants, a class of gaseous pesticides that are generally extremely hazardous, nor does it evaluate pesticides believed obsolete or discontinued (WHO, 2010).

WHO Toxicity Classification		Rat LD50 (mg of chemical per kg of body weight)			
Class	Description	Solids (oral)	Liquids (oral)	Solids (dermal)	Liquids (dermal)
Ia	Extremely hazardous	< 5	< 20	< 10	< 40
Ib	Highly hazardous	5-50	20-200	10-100	40-400
II	Moderately hazardous	50-500	200-2,000	100-1,000	400-4,000
III	Slightly hazardous	> 500	>2,000	>1000	> 4,000
Table 5	Unlikely to present acute hazard in normal use	> 2,000	> 3,000	---	---
Table 6	Not classified: believed obsolete				
Table 7	Fumigants not classified by WHO				

The procurement of any pesticide in a Bank-financed project is contingent on an assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users. With respect to the classification of pesticides and their specific formulations, the Bank refers to the World Health Organization's Recommended Classification of pesticides by Hazard and Guidelines to Classification (Geneva: WHO 1994-95). The following criteria apply to the selection and use of pesticides in Bank-financed projects:

- They must have negligible adverse human health effects.
- They must be shown to be effective against the target species.
- They must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies. Pesticides used in public health programs must be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as for personnel applying them.
- Their use must take into account the need to prevent the development of resistance in pests.

5. KEY LIVESTOCK DISEASES AND PESTS & CONTROL MEASURES IN TARGET DISTRICTS

5.1 Common Livestock Pests & Control Measures

The RPLRP will support livestock production and increase their resilience to extreme climate in the selected Districts. The livestock include; -goats, cattle, sheep and camels. The table 4 and 5 below shows the common livestock diseases and vectors/pests.

Table 4: Vector-borne Parasitic Diseases of Livestock in the Target Counties

Vectors	Disease/Condition
Ticks	East Coast Fever (ECF)
<i>Rhipicephalus appendiculatus</i>	ECF
<i>Boophilus decoloratus</i>	Anaplasmosis (Gall sickness), Babesiosis (red water)
<i>Rhipicephalus evertsi</i>	Babesiosis (red water)
<i>Amblyomma variegatum</i>	Heart water (Bush sickness)
TseTse Fly	
<i>Glossina pallidipes</i>	Trypanosomosis (Nagana)
Mange	
<i>Chorioptes bovis</i>	Pruritis
<i>Sarcoptes</i>	Pruritis
Biting flies	
<i>Stomoxys calcitrans</i> (stable Fly)	Anthrax

Table 5: Endo-parasitic Diseases

Endoparasites	
Helminths	<i>Helminthiasis</i>
Nematodes: <i>Haemonchus, Ostertagia, Trichostrongylus (chaerbertia, oesophagostomum), Nematodirus, Bunostomum (hookworm), Toxocara vitulorum, cooperia, Dictyocaulus</i>	<i>Anaemia Unthriftiness</i>
Trematodes: <i>Fasciola hepatica, Fasciola gigantica</i>	<i>Anaemia Unthriftiness</i>
Cestodes: <i>moeniezia genus, cysticercus, Echinococcus granulosus</i>	<i>Anaemia Hydatidosis</i>
Coccidia	<i>Coccidiosis</i>

Trypanosomosis

Control of tsetse flies and Trypanosomosis Insecticides

The chemicals used to control tsetse flies and drugs used to treat and control trypanosomosis are shown in Table 6 and 7. The combined strategy used is effective because Tsetse flies and trypanosomes are both destroyed and thus reduce infection in animals. A practical control strategy would include:

- Use of insecticides impregnated odor-baited traps and targets and spraying.
- Spraying and dipping animals and applications of pour-ons.
- Partner with PATTEC (Pan-African Tsetse and Trypanosomiasis Eradication Campaign) programme in order to reduce tsetse fly and trypanosomosis.

- Involve local communities in the long-term tsetse and trypanosomosis control.
- Use chemotherapy agents to cure and control trypanosomosis in animals. The drugs should be used carefully at the recommended dosage rates in order to reduce drug resistance and maintain their anti-trypanocidal activity.
- Clear bushes on the farm regularly.

Anthrax

The disease is caused by *Bacillus anthracis*, which attacks all domestic animals and many wild animals. Anthrax is characterized by fever, swollen throat and sudden deaths in cattle, and by acute death in goats and sheep.

Control of anthrax

Anthrax is a notifiable disease and is controlled by the following methods;

- i) Rapid diagnosis by examination of smears.
- ii) Disposal of carcass by efficient and safe means such as burning or burial.
- iii) Supervision of carcass until it is disposed of, with efficient methods of sterilization or using disinfectants on blood or discharges.
- iv) Annual vaccination and control of movement of unvaccinated animals.
- v) Milk from infected animals should not be consumed.

Black Quarter

Black-quarter (black-leg) is caused by *Clostridium chauvoei* and is an acute infectious disease of cattle and sheep. The disease is common in young cattle between 2-3 years because they are most susceptible. It is characterized by fever, depression, painful edematous swelling on the neck, chest, hip, acute lameness and death in 24 hours.

Control of Black-quarter

- Vaccinate cattle and sheep in high-risk areas with a bacterin containing *C. chauvoei*.
- Vaccinate calves between 2-6 months old.
- Treat susceptible cattle with penicillin.

Foot and Mouth Disease (FMD)

The disease is caused by the following 7 types of picornaviridae virus, European types O, A and C, South African territories types. SAT 1, 2 and 3 and Asia type 1. Foot and mouth disease commonly affects cattle and sheep but goats and wild ruminants are susceptible. The severity of FMD depends on the strains of virus involved and immune status of the animal. The disease is characterized by fever, vesicles in the mouth and feet, salivation; drop in milk production and abortion in severe cases.

Control of FMD

The following control measures are used to control Foot and Mouth Disease.

- Put administrative measures in place quickly and impose quarantine in order to restrict movement of animals and their products.

- Enforce policies for the disease control in order to prevent spread of the diseases in the country and in the region.
- Rapid diagnosis and surveillance for the emergence of disease by new strains of virus which are not covered by the vaccine used.
- Use properly prepared and stored vaccines.
- Vaccinate animals regularly in order to establish immunity in the control of foot and mouth disease quadri-valent vaccine containing, types A, O SAT, 1 and 2 is used to protect animals for up to 6 months.

Rift Valley Fever (RVF)

RVF is caused by Phlebovirus and epidemics often occur after 5 years. Mosquitoes spread the disease especially during wet season. The disease is characterized by fever, anorexia, salivation, nasal discharge, diarrhoea, drop in milk production and abortion.

Control of RFV

- The disease is controlled by annual vaccination of animals using inactivated vaccine and dipping or spraying animals in order to reduce risk of mosquitoes.

The strategies for control of vectors and drugs used in the treatment of vector borne diseases are summarized in Table 7, 8 and 9. The most effective strategy of controlling vector borne diseases (VBD) in ruminants is to use a strategy of controlling vectors and early treatment of vectors borne diseases.

Strategies For Disease Control

The chemicals used currently to control vectors include; amitraz, pyrethroids, organophosphates and carbamates (Table 8). Amitraz and pyrethroids are the most widely used chemicals to control ticks and tsetse flies in the country since they are effective and they also control other ectoparasites in ruminants. The chemicals should be used following the recommended dose and frequency of application in order to avoid development of resistance.

The acaricides kill ticks in the predilection sites and breaks the life cycle of ticks. The common methods used for the application of the chemicals are given in Table 9 and include, dipping, hand spraying and hand dressing.

The problems associated with use of ectoparasiticides include high costs, environmental pollution, residues in animal products and gradual development of resistance. The main advantage of the chemicals is that they are highly effective against ectoparasites and thus reduce mortalities associated with VBDs. The study conducted indicated that majority (60 %) of dairy producers spray animals.

The drugs commonly used in the programme area for the treatment and control of VBDs are given in Table 5. The drugs are effective and are given by intramuscular or subcutaneous routes to animals. However, most of these drugs have a narrow therapeutic index and animals should be given the recommended dose in order to avoid side effects.

Table 6. Control of Vector Borne Diseases in Cattle

1. Tick Species	Parasite/ Causative Agent	Disease Transmitted	Control
<i>Rhipicephalus Appendiculatus</i> (Brown ear tick)	1. <i>Theileria parva</i> 2. <i>Anaplasma Marginale</i>	1. ECF 2. Anaplasmosis	Dipping, Spraying, Pour-on
<i>Rhipicephalus avertis</i> (Red-legged tick)	1. <i>Theileria parva</i> 2. <i>Babesia bigemina</i>	1. ECF 2. Babesiosis	Dipping, Spraying, Pour-on
<i>Boophilus decoloratus</i> s (Blue tick)	1. <i>Babesia bigemina</i> 2. <i>Anaplasma marginale</i>	1. Babesiosis 2. Anaplasmosis	Dipping, Spraying, Pour-on
<i>Amblyomma spp.</i> (Bont tick)	<i>Rickettsia ruminantium</i>	Heart water	Dipping, Spraying, Pour-on
<i>Hyalomma spp.</i> (Brown legged tick)	Tick toxin	Sweating sickness	Dipping, Spraying, Pour-on
2. <i>Glossina pallidipes</i>	<i>Trypanosoma vivax</i> <i>T. congolense</i>	Trypanosomosis	Dipping, Spraying, Pour-on Chemotherapy, Control animal movement into risky areas.
3. Mange	<i>Choriptes bovis</i> <i>Sarcoptes</i>	Itching Anaemia	Ecto-parasiticides
4. Lice	<i>Linognathus stenopsis</i>	Anaemia	Ecto-parasiticides
5. Fleas	<i>Bovicola bovis</i>	Anaemia Irritation	Ecto-parasiticides
6. Biting flies	<i>Stomaxys</i>	Irritation, Transmits anthrax	Ecto-parasiticides

Table 7. Groups of Acaricides Used to Control Vector Borne Diseases in Cattle

Vector	Acaricides	Method of Application
Ticks	Amitraz Pyrethroids Organophosphates Carbamates	Spray Dip Pour-on Dusting
Tse tse fly	Pyrethroids Organophosphates	Spray Dip
Mange	Organophosphate (Coumaphos) Ivermectin	Spay Topical application
Fleas/Lice	Carbamates, Organophosphates Pyrethroids	Spray Dip Dust
Biting flies	Organophosphates, Pyrethroids	Spray, dip, and dust

Table 8. Drugs Used to Treat/Control Vector Borne Diseases in Cattle

Tick Borne Diseases		
Drug	Disease	Main action
Buparvoquone	ECF	Curative
Imidocarp Oxytetracycline	Anaplasmosis	Curative
Imidocarp	Babesiosis	Curative
Tetracycline	Heartwater	Curative
Trypanosomosis in Cattle		
Drug	Disease	Main action
Diminacene Aceturate (Berenil)	T. Vivax T. congolense	Curative
Homidium Bromide (Ethidium bromide)	T. vivax T. congolense T. brucei	Curative
Isometamidium (samorin)	T. vivax T. Congolense	Curative and prophylactic
Endo-parasites of Ruminants		
Drug	Disease	Main action
Anthelmintic group; Benzimidazole	Roundworms	Broad
Substituted phenols; Oxyclosanide	Flukes	Narrow
Niclosamide	Tapeworms	Narrow
Coccidiostats; Sulphonamides	Coccidia	Curative

Table 9. Strategies for Disease Control in RPLRP Sub Projects

Vector	Diseases	Control strategy
Ticks	ECF	<ul style="list-style-type: none"> ▪ Dip/spray animals using recommended acaricides. ▪ Apply pour-ons
	Anaplasmosis	<ul style="list-style-type: none"> ▪ Use recommended acaricides at the dose rates and frequency.
	Babesiosis	<ul style="list-style-type: none"> ▪ Check dip strength regularly
	Heart water	<ul style="list-style-type: none"> ▪ Ensure proper management and maintenance of dips. ▪ Early treatment of sick animals.

Tsetse flies	Trypanasomosis	<ul style="list-style-type: none"> ▪ Dip/spray animals using recommended insecticides ▪ Apply pour-ons ▪ Train farmers on tsetse control ▪ Avoid grazing animals in highly infested tsetse areas ▪ Clear bushes in the farms Use drugs to treat sick animals
Mange	Pruritis	<ul style="list-style-type: none"> ▪ Dip spray animals with insecticides ▪ Use ivermectin
Endo-parasites	Helminthiasis	<ul style="list-style-type: none"> ▪ Use effective drugs ▪ Deworm animals before rainy season ▪ Deworm ruminant animals every 3 months. ▪ Deworm cats and dogs every 2 months ▪ Enforce meat inspection regulations and advice people to cook meat well in order to control tape worms ▪ Drain swamps in order to control Fasciola species
	Coccidiosis	<ul style="list-style-type: none"> ▪ Feed animals with clean water and feed. ▪ Isolate affected animals ▪ Use sulphonamides or Amprolium to treat animals.
Feed borne diseases	Mycotoxicosis	<ul style="list-style-type: none"> ▪ Train farmers on good feed preparation & preservation practices. ▪ Farmers should buy feed from reputable manufacturers. ▪ Remove contaminated feed from animal compounds. ▪ Advice farmers not to feed animals with contaminated feeds. ▪ Surveillance of mycotoxins in feeds.
Plant poisoning		<ul style="list-style-type: none"> ▪ Identify poisonous plants (eg) cestrum. ▪ Uproot plants and cultivate the farm.
Breeding diseases	Brucellosis	<ul style="list-style-type: none"> ▪ Use artificial insemination service
	Trichomoniasis	<ul style="list-style-type: none"> ▪ Examine bulls before using them for breeding.
	Vibriosis	<ul style="list-style-type: none"> ▪ Surveillance of diseases ▪ Vaccinate heifers less than 8 months old ▪ Advice people to boil milk before consumption ▪ Government should subsidize AI services in order to reduce high cost of AI.
	Tuberculosis	<ul style="list-style-type: none"> ▪ Slaughter animals with chronic tuberculosis
	Infertility	<ul style="list-style-type: none"> ▪ Surveillance of diseases in the area ▪ Government should subsidize AI to levels affordable by farmers

Other Diseases	Milk fever	<ul style="list-style-type: none"> ▪ Advice farmers to use milk from reputable manufacturers. ▪ Give dairy animals salt lick with calcium and phosphorous
Bacterial diseases	Mastitis	<ul style="list-style-type: none"> ▪ Advice farmers to wash udder and use milking salve ▪ Use dry cow mastitis tubes when stopping milking pregnant cows. ▪ Early diagnosis and treatment of cows with mastitis. ▪ Frequent milking of affected udder. ▪ Cull cows with recurrent mastitis.
Bacterial diseases	Anthrax	<ul style="list-style-type: none"> ▪ Rapid diagnosis and treatment. ▪ Report suspected cases of anthrax. ▪ Annual vaccination of animals. ▪ Efficient disposal of carcasses by burning or burying.
	Black quarter	<ul style="list-style-type: none"> ▪ Vaccinate animals in high-risk areas. ▪ Treat animals early with penicillin.
Viral diseases	LSD	<ul style="list-style-type: none"> ▪ Disease surveillance

5.2 Common Fodder Pests and Common Control Measures

About 25-35% loss in agricultural produce is caused by pests and diseases, which can be controlled by use of pesticides. These pesticides kill or deter the destructive activity of the target organism and they possess inherent toxicities that endanger the health of the farmers, consumers and the environment. The RPLRP sub projects involving rangeland rehabilitation and fodder production under irrigation will not involve use of pesticides instead manual and mechanical control of weeds will be employed. Use of chemicals to control pest in fodder production is discouraged due to the adverse impacts it has on the livestock.

