HOW TO PREPARE ENVIRONMENTAL ASSESSMENTS OF PESTICIDE USE IN A.I.D. PROJECTS

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FOREWORD AND ACKNOWLEDGEMENTS

To meet its objectives in developing country projects, the U.S. Agency for International Development (A.I.D.) has to deal with a range of insects, diseases, weeds, rodents, and other harmful pests. Pesticides are often used to control these organisms.

Use of pesticides in developing countries requires special understanding and responsibilities. Some developing countries have no laws to govern the importation, domestic use, and disposal of pesticides. Countries with laws often lack the resources to enforce proper use.

Since 1978, A.I.D. has required an "Environmental Assessment" (EA) of pesticides for use in its projects. The purpose of an EA is to alert A.I.D. officials and host country decision makers of potential risks and to avert use of unacceptable pesticides. The EA identifies less hazardous pesticides and nonchemical alternatives, and specifies safety measures, training, and research so that pesticides will be used properly as a component of integrated pest management (IPM).

A.I.D. has depended heavily on the Consortium for International Crop Protection (CICP) in preparing the Environmental Assessments. CICP in fact has developed more A.I.D. Assessments of pesticides than any other organization. CICP staff and consultants, representing a diverse range of expertise in pest and pesticide management and related fields, have assisted nearly every A.I.D. mission and overseas office with EAs. In addition, CICP personnel have helped with follow-up training, research, and monitoring.

This guide was developed to help CICP consultants, A.I.D. staff, and A.I.D. contractors conduct accurate and complete Assessments of pesticides. It is based on the experience of many who have participated (through CICP) in developing EAs.

The assistance and experience of CICP consultants, developing country collaborators, and A.I.D. employees and contractors were invaluable in preparing the guide. We especially acknowledge the efforts of the late Dr. Frederick W. Whittemore and Mr. Carroll W. Collier (retired), both formerly of the A.I.D. Bureau of Science and Technology, Office of Agriculture. Dr. Whittemore and Mr. Collier directed and assisted the CICP staff and CICP consultants in developing dozens of EAs. We also acknowledge the following colleagues for reviewing and commenting on a draft of the guide: Mr. Bill Barclay (Greenpeace), Dr. Carl S. Barfield (University of Florida), Dr. Hiram Larew (A.I.D. Bureau of Science and Technology), Dr. Angel A. Chiri (A.I.D. Bureau for Latin America and the Caribbean), and Dr. William A. Overholt (A.I.D. Bureau of Science and Technology). We are grateful for their guidance and assistance.

We also are grateful for the very special and untiring efforts of CICP's founder and former Executive Director, Dr. Ray F. Smith. As Executive Director of CICP, Dr. Smith was the principal architect of A.I.D. efforts that emphasized environmentally less hazardous and economically efficient pest and pesticide management.

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ACRONYMS AND ABBREVIATIONS

ADI	-	Acceptable Daily Intake
A.I.D.	-	U.S. Agency for International Development
CFR	-	Code of Federal Regulations
CICP	-	Consortium for International Crop Protection
EA	-	Environmental Assessment
EIS	-	Environmental Impact Statement
EPA	-	U.S. Environmental Protection Agency
FAO	-	Food and Agriculture Organization of the United Nations
FDA	-	U.S. Food and Drug Administration
FIFRA	-	Federal Insecticide, Fungicide, and Rodenticide Act
IEE	-	Initial Environmental Examination
IPM	-	Integrated Pest Management
MRL	-	Maximum Residue Limit
U.S.	-	United States of America
WHO	-	World Health Organization of the United Nations

INTRODUCTION

The introduction after World War II of synthetic organic pesticides such as the insecticide DDT and the herbicide 2,4-D began a new era in pest control. Hundreds of synthetic organic insecticides, herbicides, fungicides, nematicides, rodenticides, and other chemical pesticides entered commercial markets.

The availability of modern pesticides led to widespread acceptance and reliance upon them. Chemical control soon became the predominant method of pest control in many countries. Current trends indicate that the use of pesticides in developing countries is increasing more rapidly than in developed countries. Pesticide use in Africa, Asia, and Latin America could double over the next ten years if trends continue.