5.3 Common Fodder Weeds and Control Measures

In conventional agriculture all the plants germinating in the field, which are not specifically planted by the farmer, are often called weeds. This definition of weeds have led to "weeds" being rigorously weeded out or killed by herbicides as an integral part of what is currently known as conventional farming.

Another definition is that a weed is a plant, the use of which has not yet been discovered. This definition fits in better with the natural law of biodiversity, nature striving to create balances in vegetation/soil and fauna (creatures living off plants). Farmers in Ethiopia are at times observed to be leaving edible weeds in the fields when weeding, not enough to threaten the main crop but just enough to have early

maturing vegetables to eat until the main crop is ready. Notorious (troublesome) weeds are generally divided into two major categories:

- Annual weeds (e.g. purple witch weed/Striga)
- Perennial weeds (e.g. couch grass and sedges)

Annual Weeds

These are all the weeds germinating from seed along with every crop and going through a full lifecycle from germination to flowering to setting and dropping seeds in one season. All healthy top soils have myriads of different types of weed seed, and every time the soil is disturbed a new lot germinates, in order for the ground to keep itself covered. If weeds grow unchecked, the crop we are trying to cultivate will not do well as there is too much competition.

Perennial Weeds

These are weeds with a root system that survives the dry seasons and stay alive for two or more seasons. If not controlled, perennials can completely crowd out crops in some cases by sending a dense network of underground roots and stolons in all directions. They are very difficult to control as the roots go deep and a very small piece of root or stem can regrow after weeding and create new networks. Perennials such as couch grass and sedges have a function though: they help the soil restore aeration and natural life in the patch of ground where they grow. They also protect the soil from soil erosion, being carried away by water or wind and the grasses provide fodder for livestock. If these perennial weeds cover unproductive corners of the farm or steep hillsides they are not harmful, so far they do not invade the crop area. Management practices depend on which type is predominant in the field.

Annual Weeds Control

Many methods have been devised to combat annual weeds at an early stage to get optimum yield of food crops:

1. Digging or pulling the weeds and removing them from the field (in small gardens). The weeds can be composted.
2. Shallow cultivation at an early stage and leaving the weeds to dry on top of the soil either by hand or by animal or tractor mounted equipment. Tools include row cultivators, small grain seed spring harrows and hard brushes for row treatment.
3. Slashing weeds at ground level when 10 to 15 cm tall and definitely before flowering, then leaving them on the ground as mulch, reduces the weeding work substantially. It is much lighter work to slash than to dig with a hoe and intervals between slashing can be longer than between traditional weeding/digging.
4. Planting of ground cover plants especially legumes to crowd out further "weed" germination. This not only provides ground cover but also enriches the soil, and will eliminate further weeding operations. The legumes will often continue growing after the main crop is harvested, providing soil protection until the next crop is planted. They can also become useful for feeding livestock or for incorporating into the soil as green manure.

5. Burning. Mechanized farming can choose between a variety of equipment for weed control by burning, both back pack types and tractor mounted equipment. This method will not improve soil fertility, but instead burn off badly needed humus in the top layer of the soil.

Control of perennial weeds

- Solarization. Covering weed infested land with black polythene after wetting it, and leaving for some days with hot sunshine, will completely eliminate any of the sedge species. However plastic is expensive, so if it cannot be afforded try the first option: ground cover with legumes.
- Mulching. Weeds have been successfully controlled with heavy mulching.
- Hand digging. Very careful hand digging with a knife ensuring all the little underground bulbs are removed can give a small reduction in oxalis populations (annual or perennial), but is very time consuming and bound to leave a few bulbs here and there which will waste no time in germinating.

5.4 Storage of Pesticides

Safety and Storage of Pesticides: The DA and Woreda Crop Production and Protection Expert will develop and implement arrangements for the safe use, handling and storage of pesticides, and the proper use, maintenance and storage of pesticide spraying equipment. Storage should follow the instructions provided. Pesticides should be kept separately, away from humans and animals in a closed, dry and secure place. Any surplus or unwanted pesticides should be reported to the DA for disposal.

Pesticide Storage on the Farm

The best practice guidelines on pesticide storage on the farm recommend that all farmers:

- Ensure the pesticide store is properly secured, i.e. locked and out of reach of unauthorized people, children and animals.
- Keep food and feed stuffs well away from pesticides.
- The store should be well-sited to minimize deterioration due to climatic conditions.
- The pesticide stocks should be properly managed - correctly placed, properly marked, upright, placed on intact shelves or pallets, appropriate height.
- Proper stock controls: orderly stock arrangement, segregation of different pesticide types, "first-in, first-out" stock control, controlled receiving and issuing of stocks.
- Regular store and stock inspections: checking if pesticide is still fit for use.
- No re-packing on the farm should be done except in emergency, because of the dangers associated with unsuitable packing material and inadequate labeling.
- Have personal protective equipment (PPE) available for handling pesticides during storage. Ensure timely maintenance and cleaning of the PPE.
- Have emergency procedures for fires: avoid smoking; safe electrical systems; danger warning signs; fire-fighting equipment - water, sand, fire extinguishers; equipment must have easy access; protective clothing; regular equipment checks.
- Have emergency procedures for spills and leaks: sawdust-lime mix, sand, broom, spade, buckets or strong plastic bags.
- Have emergency procedures and facilities for personnel contamination: protective clothing, showers.

Most individual farmers in Ethiopia do not procure large quantities of pesticides that would warrant storage over a long time. The trend by many farmers especially small-scale farmers is to procure only the quantities they expect to use for that planting season.

Transportation of Pesticides

Where farmers have to collect pesticides from distributors such as retailers, the following guidelines should be followed:

1. Seal small containers in plastic bags: as an added precaution, any small containers should be sealed inside a strong plastic bag.
2. Do not carry pesticides inside the passenger compartment: pesticides should be placed on the back of the truck or boot of a car, in an outsize container, or in a trailer.
3. Inform drivers: drivers collecting pesticides must understand the danger of pesticides, what the containers hold and what to do in the case of an emergency.
4. Care in loading and unloading: special care must be taken during loading and unloading to prevent container damage and spills. PPE must be used during loading and unloading process.
5. Do not push containers off the back of the vehicle. Load in a controlled way - forklift truck, hoist or suitable ramp, such as planks and old tyres to stop containers at the ground.
6. Vehicles transporting pesticides should carry spill equipment including, Lime-sawdust mix, sand, broom, spade, buckets

Determination of Risks to Farmers and General Public

Poor storage and transport of pesticides is a potential risk to farmers and the general population. There have been several cases where pesticide stores burnt down as a result of poor management. These accidents caused severe environmental contamination. On-farm storage practices for pesticides are very often not safe.

Risks associated with the transportation and storage of pesticides should be addressed will be addressed in the sub project specific Integrated Pest Management Plans. Auditing of storage facilities will be required as part of project preparation if procurement of large volumes is envisaged.

6. METHODOLOGIES FOR IPM PLANNING, DESIGN & IMPLEMENTATION

This chapter describes the typical methodologies that should be used by the RPLRP when preparing sub project Integrated Pest Management Plans (IPMPs) for sub projects specifically when screening determines that pesticides will be utilized in the specific sub project. The RPLRP will use pesticides as part of ensuring improved livestock health. The likelihood and potential for application of pesticides in the RPLRP sub projects triggers the OP 4.09 which requires the preparation of an IPMF and consequently sub project specific IPMPs.

6.1 Designing an IPMP

Integrated Pest Management is a sustainable approach to managing pests by combining cultural, physical/mechanical, biological, and chemical tools in a way that keep pests below their economic injury levels and minimizes economic, health and environmental risks. Fundamentally, IPM aims to maximize

the use of biological control; other control measures especially chemicals play a supportive rather than a disruptive role.

Every sub project under the RPLRP that triggers OP 4.09 will require the preparation of an IPMP and the sections below outlines the proposed approach in developing IPMPs. The RPLRP will recruit consultants with expertise in livestock science and pest management to prepare these IPMPs.

Setting up an IPM Program

Planning is at the core of any IPM program. Every livestock has pests that need to be considered. Waiting until problems arise will end up increasing reliance on pesticides more and more. A good Integrated Pest Management program has four parts and all the IPMPs that will be prepared under RPLRP will have to follow these parts:

- a) Identifying problems;
- b) Selecting tactics;
- c) Considering economic and environmental factors; and
- d) Evaluating the program.

Proper Identification of Problems

The correct IPM approach promotes “proactive” rather than “reactive” management. Correct identification is the first and most important step in controlling a problem. This first step is critical to future success, since an incorrect diagnosis leads to mismanagement.

Scouting is, in fact, the key feature of any IPM program. By scouting, the ability to detect potential problems early is increased. The earlier a problem is discovered, the better your chances are of avoiding economic losses. Farmers implementing RPLRP using pesticides will be trained on scouting techniques to identify pests early to promote the proactive approach in pest management as described above.

To scout effectively farmers will be encouraged and trained to:

- Identify the cause of the problem to know what kind of pest you are dealing with.
- Contact agricultural extension officers if they encounter something that they cannot identify.
- Determine the stage of growth of the pest and livestock. This is essential for proper timing of control methods.
- Decide whether the infestation is increasing or decreasing.
- Assess the condition of the livestock.
- Map out problem areas. It may be possible to limit the area that needs treatment.
- Use the right scouting method for the specific pest.

Select Tactics

- Once the problem has been identified, considerations on how to control it will have to be made. The goal in selecting control tactics is to use methods that are effective, practical, economical, and environmentally sound. To select the best control tactics, there will be need to:
 - Understand the life cycle and habits of the pest. Some control methods will work only if they are used at the right time.

- Decide whether the infestation is serious in terms of economic loss.
- Compare the costs and benefits of various control methods.
- Make plans for the future. Not every part of an IPM program can be put into effect immediately.

Sampling to determine the extent of the problem

Once the pest is correctly identified, the next question which that will need to be answered will be; Is there a risk of significant loss? Is the problem occasionally seen? Localized? Or commonly found throughout? What is the extent of the damage? Is the problem a growing threat?

Correct sampling will help to eliminate the guesswork in pest control by providing a means to quantify an old problem or discover a new one. Sampling knowledge and information on pest and crop biology should be used to make better management decisions.

Analysis to assess problem importance

This step in the pest management process entails analyzing the identification and sampling information and evaluating the need for a pest control action to make a determination on how bad the problem really is. There is need to assess whether the potential control measure are more costly than the damage potential? There is need to weigh economic, environmental, and times concerns and assess the impact of the current pest control decision on future management decisions?

Selection of appropriate management alternative

The action plan needed must entail a strategy that fits with the short- and long-term plans, labor force, capital, equipment, and finances of the farm. Therefore an evaluation of the costs, benefits, and risks of employing various management options is needed. Opportunities to integrate different pest control strategies must be considered.

Choosing controls

There is no such thing as a completely safe and natural pesticide. Pesticides can vary greatly in their level of toxicity to non-target organisms such as people, pets or beneficial insects. Even organically approved pesticides can pose a danger to people and the environment if they are not used properly.

Pesticides are grouped into various types or categories. For example, there are fungicides, insecticides, herbicides (for weeds), nematicides (for nematodes) and miticides (for mites). While many pesticides control specific problems, there are still some broad-spectrum controls. In addition, there are many products that are only effective if they are used at a specific growth stage of the pest, so timing is critical.

It is never wise to use blanket applications of pesticides on large areas or to use them based on a calendar alone. The improper use of pesticides can pose a risk to the applicator, family, plants, beneficial organisms and the environment. There are times when pesticides are needed to prevent major losses. The judicious and proper use of pesticides can occur with a sound IPM program.

The following are examples of management tactics, which can be employed;

- Biological - Parasites, predators, pest
- Chemical - Pesticides, pheromones, baits, attractants
- Physical

Consider Economic Factors

Know When It Pays to Use a Pesticide

Despite efforts to avoid using chemicals, there are times when only pesticides can control the damage. Even so, it may not pay to use them. Pesticides should be used in an IPM program only when the benefits (yield, quality, aesthetic value) exceed the costs of control. Otherwise time and money are wasted. It's not easy to figure out when it pays to use pesticides. There are many variables: the pest population, variety, and growth stage, weather, and cost of the control.

Evaluate IPM Program

Evaluation means deciding how effective a program is and whether any changes are needed. All sub projects that will prepare IPMPs will have to evaluate the IPM program, and should:

- Monitor fields and keep records. Each time field visits are made, a note of livestock and pest conditions—record yields and quality and record any counts on pest populations.
- Record control measures. Records should include dates, weather conditions, pest levels, application rates and timing, and costs. Good records are a guide if the same problem occurs.
- Compare effectiveness. Whatever control tactics are chosen, use a different method on some strips. That way comparison can be made; which worked better, taking into account costs and environmental impacts.

6.2 Implementation of IPMPs

Identify Implementation Team

As with any successful initiative, the transition to an IPM program requires a diverse, action-oriented team. This team could be part of an existing 'green team' or developed as a subcommittee under the District Environmental Committee, since implementation of a new IPM program can be tracked as a performance indicator.

The leader of this team should be familiar with pests, pesticides and pesticide regulations, leadership and have the time and authority to supervise IPM implementation. Other team members could include environmentalists, agronomists, crop protection experts (entomologists, pathologists) animal production experts, animal health experts, veterinarians, maintenance staff, public health experts, food services, industrial hygiene, environmental services, safety and infection control.

Monitoring IPM Success

Every IPMP should have mechanisms in place to monitor the success or otherwise of the plan. Every sub project investment that utilizes pesticides will require as part of its IPMP an evaluation and monitoring plan and a system in place to measure the program's achievements.

Efficacy: Since IPM is better at controlling pests, a measurable reduction in pest sightings should be observed.

Cost: The IPMP should evaluate the cost reductions over time as a result of the IPM gains.

Safety: IPM's ability to create a safer environment is predicated in large part on reducing pesticide use. The goal should be a downward trend over time or ideally, a specific reduction amount, with the end result a reduction to only very occasional usage of highly toxic pest control chemicals.

Develop Worker Training Plans and Policies

The farmers who will benefit from the RPLRP sub project investment that will use pesticides need to be provided with training, which is a fundamental part of any IPMP. Training includes among others routine, proactive surveillance, reporting pest sightings, which will quicken response times and help limit the scope of new infestations.

7. POTENTIAL ECONOMIC, ENVIRONMENTAL AND SOCIAL IMPACTS OF PEST MANAGEMENT ACTIVITIES

This chapter analyses the potential positive (beneficial) and negative (adverse) socio-economic and environmental consequences of pesticide use under the sub projects envisioned within the RPLRP.

7.1 Chemical Control Method Including Fertilizers

Broadly defined, a pesticide is any agent used to kill or control any pest. Pests can be insects, rodents or birds, unwanted plants (weeds), fungi, or microorganisms such as bacteria and viruses. Though often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides, micro biocides, rodenticides and various other substances used to control pests.

Pesticides are by their nature poisons, and their use entails a degree of risk to humans, birds, fish, bees, and other living things, as well as to the environment. To deal with and minimize these risks within bank funded projects, the bank has developed instituted OP 4.09 that require an examination of the proposed use of pesticides and the alternatives that are available, and the establishment of a framework to govern the choice of specific pesticides, as well as the manner in which they will be used.

Impact on Environment

All campaigns against invasive species of pests and disease tend to occur over large areas, thereby affecting a significant amount of territory and people. The use of pesticides in an effort to control pests, both introduced and indigenous, can lead to serious health effects. High levels of these chemicals become harmful to man and aquatic community as the chemicals are eventually washed as run offs to the water bodies. The use of pesticides becomes injurious particularly for example as evidenced by the spray drift if the spraying is not well done it affects non-target plants or animals. **Table 10** and **11** below shows the list of agrochemicals that are banned or restricted in the country.

Table 10. List of Banned Pesticides

	Common name	Use
1.	2,4,5 T (2,4,5 – Trichloro-phenoxybutyric acid)	Herbicide
2.	Chlordane	Insecticide
3.	Chlordimeform	Insecticide
4.	DDT (Dichlorodiphenyl Trichloroethane)	Agriculture
5.	Dibromochloropropane	Soil Fumigant
6.	Endrin	Insecticide
7.	Ethylene dibromide	Soil Fumigant
8.	Heptachlor	Insecticide
9.	Toxaphene (Camphechlor)	Insecticide
10.	5 Isomers of Hexachlorocyclo-hexane (HCH)	Fungicide
11.	Ethyl Parathion	Insecticide ; All formulations banned except for capsule suspensions
12.	Methyl Parathion	Insecticide ; All formulations banned except for capsule suspensions
13.	Captafol	Fungicide
14.	Aldrin	Insecticide
15.	Benomyl, Carbofuran, Thiram combinations	Dustable powder formulations containing a combination of Benomyl above 7%, Carbofuran above 10% and Thiram above 15%
16.	Binapacryl	Miticide/Fumigant
17.	Chlorobenzilate	Miticide
18.	Dieldrin	Insecticide
19.	Dinoseb and Dinoseb salts	Herbicide
20.	DNOC and its salts (such as Ammonium Salt, Potassium salt & Sodium Salt)	Insecticide, Fungicide, Herbicide
21.	Ethylene Dichloride	Fumigant
22.	Ethylene Oxide	Fumigant
23.	Fluoroacetamide	Rodenticide
24.	Hexachlorobenzene (HCB)	Fungicide
25.	Mercury Compounds	Fungicides, seed treatment
26.	Pentachlorophenol	Herbicide
	Phosphamidon	Insecticide, Soluble liquid formulations of the substance that exceed 1000g active ingredient/L
27.	Monocrotophos	Insecticide/Acaricide
28.	All Tributyltin Compounds	All compounds including tributyltin oxide, tributyltin benzoate, tributyltin fluoride, tributyltin lineoleate, tributyltin methacrylate, tributyltin naphthenate, tributyltin chloride
29.	Alachlor	Herbicide.
30.	Aldicarb	Nematicide/Insecticide/Acaricide.
	Endosulfan	Insecticide.
31.	Lindane	Insecticide.

Table 11. List of Restricted Pesticides

Common name	Remarks
Benomyl, Carbofuran/Thiram combinations	Dustable powder formulations containing a combination of Benomyl below 7%, Carbofuran below 10% and Thiram below 15%.
DDT (Dichlorodiphenyl trichloroethane)	Insecticide, restricted use to Public Health only for mosquito control for indoor residual spray by Ministry of Health. Banned for agricultural use.
Ethyl Parathion	Insecticide, capsule suspension formulations allowed in 1998.
Methyl parathion	Insecticide, capsule suspension formulations allowed in 1998.
Phosphamidon	Insecticide, Soluble liquid formulations of the substance that is below 1000g active ingredient/L.

Contamination of surface water courses and underground water

Spills in water bodies (surface) are a key concern in pesticide procurement, transport, and application because it could not only lead to contamination of water routinely used for domestic purposes but because of the toxicity to fish and other aquatic organisms.

Thus the primary concern for the RPLRP would be the possible release of the pesticides into the existing water bodies from accidental spills during the transportation of the pesticides, application of pesticides to seeds and crops, clean-up of PPE and used pesticide equipment (mixers), or the disposal of pesticide wastes (sachets, containers, packaging materials etc.). Contamination of underground water resources is also possible during the disposal of containers through leaching, burying, and accidental spills.

Contamination of surface water

Pesticide application in irrigation agriculture is a risk to surface water sources which are numerous in Ethiopia and contamination of surface water sources is a threat to human health through the contamination of water that the general public depends on for domestic and industrial use. Surface water contamination is also a risk to the aquatic life forms (flora and fauna), all which inhabit water bodies in Ethiopia, specifically in the target project areas.

The main pathways for surface contamination include dipping of livestock that could lead to unnecessary use, environmental contamination, impact on non-target organisms, and human exposure through the spray drift effect.

Impact on Health and Safety

It is understood that pesticide use can be dangerous to farmers, nearby exposed populations and the affected environment. It is estimated that there are almost 5 million cases of pesticide poisoning in developing countries each year. World Health Organization (WHO) has estimated that there are 3 million severe human pesticide poisonings in the world each year, with approximately 220,000 deaths. While developed countries use about 80 percent of the world's pesticides, they have less than half of this number of deaths. It is not known how many of these poisonings should be attributed to control measures against plant pests. The use of pesticides, fungicides and herbicides may lead to water pollution, given that water is used for drinking and other domestic purposes.

Concerns remain about worker exposure, residues on food and harm to domestic and non-target wild animals. Fish and invertebrates are frequently vulnerable, especially aquatic arthropods.

Since pest outbreaks are erratic and difficult to predict, there is a danger that more pesticides than needed may be ordered leading to stockpiles.

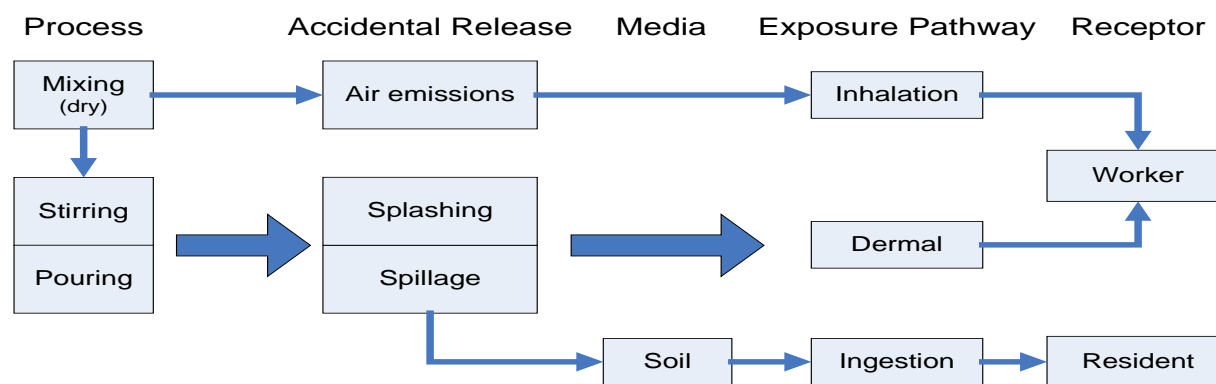
The pesticide stockpiles pose a very important problem that requires urgent attention, especially for stocks near urban areas where there is a risk of the pesticides contaminating drinking-water, food or the air.

Throughout the pesticide application process, all applicators, including loaders, mixers, applicators, and transporters are at risk of un-intentional or deliberate exposure through accidents or poor and improper handling of the spray chemical. Worker exposure to the chemical could arise prior to and/or during the actual pesticide application phase of operations.

Pre Application Exposure Pathway

Preparing pesticide solutions will involve in some cases pouring and mixing the pesticide in cans or other equipment to ensure ample mix with the water or other soluble matters. The process of mixing the pesticide can lead to exposures via inhalation, dermal contact, and incidental ingestion, mostly from releases of pesticide vapors, and solutions. Vapor releases can occur when liquid concentrated emulsions are diluted. Workers can inhale the vapors or the particulates or be exposed through dermal contact. Spills could also pose significant risk, especially for children who ingest the resulting residues that are left on surfaces such as floors. **Figure 5** below shows the possible modes of exposure during preparation of pesticides.

Figure 5. Conceptual Model for Possible Exposure Pathways from Preparation of Pesticide



Application Exposure Pathway

Inhalation of aerosol vapors during spraying is the main process for worker exposure during pesticide application. Farmers or pesticide handlers are mainly exposed through dermal contact with sprayed surfaces and incidental ingestion of pesticides. Leaky equipment can also lead to pesticide exposure through dermal contact and incidental ingestion by children who may come in contact with the spills before they are cleaned up.

Exposure During Disposal

Disposal is a key issue in any intervention that utilizes pesticides, especially during the decontamination process and disposal of the liquid effluent that will arise from washing and progressive rinse. Both burying and dumping can lead to dermal exposure to residents who come in contact with the soil or water in which the pesticide was disposed. Ingestion exposure can occur from drinking contaminated surface water. Once the excess formulation gets into the soil, the pesticide can reach the groundwater, which may be used as a water supply via household wells. Residents may then be exposed to this contaminated water by ingestion or by dermal contact when it is used for cleaning or drinking purposes.

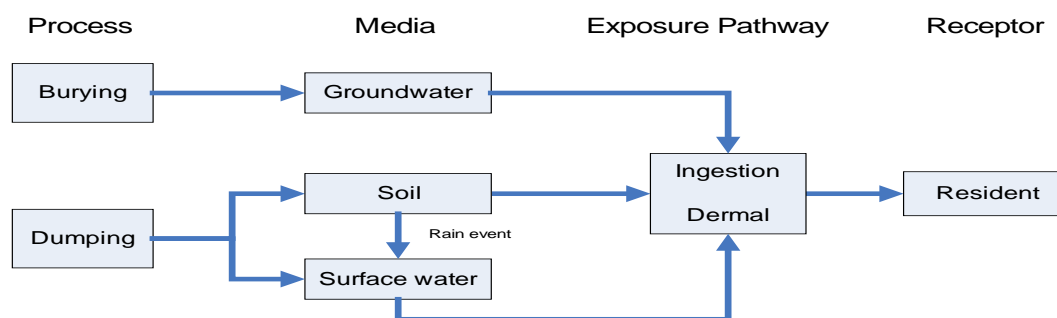


Figure 6. Conceptual Model for Possible Exposure Pathways from Disposal of Pesticide Formulations

Impacts on Non-Target Organisms

This section examines the potential effect of the pesticide on organisms other than the target pest (for example, the effect on bee colonies kept in the area). Non-target species of concern also include birds and fish. The potential for negative impact on non-target species should be assessed and appropriate steps should be identified to mitigate adverse impacts.

Pesticides are by their nature bio-poisons and whereas they are beneficial against pests (targets) their use may inadvertently harm other organisms (non-targets) leading to significant biodiversity losses. Loss of biodiversity makes ecosystems more vulnerable to changes in the environment, with lower genetic diversity and fewer species to support fundamental ecosystem functions such as pollination. All but the biologically based pesticides being recommended are broad spectrum in effect, thus will have negative impacts on beneficial arthropods in the case of insect and mite pests. Insecticides can also kill herbivorous arthropods feeding on weeds. Bees pollinate a number of crops that are not only sensitive when flying but also can carry contaminated pollen and nectar to the hive potentially killing off the whole colony.

The hazard to non-target organisms is dependent upon a pesticide's acute and chronic toxicity, and is also a function of the rate at which the pesticide breaks down (half-life) under various scenarios (aqueous or in-soil, UV exposure, etc.) in the environment. In addition, many pesticides break down to toxic daughter products that have their own half-life. Impacts to fish and other aquatic animals may be reduced through prevention of contamination to waterways and bodies. Care must be exercised with

raw material, formulated product, wash waters, and used containers or other wastes. Properly located, constructed and maintained soak pits should be utilized for washing down PPE and application equipment in order to avoid runoff to water bodies. Choice of toxicity class III and IV pesticides will pose less danger than class I and II, which are not being recommended.

The potential RPLRP program pesticides' toxicity details are discussed below and indicate known toxicity to fish and bees. Impacts to fish and other aquatic animals may be reduced through prevention of contamination to ponds, waterways, and drains with raw material, formulated product, wash waters, or used containers.

Summary of Toxicity of pesticides to Avifauna, Aquatic life, mammals and insects by Class:

Pyrethroids

- All pyrethroids are highly toxic to bees and highly toxic to fish and other aquatic organisms, except deltamethrin, which has low toxicity to other aquatic organisms.
- Birds are least affected by bifenthrin (low to medium toxicity). All other pyrethroids have very low toxicity to birds.
- Pyrethroids are highly toxic to mammals. bifenthrin, has low to medium toxicity.
- In terms of persistency in the environment, only bifenthrin is persistent. The rest of the pyrethroids have low to medium persistency.
- Bifenthrin does not accumulate in the environment. There is potential for bioaccumulation in aquatic organisms for other pyrethroids.

Carbamates

- Carbamates are highly toxic to bees.
- In addition to other aquatic organisms they are also highly toxic to mammals and birds. Acute symptoms of propoxur poisoning in birds include eye tearing, salivation, muscle in coordination, diarrhoea, and trembling. Depending on the type of bird, poisoning signs can appear within 5 minutes of exposure, with deaths occurring between 5 and 45 minutes, or overnight. On the other hand, this insecticide has very low toxic properties on fish.
- In general, carbamates have low to medium indications for persistency in the environment and bioaccumulation in organisms

Organophosphates

- Organophosphates have different characteristics and impacts on different organisms depending on the type of insecticide.
- Fenitrothion has low toxicity on mammals and fish and is not persistent in the environment. However it is highly toxic to bees, birds and other aquatic organisms, like crustaceans and aquatic insects and has a medium toxicity to aquatic worms. It has moderate to medium potential to bioaccumulate in organisms.
- Malathion is only highly toxic to bees. It has very low impacts on fish and other aquatic organism and has very low potential to persist in the environment or bio-accumulate in organisms. It shows low to medium toxicity on mammals and birds.
- Pirimiphos-methyl is highly toxic to fish and other aquatic organisms and has a high potential to persist in the environment. It has low to medium toxic effects on mammals and bees. It does not bio-accumulate in organisms.

Impacts to Birds, Fishes, and other organisms from pesticides:

Table 12 below illustrates the degree of toxicity of selected pesticide classes to birdlife, aquatic life and bees, and includes the degree of persistence in the environment and potential for bioaccumulation.

Table 12. Pesticide Toxicity

Pesticide	Mammal	Bird	Fish	Other Aquatic	Bee	Persistence	Bioaccumulate ¹
Pyrethroids	High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	Medium to High Toxicity	High Toxicity
Carbamates	Medium to High Toxicity	Medium to High Toxicity	Medium to High Toxicity	Medium to High Toxicity	High Toxicity	Medium to High Toxicity	Medium to High Toxicity
Organophosphates	Low to Medium Toxicity	Medium to High Toxicity	Low Toxicity	Low Toxicity	High Toxicity	Low Toxicity	Low Toxicity

Source: IVM PEA

¹ Bioaccumulation in the environment, not in mammalian bodies (mammalian detoxification produces different results).

² Low toxicity, but high chronic or bioaccumulation effect on raptors, pelicans.

Key

High Toxicity	High Toxicity
Medium to High Toxicity	Medium to High Toxicity
Medium Toxicity	Medium Toxicity
Low to Medium Toxicity	Low to Medium Toxicity
Low Toxicity	Low Toxicity
Data Not Found	

7.2 Use of Biological method

The biological control of pests and diseases entail the use of insects, bacteria or fungi on the host to eliminate the pest or disease.

Impact on Environment

This is one of the known environmentally friendly control methods as compared to other control methods. Unlike other methods biological control is applied carefully and selectively and since no chemicals are used it has no adverse effect on the environment. In comparison to other methods it is cost effective since its application may entail community participation and can be integrated in other control methods.

The only criticism is that the control agents are slow in action and take a longer period to generate results and therefore cannot be used in emergency situations. The danger comes in when the host is

eliminated if the pest is not host specific then they may attack other plants (crops) or insects and therefore create an imbalance in the ecosystem.

Impact on Health and Safety

Since no chemicals are used there are no dangers and thus the method is generally/fairly safe.

7.3 Use of Mechanical Method

This method involves the use of automated machines and may also be expensive depending what machines are used.

Impact on Environment

This may be friendly or unfriendly to the environment depending on the operation carried out and the disposal technique of the weeds or the wastes.

Impact on Health and safety

The wise operation of the machines and the supporting labour becomes important in the safety and handling.

7.4 Use of Manual method

The manual control basically consists of the use of labour with simple implements/tools. The major concern is often the high cost involved.

Impact on Environment

It is friendly to the environment as there is no pollution of land, water or air when the method is applied.

Impact on Health and Safety

Since no chemicals are used there are no dangers and thus the method is generally/fairly safe.

7.5 Use of Quarantine

Quarantine refers to a period when an animal or person that has or may have a disease is kept away from others in order to prevent the disease from spreading.

Impact on Environment

This method is fairly safe to the environment as it allows for the control and management of pests and diseases through isolation.

Impact on Health and safety

Quarantines ensure safe passage of livestock by reducing contamination or spread of diseases.

8. MITIGATION MEASURES AGAINST ADVERSE IMPACTS

This section outlines the various measures proposed to mitigate against any of the potential adverse impacts likely to occur as outlined above. The primary mitigation measures include training in safe and judicious pesticide use and management; include provision of Personal Protective Equipment (PPE) and training to spray personnel, and thorough and consistent supervision and monitoring. Also important

are the identification of appropriate pesticide storage facilities and training and equipping health facilities with adequate exposure treatment drugs.

8.1 Management of Pesticides

Improper storage, handling, transportation, treatment and disposal of pesticides can be a risk to human health and the environment through leakage of toxins into groundwater, soil, and the atmosphere. Populations may potentially be affected when pesticides are ingested through contaminated water sources and polluted air, and when poor labour practices put workers in direct contact with pesticides. This means, the project will observe a number of measures to ensure proper handling and application of agro-chemicals.

Routine pesticide store management procedures

- The storekeeper should put on essential protective clothing (overalls and boots) upon arrival at the pesticide store.
- There should be a quick daily inspection of drums and containers to ensure that there have been no overnight spills or leaks.
- Spilled and leaked pesticide must be cleaned up immediately;
- Drums and containers should be thoroughly inspected monthly for leaking seals, split seams and corrosion.
- Leaking or old drums should be removed and their contents transferred to empty containers. Appropriate protective clothing should be worn and precautions taken. Replacement containers should be sealed and relabeled.
- Transfer of chemicals to new containers should be recorded on the stock record sheet.
- Dates on labels of containers in the store should be checked monthly and outdated stock separated for disposal. Any labels in poor condition should be replaced.

Arrival of a consignment of agro-chemicals at the store:

- The back of the transport vehicle should be checked for spills and the containers for leaks or broken seals; the vehicle should be decontaminated of any spills. Chemicals from containers with leaks or split seams should be transferred to empty containers in good condition and relabeled.
- Pesticide containers should be carefully unloaded from the delivery vehicle. The delivery note should be examined and check-list of chemicals arriving at the store should be prepared on a stock record sheet.
- Containers of chemicals placed in the store should be set on floor dunnage and stacked using wooden pallets as necessary.
- The location of chemical containers in the store should be recorded on the stock record list.

Taking agro-chemicals from the store for pest control purposes

- The condition of the transport vehicle should be checked before placing containers of agro-chemicals in it. It should also be ensured that no foodstuffs are to be carried on the same vehicle.
- The removal of agro-chemicals from the store should be recorded on the stock record sheet.
- The stock first deposited in the store should be the first to be taken out.
- Pesticide containers should be carefully loaded on to the dispatch vehicle and the driver provided with a delivery note.

Rules for proper pesticide storage and stock management

- Pesticide stores should not be located near water bodies.
- The storage capacity (total storage surface) should be sufficient to store the total stock of agro-chemicals at any time.

Each store should have at least the following:

- Sufficient ventilation openings to avoid unnecessarily high temperatures;
- Floors be made of, or covered by, impermeable concrete or impervious cement (as a temporary measure, floors may be covered with a large and thick polyethylene sheet);
- Ramps at entrances to contain any major leakage within the store;
- Doors that are lockable and bars across ventilation holes and windows to prevent unauthorized entry.
- The floors of the stores should have a layout of separate blocks with aisles between them. Ideally, the outline of the blocks should be painted on the floor. Each block should contain only one product. There should be sufficient space between blocks to move containers freely, enable the inspection of containers and treat leakages. Drums should be stacked in such a way that each can be inspected from the aisles between the blocks. Drums and bags should be stored on pallets. The number of containers stacked on top of each other should not exceed the stacking recommendations for the type of container concerned. Over stacking may lead to rupture of lower containers down and reduces access to containers.
- Pesticide stores should only contain pesticides. All other goods or objects should not be mixed in the agro-chemical stores.
- Expired and obsolete agro-chemicals should be separated from in use or non-expired stocks.

Each store should have the following for dealing with emergencies:

- A few bags of sawdust and/or sand to absorb leaked or spilled pesticides;
- A number of empty containers (preferably salvage drums that can contain a whole 200-litre drum) and empty bags to repack heavily damaged or leaking containers;
- Spade and brush;
- Fire extinguisher;
- First Aid box.
- Protective gear for staff to enable them to deal with emergencies (nitrile rubber or neoprene gloves, rubber boots, overalls, goggles, vapour masks or half-face respirators with organic vapour cartridges)
- Water supply from a tap, or a container of water, to wash hands and face if these become contaminated; and
- Eyewash set.
- The contents of leaking or heavily damaged agrochemical containers should be repacked in appropriate replacement containers. Repacked agro-chemicals should be labeled immediately. Stores should be inspected regularly and any leakage or contamination should immediately be cleaned up.
- Storekeepers should keep a record of the stocks in their custody and such recorded information should include the date of arrival, formulation, quantity, unit size, date of manufacture, supplier, and origin for incoming pesticides. For outgoing pesticides, the date, formulation, quantity, unit size, and destination. Records should also regularly be updated.
- A "first in - first out" principle should be applied consistently. In other words, always finish old consignments before using newly arrived consignments.

Essential Equipment within a Pesticide Store

- Thick polyethylene sheeting on floor (if surface is not concrete or otherwise impermeable)
- Floor dunnage (bricks, timber)
- Wooden pallets
- Ramps at entrance to contain leakage
- Entrance door with lock to prevent unauthorized entry
- Bars across windows and ventilators to prevent unauthorized entry
- Container of absorbent sand, sawdust or dry soil
- Shovel
- Long-handled brush with stiff bristles
- Short-handled brush and pan
- Water supply, or container of water, with soap
- Detergent solution
- Drum spanners
- Metal funnels
- Protective clothing:
- Empty pesticide containers (preferably salvage drums that can contain a whole 200-litre drum)
- Empty bags to repack heavily damaged or leaking containers
- Self-adhesive warning labels for marking drums
- Stock record sheets

Stacking Positions and Heights

Agro-chemical stock be arranged in such a manner that, the oldest first ("first in first out" principle) and to prevent expired/obsolete stock from accumulating in the store. Containers are to be arranged to minimize handling and thus, avoid mechanical damage giving rise to leaks. Floor spaces should be uncluttered, with marked, 1-m wide, gangways between shelves or stacks that permit easy inspection and allow free air flow. This also enables immediate clean-up in the event of any leakage or spills, which can be seen quickly. Climbing on pesticide containers to reach other containers should not be necessary - damaged or corroded metal drums can easily give way under a person's weight and this leads to potentially fatal gross contamination with pesticide.

Dunnage (timber and bricks) should be used so that, containers are not placed directly on the floor. Stacked containers should be on pallets. Any possible corrosion resulting from rising damp or leaking chemicals should be promptly detected and timely addressed. Dust, granule and wettable powder formulations should be kept in cartons during storage to avoid caking. Concentrate formulations, especially those in glass bottles, should also be kept in cartons to avoid breakage. Storage shelves should not exceed a height of 2 m to avoid the use of ladders. Containers should not exceed a height of 107 cm on each pallet. Containers and cartons should be stacked at safe heights ensuring that they are stable.

Maximum stacking of containers on top of each other

Package type	Number of layers on basal pallet	Palletized: number of packages on each pallet
Steel drums (200 l)	1	3-4
Steel drums (smaller than 200 l)	2	3-4
Fibre drums (200 l)	1	3

Fibre drums (smaller than 200 l)	2	3
Plastic drums (200 l)	1	2
Plastic drums (smaller than 200 l)	2	2
Paper sacks	4-5	3
Plastic sacks	4-5	3
Fiber case containing tins	4-6	3-4
Fiber case containing soft packages (plastic bottles, sachets)	4-6	2
Wooden cases	2-4	3-4

Record Keeping

Since a number of agro-chemicals tend to have a limited shelf-life, it is essential that only sufficient pesticide will ordered for requirements and that issues are made on a "first in -first out" basis. This is aimed at ensuring that, no huge amounts of agro-chemicals accumulate due over-stocking etc. and slow pace of usage. Records will be kept separate from the pesticide stock so that they are not destroyed in the event of a major disaster (such as fire, flood, earthquake, hurricane or destruction during civil unrest).

Records will be kept as sheets in a ledger or in card index form. Duplicate records adjacent to the stock itself may also be required, perhaps in simplified form. Again, a supply of material safety data sheets will be requested from the supplier or manufacturer. Records are to be accurate and with sufficient details to enable a replacement storekeeper to take over responsibility without necessarily having to refer to the previous storekeeper. This will enable smooth operations of the stores.

As noted, agro-chemicals have a limited shelf-life, and stock batches bought at different times may vary in formulation and packaging. It is important that a completely separate record be allocated to each consignment of different agro-chemicals as it is received by the store. The national authority responsible for the procurement of agro-chemicals needs to be regularly updated on stocks kept in various locations in the country and stores should be able to supply this information.

A possible layout for a pesticide store record sheet is given below. The store record sheet allows the progress of each consignment of a particular pesticide to be followed from receipt, through inspections, stocktaking and checking to issues, analysis of stock after the shelf-life has expired and disposal when deterioration has been established.

The store supervisor should ensure that there is an adequate system being followed by the storekeeper at all times. The storekeeper should be trained in the use of the records system and must be responsible for its upkeep.

Sample pesticide store stock record sheet

Pesticide group	<i>Insecticide OP</i>
Ref. no.	<i>Inv 29/5[R3]</i>
Common name	<i>Chlorpyrifos</i>
Trade name	<i>Dursban</i>
Formulation/concentration	<i>% EC, 400 g/litre</i>
Manufacturer/supplier	<i>Dow Elanco, USA</i>
Quantity (agreed issuing quantity/package)	<i>1 000 2.5-litre plastic containers</i>
Primary packaging quantity	<i>Four containers of 250 cartons</i>
Date received	<i>20 December 2013</i>
Use-by date	<i>1 December 2015</i>

Workers Safety and Protection

There are certain measures which should always be undertaken by pesticide operators to help protect against contamination during the handling and application of pesticides. These measures should always be followed.

Reading and Understanding Labels

The first principle is to always read and follow the label recommendations on the pesticide container. If the label information cannot be read or understood for any reason, then the operator should find someone who can explain the instructions to him. Apart from the written instructions, the operator should also look for pictorial information on the label which will indicate the degree of hazard presented by the pesticide formulation. Similarly, warning symbols, such as skull and crossbones, give information on the type of chemical hazard.

Know how to read the pesticide label i.e. common, active ingredient (chemical), and trade name of the pesticide on the label.

- ❖ Know how to identify the percentage of active ingredient in the pesticide formulation; and
- ❖ Understand the hazard levels associated with pesticides ions e.g. quantity, pests, dates, locations etc.

Things to know on pesticide labels include:

- ❖ Trade (Product) Name, every manufacturer has a specified commercial trade name for their product. The trade name may indicate the type of formulation and the percentage of active ingredient (chemical in the pesticide responsible for the pesticidal activity). For example: Diazinon 60EC is the trade name and it contains 60% of Diazinon as the active ingredient and it is an emulsifiable concentrate (EC). Diazinon can also be marketed as “Sunzinon 60EC” or “Trisudin 60EC”.
- ❖ Ingredient Statement. Every pesticide label should have the name and the percentage of the active ingredient (AI) and any inert ingredients which is usually not named. Inert ingredients do not possess pesticide activity and are usually added to serve as a carrier for the AI Classification Statement.

- ❖ “Restricted Use” means that the pesticide is for retail sale only and to be used only by certified operators or persons under their direct supervision. Unclassified pesticides are common general use pesticides which can be purchased and used by the general public.
- ❖ Type of Pesticide. The type of pesticide is listed on the front panel of the pesticide label. For example: “Insecticide for the control of insects on vegetables and ornamentals”.
- ❖ Net Contents usually expressed as grams for dry formulations or liters for liquid formulations.
- ❖ Signal Word and Symbols, most pesticides should have a signal word which indicates approximately how toxic the pesticide product is.

Avoiding Contamination - Direct exposure of the skin, nose, mouth or eyes should be avoided or minimized when working with pesticide products to reduce the chances of personal contamination.

When pouring and mixing the concentrated product, every effort should be made to avoid splashing or spilling onto skin or clothing. If any product falls on the skin, or into the eyes, then this should be washed off as soon as possible. Heavily contaminated clothing must be removed and washed with detergent and water.

The likelihood of contamination can be greatly reduced by using suitable equipment for measuring out and transferring the product. In particular the hands must never be used as scoops nor should the hands or arms be used to stir liquids.

The most appropriate application technique should be selected to control the pest problem. It is very important that the application equipment is in a good state of repair and that it is properly maintained and calibrated.

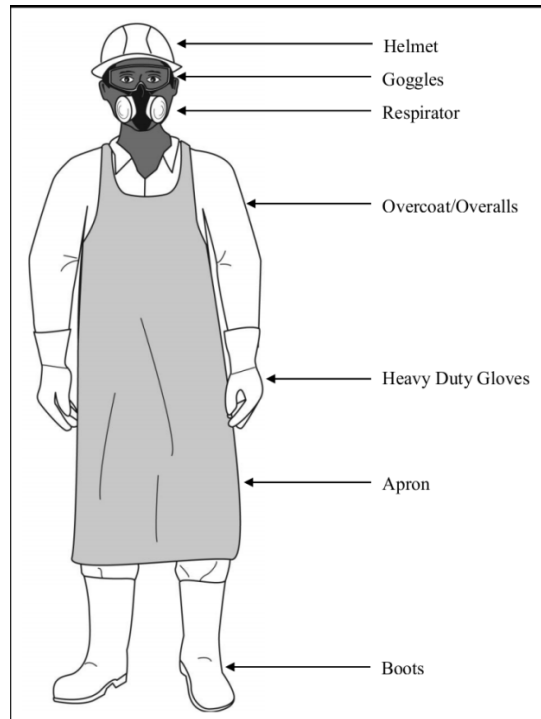
When spraying the diluted product the applicator should always work upwind of the spray to avoid coming into contact with it. He should also avoid contact with freshly sprayed foliage as far as possible.

Personal Hygiene - Another basic principle of personal protection is good hygiene when working with pesticides. This is to ensure that if any contamination occurs then it is removed in good time. In addition personal habits will help avoid direct contamination in itself.

Operators should not eat, drink or smoke during work and should not touch their face or other bare skin with soiled hands or gloves. They should always wash their hands and face after handling pesticides and before eating, drinking, smoking or going to the toilet. When they have finished work for the day they should then wash themselves thoroughly. Their work clothes should also be washed after work, separately from other clothing, and then dried.

Safety Gear - For the effective safety and protection of the workers handling agro-chemicals, the provision of the following is deemed necessary.

- Helmet or cloth cap
- Safety spectacles, goggles or face shield (attached to helmet)
- Dust or light fume masks
- Emergency vapor masks or half-face respirators with organic vapor cartridges
- Nitrile rubber or neoprene gloves or gauntlets
- Overalls
- Nitrile rubber or neoprene aprons
- Strong rubber or neoprene boots



Full Personal Protection Equipment for a Pesticide Operator

In hot weather conditions, wearing of additional protective clothing and other equipment can cause severe discomfort and even physical distress due to heat stress if they are made of inappropriate materials. In addition, because of the discomfort, operators may dispense with protective apparel and become subject to greater exposure and possible contamination. There are certain measures which can help reduce this problem, namely:

- a) Where possible using a pesticide formulation which does not require the wearing of additional items of protective clothing;
- b) Applying the pesticide in the cooler hours of the day when it is more comfortable to wear protective equipment.

Given the climate in Ethiopia, cotton may be the most comfortable material for making up protective garments and should be readily available on the market. The protection given by cotton depends upon its weight and thickness, therefore it is advisable to choose garments with the material as thick and as heavy as can be worn with reasonable comfort in the prevailing climate.

Another alternative material for wearing in the hot and humid conditions includes non-woven polypropylene. This material is as comfortable as cotton in these conditions but is less durable and therefore will have to be replaced more often according to the type of work involved.

Fire Emergencies

Pesticides, especially those formulated as liquids, present major fire hazards because the solvents used in formulations (oils and petroleum distillates) have low flashpoints and may be readily vaporized at normal temperatures. In poorly ventilated stores heavy vapors may likely accumulate near the floor if drums are left open or if leaks and spills are not cleared up. An electrical spark, naked flame or even the

sun's rays concentrated by a glass container can potentially cause an explosion which can trigger and spread fire.

It is also important to note that, some wettable powders can start fires through spontaneous combustion, while sodium chlorate (used as a herbicide, defoliant, desiccant and soil sterilant) is a powerful oxidizing agent that easily catches fire and should only be supplied with a fire suppressant in the formulation (once sodium chlorate containers have been opened their entire contents should be used immediately).

The outside of pesticide stores should bear prominently displayed **WARNING NOTICES** stating "**DANGER PESTICIDES: AUTHORIZED PERSONS ONLY**" AND "**NO SMOKING: NO NAKED FLAME**" AS WELL AS **HAZARD SYMBOLS**. It is important that, rules governing the operations of the agro-chemical stores be strictly followed by all project staff.

The pesticide storage area must have a warning sign prominently displayed at the entrances bearing, in clearly visible, block letters, the words:

- Warning;
- Authorized Persons Only and
- Chemical Storage or Pesticide Storage



This is possible by training of staff on safety aspects of agro-chemical storage, handling and application.

Fire extinguishers (powder or carbon dioxide, not water) should be available in the reach of the store and should be regularly checked. Static or running water (required, together with soap, for decontamination purposes) should also be available and buckets of sand or earth (also required for absorbing any liquid pesticide spills or leaks) are useful for putting out small fires.

In the event of a fire, it is essential to try to contain the agro-chemicals that leak from burning and exploding containers in the store. Hence, the need for bunding to be done around the store to prevent the water used to fight the fire, which inevitably becomes contaminated with pesticides, from contaminating the neighborhood and thus the environment generally.

8.2 Management of Pesticide Spills and Leaks

Leaks

Containers may leak for a number of reasons; for example, strong sunlight can degrade some plastic containers, including bottles and plastic sacks. Rodents may damage paper, board or fibre containers. Termites may equally attack paper and card in chemical stores. Stores should be inspected regularly, at least every two months. Old, rotting and leaking containers are extremely difficult to move safely, so any leaking containers should be dealt with immediately. Usually, the only way to deal with a leak is to repack the material in a sound container. New containers are preferable; if available, but old containers of various types and sizes may be used for this purpose (old containers are also useful for temporarily storing the products of spills). They must have been thoroughly decontaminated (see next section) and their old labels completely removed.

Agro-chemicals will be repacked in containers made of the same materials as the original containers as some chemicals are not compatible with different materials. Ideally a drum that contained the same product should be used. If unavailable, the container must have been properly cleaned of previous contents to avoid cross-contamination. New labels must be written out immediately with all the information on the old label and fastened securely to the new container. Write the date of repacking (and the date of the original receipt) on the replacement container and ensure that the repacked material is used first.

Liquid spills

The spill should not be hosed down as this merely disperses the pesticide over a wider area. A supply of absorbent sawdust, sand or dry soil should be kept in a container in the store. Nitrile rubber protective gloves and face-mask should be worn. Sawdust, sand or dry soil should be scattered over the area of the spill and left for a few minutes to soak up the chemical. The sawdust, sand or dry soil containing absorbed spilled chemical should be swept or shoveled up and placed in a marked container for disposal. After sweeping, more than once if necessary, a scrubbing brush at the end of a stick should be used to scrub down the area of the spill with water and strong soap or detergent. Excess soapy water should be removed with a rough floor cloth and not hosed down.

Solid spills

- Dusts, wettable powders or granules can create dust when swept up without the use of an absorbent material. A supply of absorbent sawdust, sand or dry soil should be kept in a container in the store where they can easily be reached for use in an emergency.
- Nitrile rubber protective gloves and face-mask should be worn. The sawdust, sand or dry soil should be dampened and applied with a shovel over the area of the spill.
- The damp sawdust, sand or soil containing spillage material should be swept or shoveled up carefully and placed in a marked container for disposal.
- After sweeping, more than once if necessary, a scrubbing brush at the end of a stick should be used to scrub down the area of the spill with water and strong soap or detergent. Excess soapy water should be removed with a rough floor cloth and not hosed down.

Disposal of Pesticide Containers

Accidents have reportedly been caused by empty pesticide containers which sometimes end up being used to store water and food. An empty pesticide container can never be cleaned completely of pesticide and should be disposed of in a way that ensures it cannot be used for other purposes. It is,

however, wise to retain samples of various types of container, which have been carefully cleaned, in the pesticide store for use in repacking the contents of damaged containers and storing cleaned up leaks and spills prior to final disposal.

Empty containers awaiting disposal should be stored in a special, secure area in the pesticide store to ensure that they are not stolen and used for other purposes. Empty containers should always be cleaned out, as far as is practicable, before disposal to minimize both hazard and waste of residual pesticide.

Containers that have contained EC or wettable powder (WP) formulations should be rinsed with water several times and the rinsing added to the spray tank before it is topped up to the required volume. Following this, containers can be washed out with a mixture of water, detergent and caustic soda. Containers of liquid formulations may be cleaned with kerosene (paraffin) or diesel fuel and the washings (small quantities of about 5 liters) collected for sending later to a central location for disposal by the national authority in a safe and environmentally sound manner.

As long as they are not heavily contaminated paper, cardboard and fiberboard containers should be burnt on a fire in the open. However, cartons that have contained phenoxy acid herbicides should not be burnt because the combustion products can damage crops at long distances. Highly contaminated cardboard, paper and jute materials should be collected and sent to the central disposal centers along with other toxic waste.

NOTE: LABEL INSTRUCTIONS SHOULD BE FOLLOWED FOR THE PROPER DISPOSAL OF THE RESPECTIVE PESTICIDE CONTAINERS!

Disposal of expired agro-chemicals

Occasions will arise when it will be necessary to dispose of agro-chemicals concentrates, either because the stock is outdated or has been found to be unusable or because the product is no longer registered for the original purpose. Where very large quantities are to be disposed of, professional advice must be sought from the suppliers and national authority.

If only a few kilograms or liters of pesticide are involved, they should be collected for sending later to a central location for disposal by the national authority. Larger quantities of agro-chemicals are best disposed of by burning in a special incinerator (at 1,200°C) - this does not mean that it would be safe to burn them at a lower temperature on a fire. Incineration requires special equipment with provision for "scrubbing" the combustion products, but this is beyond the capacity of agro-chemicals storekeepers and should be referred to the relevant national authority. Other means of disposal are to return the pesticide to the supplier or pass it on to a specialist disposal agent elected by the national authority.

Returning the pesticide to the supplier or to the national authority is the safest means of disposal. Disposal involves chemical methods such as alkaline and acid hydrolysis. Oxidation, reduction and spraying on to the ground or allowing escaping into the atmosphere may also be employed, but require specialist skills. The end product in most cases is still toxic. Storekeepers should not become directly involved with pesticide disposal and should refer to the relevant national authority.

8.3 Measures to Reduce Exposure Risks during Pesticide Transport

Prior to long-distance transport of the pesticides from the customs warehouse/central storage facility to the agricultural project areas, drivers will be informed about general issues surrounding the pesticides

and how to handle emergency situations (e.g. road accidents). Training for long-distance transport from the distributorship to the storage facilities will include the following information:

- Purpose of the pesticides
- Toxicity of the pesticides
- Security issues, including implications of the pesticides getting into the public
- Steps to take in case of an accident or emergency (according to FAO standards)
- Combustibility and combustion by-products of insecticide
- Handling vehicle contamination

Mitigating Fetal Exposure

All the potential females expected to handle pesticides should be tested for pregnancy before being engaged in the pesticide application process. Female persons found to be pregnant should be re-assigned to positions that require less exposure to pesticides.

Mitigating Pesticide Applicator Exposure

Each operator handling pesticides (loaders, transporters, mixers, and applicators) will be provided with the following Personal Protective Equipment (PPE) and other safety equipment, in accordance with WHO and FAO specifications for pesticide handling.

These PPEs will be replaced frequently whenever wear and tear is identified or reported. However, the respirators will be replaced every day after use. **See Table 13** below for a reference guide to PPE.

- Broad-rimmed hat/helmet
- Face shield or goggles (face shield preferable)
- Respirators-disposable and replaced on a daily basis
- 2 sets of cotton overalls per spray operator
- Nitrile rubber, neoprene, PVC or butyl rubber gloves, without inside lining, long enough to cover forearm and replaced if torn or if wear and tear is noticed
- Rubber boots

Table 13. Protective Clothing and Equipment Guide to use during application

Signal Words on Pesticide Label Formulations	Caution	Warning	Danger
Dry	Long-legged trousers and long-sleeved shirt; shoes and socks	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves; cartridge or canister respirator if dust is in air or if precautionary statement on label says: "Poisonous or fatal if inhaled"
Liquid	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; rubber gloves. Goggles if	Long-legged trousers and long-sleeved shirt; rubber boots, wide-brimmed hat; rubber gloves, goggles or

		required by label precautionary statement; cartridge or canister respirator if label's precautionary statement says: "Do not breathe vapors or spray mists" or "Poisonous if inhaled"	face shield. Canister respirator if label's precautionary statement says: "Do not breathe vapors or spray mists" or "Poisonous if inhaled"
Liquid (when mixing)	Long-legged trousers; long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves; rubber apron	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; rubber gloves; goggles or face shield; rubber apron. Respirator if label's precautionary statement says: "Do not breathe vapors or spray mist" or "Poisonous [or fatal or harmful] if inhaled"	Long-legged trousers and long-sleeved shirt, rubber boots, wide-brimmed hat, rubber gloves, goggles or face shield. Canister respirator if label's precautionary statement says: "Do not breathe vapors or spray mists" or "Poisonous if inhaled"
Liquid (when mixing the most toxic concentrates)	Long-legged trousers; long-sleeved shirt; boots, rubber gloves, waterproof wide-brimmed hat	Water-repellent, long-legged trousers and long-sleeved shirt; rubber boots, rubber gloves, rubber apron; waterproof wide-brimmed hat; face shield; cartridge or canister respirator	Waterproof suit, rubber gloves, and waterproof hood or wide-brimmed hat.

Workers should be closely monitored for symptoms of acute pesticide exposure, because there will always be some level of exposure. In addition, workday duration should be monitored to limit exposure as required by safety recommendations (Najera and Zaim, 2002).

Monitoring and reporting of acute exposure of the pesticide applicators should be undertaken by reviewing Incident Report Forms that are made available to every pesticide applicator. Any exposure incident should be normally recorded as a form of best practice, and guidelines established for the action to be taken, e.g., immediate treatment and/or referral to the health facilities for further treatment. In addition, IRFs will be reviewed by the Monitoring and Evaluation Officer to determine if corrective action is required. Similarly, human exposure will be monitored using the reported cases of exposure or those reported in the health centers.

The individual or group farmers or those expected to handle pesticides will receive intensive training on the use, operation, calibration and repair of the sprayer and practical exercises prior to the beginning of the pesticide application. They will also receive training to understand proper hygiene, to recognize the signs and symptoms of poisoning, and to understand the referral procedure for any incidents involving poisoning.

Mitigating Pesticide Exposure through Treatment

The following drugs are recommended for use in case of exposure to the pesticides. The project should try and reach out to Ministry of Health and ensure that all the health facilities around the project sites are stocked with these recommended drugs and that all the staff responsible receives training on emergency treatment to pesticide exposure.

Table 14. Drugs Recommended for Treatment of exposure

Name of drug	Active ingredients
Promethazine	Promethazine Hydrochloride
Panadol	Paracetamol
Diazepam	Benzodiazapine/Diazepam
Lorazepam	Lorazepam
Calamine cream	Calamine, zinc oxide, glycerol, phenol, purified water, sodium citrate, betonite,
Vit E	Tocopherol, fragrance, mineral oil, deionized water, sodium hydroxide, stearic acid
Hydrocortisone cream	1% hydrocortisone
Salbutamol	Salbutamol 100 mcg, suspended inert aerosol
Salbutamol tablets	Salbutamol sulphate 4 mg
Activated Charcoal	Activated Charcoal

All the pesticide applicators will receive detailed training on the emergency steps to take if accidental exposure of the chemical occurs through ingestion, eye or dermal contact with the chemical. This training will be conducted by RPLRP in collaboration with existing health officers and will include of drills to test knowledge of the operators. The following are basic first aid procedure for which the RPLRP/PCU will train all the pesticide applicators as part of handling pesticide poisoning.

Follow the first aid instructions on the pesticide label. Take the pesticide can or label to the doctor or medical practitioner if seeking medical assistance.

For poison on skin:

- Remove contaminated clothing and drench skin with water
- Cleanse skin and hair thoroughly with detergent and water
- Dry victim and wrap in blanket

For chemical burns:

- Remove contaminated clothing

- Wash with large amounts of running water
- Cover burned area immediately with loose, clean soft cloth
- Do NOT apply ointments, greases, powders or other medications to burn

Poison in Eye:

- Wash eye quickly but gently
- Hold eyelid open and wash with gentle stream of clean running water for 15 minutes or more
- Do NOT use chemicals or medicines in the water; they may worsen the injury

Inhaled Poison:

- Carry victim to fresh air immediately
- Open all windows and doors
- Loosen tight clothing
- Apply artificial respiration if the victim is not breathing or victim's skin is grey or blue. If the victim is in an enclosed area, do not enter without proper protective clothing and equipment. If proper protection is not available, call for emergency equipment from your fire department.

Poison in mouth or swallowed:

- Rinse mouth with plenty of water.
- Give victim large amounts (up to 1 litre) of milk or water to drink.
- Induce vomiting only if the pesticide label instructs you to do so.

Mitigation Measures against Warehouse/Storage Exposure

In order to mitigate risks associated with pesticide storage, the following key points will serve as key mitigation steps:

- All primary pesticide storage facilities will be double-padlocked and guarded
- All the storage facilities will be located away from nearby watercourses, domestic wells, markets, schools, hospitals etc.
- Soap and clean water will be available at all times in all the facilities
- A trained storekeeper will be hired to manage each facility
- Recommended pesticide stacking position and height in the warehouse as provided in the FAO Storage and Stock Control Manual will be followed
- All the warehouses will have at least two exit access routes in case of fire outbreak
- A fire extinguisher will be available in the storage facilities and all workers will be trained on how to use this device.
- Warning notices will be placed outside of the store in the local language(s) with a skull and crossbones sign to caution against unauthorized entry
- All pesticides will be used and any remnants will be stored under lock and key until the next round of application.
- Application of First In/First Out (FIFO) approach in pesticide distribution will be practiced to avoid accumulation of expired pesticide

Mitigating Exposure Impacts through Container Re-use

Best practices emphasize that no matter how many times a container is cleaned; it should never be used to carry anything other than pesticides. Any container once used to contain potentially harmful chemicals should never be used to hold household items or foodstuffs, especially water.

Disposal of Pesticide wastes and Containers

General guidelines outline the sources of pesticide wastes as following:

- *Caking due to poor methods of storage.*
- *Unidentifiable products due to lack of label.*
- *Banned products.*
- *Expired products.*
- *Pesticide spillages and leakages.*
- *Contaminated items (soils, clothing etc.).*
- *Rinsate from pesticides applicators.*

Avoidance of Pesticide Wastes

A number of preventive steps can be taken to avoid the difficult problems and costly solutions of pesticide waste disposal. These include the judicious purchase, collection, transport, storage and use of pesticides.

Purchasing Pesticides

When purchasing pesticides, the following precautions should be observed:

- *Only purchase what you need: calculate carefully the amount needed and try to avoid being left with a surplus. For example, do not buy a large container if only a small portion of its contents is likely to be used by the end of the season.*

Supervision

Supervisors will be necessary for ensuring quality control and overseeing pesticide application at all levels. Supervisors will observe applicators undertaking pesticide preparation, application technique, and clean up procedures after pesticide application. Scrupulous attention to personal hygiene is an essential component of the safe use of pesticides. For operators, safety precautions will depend largely on personal hygiene, including washing and changing clothes. A schedule for carrying out and supervising personal hygiene, regular washing of protective clothes and cleaning of equipment will be organized along the following lines (WHO 2006):

- Pesticide applicants will be provided with sets of overalls to allow for daily changes.
- Washing facilities with sufficient water and soap will be made available in the field at appropriate locations.
- All working clothes must be removed at the end of each day's operations and a shower or bath taken—in circumstances where a full-body shower or bath is not feasible, face/neck and hands must be washed with soap and water.
- Working clothes must be washed regularly.

- Particular attention will be given to washing gloves, as wearing contaminated gloves can be more dangerous than not wearing gloves at all.
- Eating, drinking and smoking during work will be strictly forbidden.
- Pesticide applicators will never wash themselves, their overalls, or their PPE in any water bodies, or where wash water will drain to water bodies.

8.4 Institutional Structures for Implementing Mitigation Measures

The proposed mitigation and monitoring measures require a clear and adequate institutional framework that will be used for each sub project investments where pesticides will be used. Mitigation and monitoring measures will occur at different levels and undertaken by different institutions as described below.

MoA

MoA will be the principal institution responsible for overall monitoring and mitigation of the adverse impacts of the pesticides including ensuring that the IPMP is followed under the RPLRP. The RPLRP will recruit consultants (in the event that they lack specialist) agronomists, crops specialists who will prepare the IPMPs for sub projects in line with the requirements of this IPMF. The IPMPs will be submitted to the RPLRP/PCU for review before they are subsequently sent to the World Bank for approval. No financial disbursement for pesticide related sub project will be undertaken until the bank approves the IPMP.

RPLRP/PCU

The MoA has established a Project Coordination Unit (PCU), which will undertake screening of all sub projects to determine if they intend to use pesticides and hence trigger the need to prepare an IPMP. If a project is screened and found that it will use pesticides, the PCU will prepare Terms of Reference for the preparation of an IPMP. The PCU will also provide overall technical support in monitoring of proposed mitigation measures and indicators on a period basis including the review of the monitoring reports.

Farmer Groups

The sub project will use farmer groups and associations who are the project beneficiaries to undertake monitoring for instance in observing the pests in the farms, identifying weeds, and reporting as part of the surveillance to inform what sort of control measure to adopt. The farmer groups and associations will be trained on surveillance and best management practices in pesticide application and use.

Environmental Protection Authority (EPA)

EPA will ensure that there is enforcement including monitoring of the guidelines and regulations for waste disposal including pesticide wastes and will undertake this jointly with the MoA.

Ministry of Health

Ministry of Health will undertake surveillance of health effect due to chemicals in the project areas. They will also closely coordinate the treatment of affected persons in the local Health Centers in the project areas.

9. INTEGRATED PESTICIDE MITIGATION & MONITORING PLAN

The Environmental Mitigation and Monitoring Plan (EMMP) presents a program by which should be used by RPLRP/PCU to assure initial and on-going compliance with environmental requirements and guidelines for pesticide use. The plan also includes activities proposed for mitigating environmental and social impacts of pesticides. The sections below are summaries of the adverse impacts as well as mitigation measures proposed followed by a full plan that highlight the monitoring aspects.

9.1 Protective Clothing not Used by Farmers

Few farmers normally use even the bare minimum of appropriate pesticide protection clothing and equipment; use of PPE by farmers is still a remote phenomenon in Ethiopia. Farmers still generally mix chemicals (where the pesticide is most toxic) without rubber gloves, a bucket of water to wash off spills, or goggles and spray while walking through the spray path without rubber boots, goggles, rubber gloves, a plastic sheet between the sprayer and the back, and with only every-day clothing. This behavior is common with Ethiopian farmers especially small-scale farmers even though they generally believe that pesticides pose danger to their health.

Recommendations

The key danger times are during mixing and when walking through the spray path. Eye and feet protection are the greatest priority. Goggles, long pants, and rubber boots are most needed. The RPLRP sub projects that will use pesticides should provide the necessary PPEs for all the farmers as recommended. Those that apply pesticides should be encouraged to wash their clothes after each day's spraying.

Pesticide usage should be in the context of IPM programs

Pesticides are often seen as a first choice in pest control whereas following IPM their use should be the last choice when all else fails. In addition the decision to use pesticide is based on the presence of the pest and not on decision protocols such as action thresholds. As it is now for most crops, recommendations imply that as soon as the pest is seen, a pesticide should be used. As a result more applications are probably given than would be necessary if decision guides were developed based on field verification or trials. Pest control recommendations include many non-pesticide practices and pesticide usage should also be seen as a last resort.

Recommendations

Monitoring programs need to be developed along with action thresholds as methods to quantify pest abundance as a guideline to initiate pesticide usage for more crops. Pest control recommendations should include many non-pesticide practices first and pesticide usage only as a last resort.

Pesticide disposal of containers and obsolete product needs to be strengthened

Concern that pesticide containers will be poorly disposed and probably scattered around fields or near farmers' homes will remain a key concern in the implementation of sub projects within RPLRP that will entail use of pesticides. Farmers reuse sometimes containers. Both unsound disposal and reuse of

containers pose hazardous situations. If the containers are burned, products from burning can be more hazardous than the pesticide itself.

Recommendations

Pesticide containers will be disposed following the guidelines for disposal of pesticides wastes and containers. The RPLRP PCU must develop a **Pesticide Waste Disposal Plan** for use by the farmers in its areas of operations that will include the disposal of pesticide containers.

Rotate pesticide chemical groups to minimize pesticide resistance

Repeated pesticide use presents risks for development of pesticide resistance where mortality rates decline. When this occurs it is often difficult to find substitutes.

Farmers need to have knowledge of the general families of pesticides for rotation must occur between families and not just brand names. Farmers generally do not know that different brand names are often the same chemical.

Protecting biological reserves from pesticide incursion

It has been observed that due to the pressure to expand agricultural lands, crops where pesticides are used are being grown along the borders of national parks, rivers, and other protected areas. Proximity of these fields poses hazards to ecologically sensitive areas.

Pesticide can enter protected areas by a number of means with drift posing the most imminent threat. Herbicides, being more water soluble, have a history of leaching into underground aquifers particularly in sandy soils. They are carried downward by rainwater seeping into the soil. Farmers may improperly dispose of pesticide containers and rainwater can leach pesticides into groundwater. The same can be said when farmers wash their sprayers and throw rinsate onto the ground or worse directly into bodies of water.

9.2 Monitoring and Evaluation for the various Pest Management Practices of the PMPs

Successful implementation of the agricultural related investments under RPLRP in the target project areas will require regular monitoring and evaluation of activities undertaken by the Farmer Groups. The focus of monitoring and evaluation will be to assess the build-up of IPM capacity in the Farmer Groups and the extent to which IPM techniques are being adopted in agricultural production, and the economic benefits that farmers derive by adopting IPM. It is also crucial to evaluate the prevailing trends in the benefits of reducing pesticide distribution, application and misuse.

Indicators that require regular monitoring and evaluation during the programme implementation include the following:

- *The IPM capacity building in membership of Farmer Groups: Number of farmers who have successfully received IPM training in IPM methods; evaluation the training content, methodology and trainee response to training through feedback*

- *Numbers of Farmer Organizations that nominated members for IPM training; emphasize the number of women trained; assess Farmer Groups understanding of the importance of IPM for sustainable livestock production*
- *Numbers of farmers who have adopted IPM practices as livestock protection strategy in their production efforts; evaluate the rate of IPM adoption*
- *How has the adoption of IPM improved the production derive by adopting IPM*
- *Economic benefits: increase in livestock and fodder productivity due to adoption of IPM practices; increase in farm revenue resulting from adoption of IPM practices, compared with farmer conventional practices;*
- *Social benefits: improvement in the health status of farmers*
- *Numbers of IPM networks operational and types of activities undertaken*
- *Extent to which pesticides are used for livestock production*
- *Efficiency of pesticide use and handling and reduction in pesticide poisoning and environmental contamination*
- *Levels of reduction of pesticide use and handling and reduction in pesticide poisoning and environmental contamination*
- *Number of IPM participatory research project completed*
- *Influence of the results of IPM participatory research on implementation of IPM*
- *Overall assessment of: activities that are going according to plans; activities that need improvements; and remedial actions required.*

The following indicators will be incorporated into a participatory monitoring and evaluation plan:

- *Types and number of participatory learning methods (PLM) delivered; category and number of extension agents and farmers trained and reached with each PLM; practical skills/techniques most frequently demanded by farmers.*
- *Category and number of farmers who correctly apply the skills they had learnt; new management practices adopted by most farmers; types of farmer-innovations implemented; level of pest damage and losses; rate of adoption of IPM practices; impact of the adoption of IPM on production performance of farmers*
- *Increase in production systems/livestock production; increase in farm revenue; social benefits: e.g. improvement in the health status of farmers, reduction in pesticide purchase and use; and number of community families using preventive mechanisms against diseases.*

Proposed Pests Monitoring and Evaluation Regime

The participatory M&E system for IPM should also be enterprise-based so as to deal with a group of diseases and pests affecting any single livestock. The approaches being proposed here therefore does not handle single pest to otherwise the issue of different agronomic practices for different crops would have to be taken into consideration.

Since pest problem is an existing problem and a major constraint to several enterprises in Ethiopia, it is obvious that there are already existing pest management programmes within the country. In view of these efforts, it will be advisable to use the Participatory Impact Monitoring (PIM) approach.

Monitoring of pesticide use will also be vital in order to detect health and environmental impacts, and to provide advice on reducing risks. Depending on the circumstances, this may include monitoring of:

- *Appropriate use of protective gear*
- *Incidence of poisoning*
- *Pesticide residues in food crops and drinking water*
- *Contamination of surface water and ground water*
- *Environmental impact (impact on non-target organisms, ranging from beneficial insects to wildlife)*
- *Efficacy*

The steps involved in participatory M&E should include:

- *Stakeholder Analysis and identification of M&E team*
- *Setting up objectives and expectations for monitoring*
- *Selection of Impacts to be monitored (Variables/Indicators)*
- *Develop Indicator sheets*
- *Develop and test the tools to be used in data collection (Usually Participatory Rural Appraisal tools are used)*
- *Collect the data from as many sources of stakeholders as possible*
- *Assessment of the data and discussion for a arranged on regular basis*

Participatory Impact Monitoring (PIM)

Participatory Impact Monitoring (PIM) should be employed for continuous observation, systematic documentation and critical reflection of impacts of IPM, followed by corrective action (plan adjustments, strategy changes). Project staff and target groups, using self-generated survey results, should undertake this task. The stakeholder analysis and selection of participatory M&E team is therefore very important in implementing an effective impact monitoring.

Once an agreement on the objectives of PIM is reached among the stakeholders (development partners, implementing agency, target groups etc.), their expectations and fears regarding project impact are identified, e.g. in brainstorming sessions. Having examined already existing M&E data regarding the selected impacts, the task is to develop indicator sheets which contain all important information for impact measurement: definitions of terms, indicators and their rationale, survey units and respondents, instructions for data collection, statements on limitations of the methods used.

The factsheet assumes that political, legal, agro-ecological and other framework conditions are almost the same for a single enterprise; any observed differences regarding selected impacts will be largely due to the (additional) input towards IPM. After the selection of impacts to be monitored, impact hypotheses are established in order to obtain a clearer picture of the IPM and the environment in which it acts. In impact diagrams, project activities/outputs that are supposed to lead to a certain impact can be arranged below, external factors above the impact in the centre of the diagram.

Once questionnaires and other tools (e.g. PRA instruments) have been pre-tested, and a decision on sample size and composition has been taken, impact-related information and data is collected and processed. Interviews are held with randomly selected individuals (e.g. female farmers), key persons

(e.g. village elders, teachers) or groups (e.g. Saving and Credit Groups, Development agencies, Institutions etc.).

Joint reflection workshops with project staff, target group representatives and other stakeholders are conducted in order to (a) consolidate impact monitoring results by combining the views of various actors and (b) ensure that necessary plan adjustments and strategy changes are in line with the target groups' demands and capacities.

Integrated Pest Management Monitoring Framework

The Participatory M&E Framework for IPM should follow a feedback principle in which results or impact of any interventions can be traced to the activities/inputs. Either by using conventional pest management method or IPM, the feedback should allow for evaluation of the methods used and adjustment or incorporation of additional control methods. The results of the activities form the basis of the factsheets to be used in monitoring.

Environmental Monitoring and Mitigation Plan (EMMP).

Pesticide Pre-Application Phase-Control of Pests

Impact	Mitigation Measure	Monitoring Indicator	Responsibility
Accidental Spills of pesticides during road transportation to warehouse and field application sites (Human Health and Environmental impacts)	Ensure that the drivers identified to haul the pesticides to the sites are well trained on the FAO standards and guidelines for the storage, transport and stock control for pesticides. Damaged packaging will not be accepted, and loads will be tied down to vehicle bed or sidewalls.	Number of Road Accidents and spills reported Records showing Drivers Training	RPLRP/MoA/Woreda Extension Staff
Possible environmental contamination (soil, water, biodiversity) caused by warehouse exposure due to poor siting of warehouses, pilferage or vermin attack of the stored treated seed and pesticides before use.	Ensure the selected warehouse is sited away from a flood plain area, water course, wells, schools, markets etc.	Storage facility located outside of floodplain, away from nearby schools, hospitals, water courses	RPLRP/MoA/Woreda Extension Staff
	Secure the selected warehouse and apply all the guidelines for Storage and Stock Control manual by FAO.	Storage facilities secured as per the FAO Storage and Stock Control Manual	RPLRP/MoA/Woreda Extension Staff
Accidental Fires and injuries in the warehouses	All warehouses must be equipped with a fire extinguisher, thermometer, exit doors and warning signs, and proper stacking position and height as stipulated in the FAO Storage and Stock Control Manual.	Presence of firefighting equipment, warning signs and at least 3 exits access in the warehouse	RPLRP/MoA/Woreda Extension Staff
	All the workers handling pesticides or other products and equipment in the storage facilities must all have PPE including goggles, gloves, boots, overall, dust masks etc.	Availability of PPE to all the workers.	RPLRP/MoA/Woreda Extension Staff
	All operators and store managers must be trained on how to operate the fire extinguishers and what to do in case of fire outbreaks. Develop an Emergency Response Plan	Training in fire prevention and fighting Existence of an Emergency Response Plan	RPLRP/MoA/Woreda Extension Staff

Pesticide Pilferage –including pilferage of treated seeds from storage facilities;; Potentially cause human and environmental impacts related to exposure	Ensure all the pesticide storage facilities are secure, with double locks, full time security and routine stock control audits conducted to determine stock quantities	Presence of security personnel Double locked access doors Adequate inventory and stock control records	RPLRP/MoA/Woreda Extension Staff
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Pesticide Application Phase Potential Impacts

Impact/Issue	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring Frequency	Responsibility
Foetal exposure caused by using pregnant female operators in the application of pesticides	Pregnancy tests to ensure pregnant women are not on the teams that apply pesticides; prohibition of breastfeeding women on pesticide application teams	Percentage female operators who took pregnancy tests	Once before application begin and then after every 30 days for repeat purposes.	Ministry of Health/ RPLRP/ MoA/Woreda Extension Staff
	Education of women regarding risk and presentation of consent forms	Percentage female operators who indicated they were not breastfeeding		
		Percentage of female operators who have signed consent forms		
	Reassign women operators who become pregnant during the application to tasks that minimize occupational exposure to insecticides	Number of expectant females reassigned to storekeeping work etc. Reported cases of pesticide inhalation	Periodically re-assignment as the cases are identified	RPLRP/MoA/Woreda Extension Staff
Operators, drivers and storekeepers exposure due to negligence or lack of PPEs, or un-	Provide PPEs to all the workers, farmers and store managers. Train on emergency procedures to take if exposure occurs accidentally i.e. dermal, eye or ingestion	Record indicating training has been conducted Ability to respond as required when exposure incidents are	Training to be undertaken once during the overall ToT	RPLRP/MoA/Woreda Extension Staff

intentional exposure caused by accidents	emergencies.	encountered.	Daily monitoring of operators by team leaders to ensure full use of PPE	
	Ensure that effective monitoring of operations diligently and take action to correct any non-compliance issues noted right away.	Availability of PPE for all operators including store keepers, drivers		
	Procurement of sprayers or application equipment manufactured according to WHO specifications; procurement and proper use of PPE by spray operators, team leaders and supervisors (cotton overalls, face shield, dust mask, broad-rimmed hat, rubber gloves, gum boots) procurement of PPE for wash persons.			
	Prohibition of eating, drinking and smoking during work;			
Acute Effects of Pesticide Exposure	Ensuring treatment medicines for insecticide exposure are available at the County and District and Village level.	Availability of exposure treatment medicine in the hospitals	Once before spraying begins and then periodically to check if the medicines are finished in the health centers and if the first aid kits require replacement.	RPLRP/MoA; Ministry of Health/Woreda Extension Staff
	Ensure first Aid kits are available in the storage facilities and the transport vehicles	Percentage of treatment medicines available at health facilities Availability of first aid kits in storage facilities and hired vehicles		
Contamination of biodiversity (water and soil) from pesticide releases during application	Create buffer zones in areas where pesticide application is close to critical biodiversity Avoid over application of pesticides that could lead to increased run off	Presence of buffer zones in critical areas	Daily monitoring during pesticide application Periodic sampling of water from natural water bodies to	Contractor/Woreda Extension Staff

			determine the presence of pesticide residue	
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Pesticide Post Application Phase

Impact	Mitigation Measure	Monitoring Indicator	Monitoring Frequency	Responsibility
Pilferage and Community Exposure, Environmental Contamination from any remaining pesticides not used	Keep storage facilities up to standards described in FAO Pesticide storage and stock control manual; Storage of all insecticides, empty packaging, barrels and tubs in storage facilities	Presence of a dedicated and trained storekeeper Insecticide stored separately Stock records up-to-date Facility double-padlocked and guarded Facility physically secure Cases of theft or pilferage reported	Daily accounting of insecticide and tally of used sachets Periodic monitoring of the warehouse to ensure that it does not have structural problems.	RPLRP/MoA/Woreda Extension Staff
Operator exposure due to lack of washing after spraying	Ensure all operators are provided with PPE and adequate water and soap for washing	Reported cases of operator exposure Soap and clean water available at all times (previously mentioned)	Whenever pesticides are applied	RPLRP/MoA/Woreda Extension Staff

Exposure (human and animal) from Pesticide Containers through re-use or poor disposal	<p>Ensure that all the pesticide containers, sachets etc. are treated as hazardous wastes and hence disposed in an environmentally sound manner including NO REUSE.</p> <p>Ensure that all pesticide containers and sachets are collected back from the farmers in order to avoid re-use or poor disposal</p> <p>Conduct training and awareness campaigns among farmers and residents on the hazards of re-using pesticide containers and sachets</p>	<p>Availability of Pesticide Waste Disposal Plan</p> <p>Strict inventory of all the pesticide containers and sachets that must be returned to the RPLRP project for custody before disposal</p> <p>Absence of pesticide containers used by residents</p> <p>Number of awareness and sensitization campaigns conducted by the program</p>	<p>Routine collection (daily) of pesticide containers from farmers</p> <p>Routine awareness creation campaigns</p>	RPLRP/MoA/Woreda Extension Staff
Exposure and contamination from Expired Pesticides	<p>Procure pesticides with long shelf life preferably 2-3 years to avoid expiration</p> <p>Do not procure excess pesticide stock that will eventually expire; Only procure pesticides that will be used based on quantification following a strict pesticide needs assessment.</p>	<p>Shelf life of pesticides procured</p> <p>Comparison of quantity of stock procured and needs assessment report</p>		RPLRP/MoA/Woreda Extension Staff

10. PROJECT REVIEW, COORDINATION & IMPLEMENTATION ARRANGEMENTS

10.1 Sub Project Investment Review

Each sub project will need to be reviewed independently for potential pesticide related environmental and social impacts. In cases where an IPMP is required, it will be paramount that one is prepared in order to ensure that proposed mitigation measures are proposed in the sub project design.

Screening and sub project investment preparation

Screening of investments will commence right at the project inception phase as soon as the specific sub project details are known including nature and scope, proposed location and area among other parameters. Screening is expected to happen concurrently with the project specific feasibility studies so that any potential impacts identified.

The screening process could result in any of the following determination;-

1. Need for an IPMP if pesticide use will be required as part of the sub component related to agriculture
2. No further pesticide evaluation study needed if the sub project does not involve pesticide usage

Who undertakes screening?

The project/screening report will be prepared by RPLRP/PCU. The Bank also requires that sub projects are screened in order to make a determination as to whether an IPMP is needed or no further pesticide related studies are needed for the sub project. In order to blend the requirements of the bank, the screening will be done and submitted to the bank.

10.2 Preparation of IPMP

A consultant will be recruited by RPLRP/PCU for any sub project that is poised to implement a pesticide related project which will be prepared in accordance with the specific Terms of Reference (ToR) which will be followed in development of IPMP.

11. CAPACITY BUILDING, TRAINING AND TECHNICAL ASSISTANCE

11.1 Institutional Capacity for IPMF Implementation

IPM is a knowledge intensive and interactive methodology. The need to accurately identify and diagnose pests and pest problems and understand ecosystem interactions could enable farmers with biological and ecological control opportunities and in making pragmatic pest control decisions. Thus the success of IPM depends largely on developing and sustaining institutional and human capacity to facilitate

experiential learning for making informed decisions in integrating scientific and indigenous knowledge to solve specific problems. Poor communication between farmers, extension has often led to poorly targeted research or to poor adoption of promising options generated by research.

Capacity building will be achieved through farmer-based collaborative management mechanisms where all key stakeholders shall be regarded as equal partners. Beneficiary farmers shall be the principal actors facilitated by other actor such as from research institutes, academic institutions, sector ministries, NGOs, etc. as partners whose role will be to facilitate the process and provide technical direction and any other support necessary for the implementation of IPMPs. The major actors and partners will include the following:

Pesticide Distributors

In many cases, farmers' primary sources of information and advice on pest management and pesticide use are pesticide distributors or sales staff who represent a special interest and are not likely to advise on non-chemical alternatives or cultural techniques to prevent the pest problem in the first place. Extension workers should be prepared to advise farmers on alternative pest management approaches, cost aspects of various control options, and, where chemical control remains desirable, on the proper selection, handling and use of pesticides and their hazards. To avoid conflicts of interest, extension services should not receive income from selling pesticides.

The program beneficiary farmers

As the principal beneficiaries they will be organized into Farmer Groups for training and adoption of IPM practices. The farmers will be facilitated to set up Community IPM Action Committees to coordinate IPM activities in their areas.

MoA

Has the national mandate in implementation of livestock production and pest management research. RPLRP/PCU will provide logistical and technical support to the extension staff of MoA in each sub project area to be trained as IPM trainers and to exploit their experiences in the implementation of IPM and management of outbreak and migratory pest. The extension staff from the MoA under RPLRP/PCU will undertake to build the capacities of farmers and community leaders in promoting IPM activities. These in turn will facilitate information sharing with Farmers Field Schools (FFS).

Ministry of Health

The local hospitals or clinics in the RPLRP project investment areas should set up a log or a database on incidence of data on poisoning, effect of pesticides on human health and environmental contamination. This data will then be used to measure and validate the ameliorating effects of IPM adoption and implementation that is expected to reduce risks to pesticides exposure. Training of medical staff at health clinics in recognition and treatment of poisoning symptoms may be required alongside with the provision of antidotes.

Distributors/Agro Vets Proprietors

Training and information may also be required for retailers and farmer groups or cooperatives involved in the sale or distribution of pesticides. Ideally, pesticide retailers should be licensed, with appropriate training as a prerequisite.

Environmental Protection Authority

EPA will undertake monitoring of environmental effect of agrochemical usage, disposal of agrochemical waste that includes empty containers and obsolete products. Other Partners will include the following:

- a) **Research and training institutions:** to formulate proposals for research and training programmes for the development of IPM protocols, and training modules for participating RPLRP- commodity IPM team and programme staff.
- b) **World Bank, FAO and Global IPM facility:** to be a valuable sources of technical information and to provide technical support for training, planning and field implementation of IPM in Farmer Groups. The RPLRP sub projects will also build on the knowledge, structures, facilities, and lessons learnt in other related projects in Africa and elsewhere.
- c) **Agriculture Service Providers and NGOs** that are working on providing services to farmers and improving agricultural productivity, environmental management and rural health matters will be identified to provide services and technical support to the field implementation of IPM and other pilot PMP.

11.2 Technical Capacity Enhancement

World Bank recognizes that safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in developing countries, where the level of education of applicators may typically be lower than in developed countries.

In this regard, training of pesticide users and applicators will be a vital component of capacity building in this program. The program will, using the extensive resources available from the RPLRP prepare a comprehensive training manual on pesticide use and management, targeting different actors within the program, ranging from extension service providers, actual farmers, loaders, mixers, transporters, government staff among others.

The RPLRP should run extensive training programs for farmers, farmer leaders, extension workers, and stockists. These training programs should if possible be further amplified by training that is being undertaken by other institutions such as NGOs, pesticide wholesalers, etc.

For farmers, farmer leaders, and extension workers, the training should be fodder/livestock based with farmers being organized into groups led by a farmer leader. The method for training farmers and farmer leaders is the on-farm demonstration where farmer groups are led, step by step in growing the crop during the season from planting to harvest and increasingly into post-harvest activities and even marketing.

There are two types of knowledge that farmers must assimilate and which the RPLRP sub projects must adopt in order to rise above their current level. One is that knowledge of practical skills that can be learned by seeing someone do it or by observation. More difficult to learn however is the set of

knowledge that requires analysis and decision-making and what to do if conditions changed in the field different from what occurred during the demonstrations.

On-farm demonstration is adequate for the former if repeated over several sessions but not good on the latter. The FAO farmer field school method teaches farmers how to make decisions and gives them skills to develop their own technologies when new pests appear. Part of the farmer field school method teaches farmers how to conduct their own applied research and analyze data.

In addition partners should introduce farmer driven research into trained farmer groups. This not only can be used as a learning tool but also can increase our knowledge of the performance of IPM technologies. These could be testing various pesticides, action thresholds, monitoring and scouting schemes, fertilizer rates, varieties, etc.

It will require that the RPLRP undertake periodic evaluations of the on-farm demonstration methods in terms of adoption surveys. An outside consultant with a background in agricultural extension theory and practice should be engaged to make a review of the on-farm demonstration programs and make recommendations on improving training skills and conducting evaluations.

Data should be taken on attendance and published in project reports as should results of quizzes and adoption evaluations. Commonly used evaluations are short quizzes before and after training sessions. This would tell the trainers immediately if their training session were successful. If not, the presentation should be changed and more time spent on less understood concepts. Concepts are best presented with analogies or short exercises conducted by the farmers. The trainer should act as a facilitator as farmers learn best from other farmers thus discussions should be undertaken where farmers themselves come up with the answers. If they are merely told or just see it done by others it does not stick in their mind as well.

The RPLRP IPM program will be obliged to focus on Farm Chemical Safety (FCS) and worker protection practices by creating awareness among farm workers about the potential hazards of misuse of farm chemicals through farm training programs and seminars. Key training and awareness creation topics will include but not limited to among others:

1. **Chemical knowledge:** registration, correct use, application procedures and label specifications. This training includes an in-depth review of label information, as well as a discussion of chemical concentrations, application rates, equipment calibration and maintenance, application intervals, and demonstrations of proper equipment use.
2. **Pest knowledge:** farmers will be trained to recognize crop and animal pests and damaging threshold levels, as well as key cultural practices to promote seed health, and when pesticide use is necessary and appropriate.
3. **Storage:** proper storage of chemicals in relation to other structures on the property. The need for a separate, clearly marked and locked facility will be emphasized for exclusive storage of farm chemicals. Pesticides should be kept away from food for human or animal consumption or sources of drinking water. Pesticides should always be stored in their original containers.

4. **Transport:** safe transport of pesticides will be discussed (i.e. not using public transportation if possible, keeping chemicals in a closed environment, how to avoid punctures and torn bags, etc).
5. **Worker protection:** Types of personal protective equipment (PPE), when they should be worn and why, and how they should be cared for. The basic PPE recommended for all pesticide applications includes long-sleeved shirts, long pants, shoes and socks. According to the toxicity and label directions, chemical-resistant gloves, aprons, and masks may be required, and will be provided.
6. **Safety practices:** proper mixing techniques, the importance of reusing rinse water for mixing, and the importance of not contaminating water sources. The types of containers used in chemical preparation, their proper use, cleaning and storage will be addressed. Applicators will be taught not to eat, drink or smoke while applying pesticides.
7. **First aid and medical facilities:** first aid materials must be made available (soap, clean water and a towel) especially in case of spills. Participants will be taught to identify the primary symptoms of chemical exposure and what do to in an emergency.
8. **Waste Management:** how to clean up and safely dispose of any chemical not used. For liquids, empty containers will be rinsed 3 times, and emptied into the spray tank as part of the application mixture. When the product is used completely, chemical containers should be triple-rinsed and punctured before being buried. Containers should NEVER be reused.
9. **Protection of drinking water:** Training will emphasize the importance of protecting potable water sources and avoiding contamination of ground and surface waters. Participants will be trained to identify their drinking water source, and to keep all pesticides away from that source. Characteristics of the water source and mitigation measures to avoid contamination will be addressed.
10. **Environmental safety:** the importance of protecting natural resources and the proper use of pesticides to avoid environmental contamination and impacts on non-target organisms will be addressed. An additional training phase will be targeted towards women and children who may come into the production fields or who may be exposed to residues on the clothing of their spouses at home. Basic training materials in local languages, with illustrations will be developed for this purpose.

Training for those exposed to treated seed may be somewhat limited in scope, but should include the following:

Wear the appropriate PPE: Do not allow pesticide-treated seed to contact skin, eyes, hair, or any other part of the body. Do not allow untrained or unprotected people in the field where seed is being distributed and planted. This is very important for women, children, the elderly and other sensitive receptors. Wash the PPE and equipment immediately after use, and only at designated sites. Do not bring contaminated clothing home.

The RPLRP will adopt a strategy where extension services stress usage of a few basic pieces of protective clothing and then working into more complete coverage after the first few have been adopted. Communities could be encouraged to form professional spray teams that would be hired. These could be more efficiently trained to wear protective equipment.

11.3 IPMF Implementation Budget

The estimated total cost for IPMF implementation is indicated in the table 16 below and included the resettlement implementation costs. The program management team of RPLRP will be responsible in the implementation of this IPMF and estimated costs for the various activities under this program will be built in the budget. The core activities will be as follows:

- a) Coordination
- b) Development of IPM packages for the RPLRP investments
- c) IPM orientation workshops
- d) Training of trainers and Farmer groups training
- e) Public awareness and promoting the adoption of IPM practices
- f) Field guides/training materials for production, purchase and distribution
- g) Farmers field days
- h) Field visits and study tours
- i) Database for human-health and environmental contamination
- j) Crop pest surveillance and updating pest/disease database
- k) Annual workshops on progress and lesson learnt
- l) Participatory IPM research and development
- m) Monitoring and evaluation

Table 16. Tentative cost estimates of budgetary requirements (USD)

Line item	Year 1	Year 2	Year 3	Year 4	Total
Capacity Building					
IPM orientation	5,000	5,000	5,000	5,000	20,000
TOT	20,000	10,000	10,000	10,000	50,000
FG training	10,000	10,000	10,000	10,000	40,000
Database	5,000	5,000	5,000	5,000	20,000
Surveillance	15,000	10,000	5,000	5,000	35,000
Workshop	20,000	10,000	10,000	10,000	50,000
					215,000
Research & Development					
Participatory IPM	30,000	10,000	5,000	5,000	50,000
Field days	40,000	20,000	5,000	5,000	70,000
					120,000
Advisory Services					
Field guides/IPM materials	10,000	10,000	10,000	10,000	40,000
Public awareness	10,000	10,000	10,000	10,000	40,000
Pest specialist	25,000	25,000	25,000	25,000	100,000
M&E	30,000	30,000	30,000	30,000	120,000
Coordination	15,000	15,000	15,000	15,000	60,000
					360,000

APPENDIX 1 – List of Registered Pesticides and Insecticides in Ethiopia

No	Trade Name	Common Name	Approved uses	Registrant
1	ACE 750 SP	Acephate	For the control of aphids, thrips and caterpillars on flowers.	27
2	Actara 25 WG	Thiamethoxam 250g/kg	For the control of aphids, white fly & caterpillar on flowers.	6
3	Actellic 2% dust*	Pirimiphos-methyl	For the control of storage pests on cereals and pulses.	6
4	Actellic 50 EC*	Pirimiphos – methyl	For the control of aphids in cotton.	6
5	Actellic 50 EC	Primiphos methyl 50% EC	For the control of mosquitoes (<i>Anopheles arabiensis</i>).	6
6	Adonis 12.5 UL*	fipronil 12.5% ULV	For the control of locusts.	3
7	Agro-Lambacin Super 315 EC	Profenfos 30% + Lambda-Cyhalothrin 1.5%	For the control of African Bollworm (<i>Helicoverpa armigera</i>) cotton.	9
8	Agro-Thoate 40% EC*	Dimethoate 40% EC	<ol style="list-style-type: none"> 1. For the control of beanfly (<i>Ophiomyia phaseoli</i>); Bean aphid (<i>Aphis fabae</i>); Thrips (<i>Taenothrips spp.</i>) ABW (<i>Helicoverpa armigera</i>) on french beans. 2. For the control of aphids (<i>Myzus persicae</i>) and ABW (<i>Helicoverpa armigera</i>) on tomato. 3. For the control of cabbage Aphid and various aphids on cabbage and potato, respectively. 	9
9	Akito 2.5% EC	Beta cypermethrin	For the control of stalk borer on Maize	5
10	Alphahock 7.5% ULV	Alphacypermethrin 7.5% ULV	For the control of sweet potato butterfly on sweet potato	5
11	Alphos 56% Tab.	Aluminium Phosphide 560 gm/kg	Insecticide (Fumigant) for the control of maize weevil on maize.	33
12	Apron Star 42 WS	thiamethoxam 20% + metalaxyl - 20%	For the control of Russian wheat aphid on barley (To be used as seed treatment pesticide)	6

		+ difenoconazole 2%		
13	Avaunt 150 SC	Indoxacarb	For the control of stalk borer on maize, sweet potato butter fly on sweet potato, caterpillars on flowers & African boll worm on cotton.	5
14	Basudin 600 EW****	Diazinon	For the control of armyworm and other pests on cereals.	6
15	Baythroid 050 EC*	Cyfluthrin	For the control of shoot fly, aphids, fleas and stock borer on sorghum.	11
16	Bestox 7.5 ULV*	Alphacypermethrin	For the control of African bollworm on cotton.	3
17	Celphos	Aluminium phosphide 56% table	for the control of maize weevil (<i>sitophilus</i> spp) and flour beetle (<i>Tribolium</i> spp) on stored maize.	24