Most pesticides being used in developing countries originate in industrialized nations. About 30% of total U.S. pesticide production is exported. The exports include pesticides not registered for any use, or considered too dangerous for unrestricted use, in the U.S.

Chemical pesticides have spread much faster in developing countries than the capability to ensure their effective and proper use. Many of these countries do not have laws to govern importation, use, and disposal of toxic chemicals. Even if they have laws, governments frequently lack the means to enforce them.

The U.S. Agency for International Development (A.I.D.) now requires a risk-benefit evaluation of pesticides and pest control practices used in the Agency's overseas assistance projects. A.I.D. policy is to encourage use of nonchemical pest control methods and practices that reduce reliance on chemical control. When pesticides are used, it is A.I.D. general policy to avoid using pesticide chemicals that the U.S. Environmental Protection Agency (EPA) has not registered or has registered with restriction because their toxicity warrants special handling. A.I.D. approves use of pesticides only if a review indicates a favorable benefit-risk ratio.

The purpose of this guide is to assist consultants of the Consortium for International Crop Protection (CICP), A.I.D. staff, and A.I.D. contractors when developing Environmental Assessments of pesticides in A.I.D. projects. The guide tells what is needed and how to proceed when conducting the Assessments. It will help to minimize time spent on the Assessments and avoid errors and omissions that can delay A.I.D. decision making.

WHAT IS AN ENVIRONMENTAL ASSESSMENT?

In the A.I.D. system, an Environmental Assessment is "a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment of a foreign country or countries."[1] The purpose of the EA is to alert A.I.D. and host country decision makers of the

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[1]International Development Cooperation Agency, Agency for International Development, 22 CFR Part 216, Environmental Procedures, §216.1(c)(3), October 9, 1980.

potential for significant environmental effects in A.I.D. projects and outline steps for avoiding or minimizing adverse effects. Procedures for the EA appear Title 22 of the Code of Federal Regulations, Part 216 (abbreviated as 22 CFR Part 216), known as Environmental Procedures, which appears as Annex 1.

Steps Leading to an Environmental Assessment

Need for an EA is determined as the A.I.D. project is developed (see Figure 1). The A.I.D. project document (Project Identification Document or Project Paper) includes an Initial Environmental Examination (IEE), which precedes the EA. The IEE is the first review of the foreseeable effects of a proposed action (e.g., use of pesticides) on the environment. Its function is to provide A.I.D. officials the basis for reaching a "Threshold Decision". A Positive Threshold Decision indicates that the proposed action may have a significant effect on the environment. A Negative Declaration indicates that the proposed action should not have a significant impact on the environment. A Positive Threshold Decision requires preparation of an EA or, rarely, Environmental Impact Statement (EIS). An EIS is similar to an EA except it requires a more rigorous review (by both U.S. and host country agencies) and usually public hearings on the proposed action.

The EAs may cover a range of proposed environmental actions, such as road building, etc. Some of the EAs are devoted entirely to pesticide use. This guide considers assessment of pesticides.

WHAT IS MEANT BY "PESTICIDE"?

"Pesticide," from the words "pest" and "cide" (a Latin derivative meaning killer), is a chemical agent that kills or in some other way diminishes the actions of pests. Pests include harmful insects and other invertebrate organisms, weeds, microorganisms, rodents, and birds.

Pesticides are classified according to their function -- insecticide to control insects, fungicide to control fungi, etc. The principal types of pesticides appear in Table 1.

In A.I.D. livestock production projects, it is important to distinguish pesticides used to control parasites that harm animals or cause disease from drugs used to combat disease directly. Drugs come under the jurisdiction of the U.S. Food and Drug Administration (FDA) and are handled differently. If in doubt about the status of a livestock chemical, contact EPA's Registration Division, Insecticides and Rodenticides, Washington, DC 20460 (telephone: 703-557-2400).

Sometimes a pesticide may appear to be the only method for controlling a pest. However, by assessing the situation it is often possible to find cheaper, longer lasting, and less hazardous methods. Integration of effective nonchemical control methods (Table 2) within an ecological framework may reduce or even eliminate the need for chemical pesticides.

Figure 1. Steps Leading to the Decision for an Environmental Assessment in A.I.D. Projects Per Title 22 of the Code of Federal Regulations, Part 216, Environmental Procedures

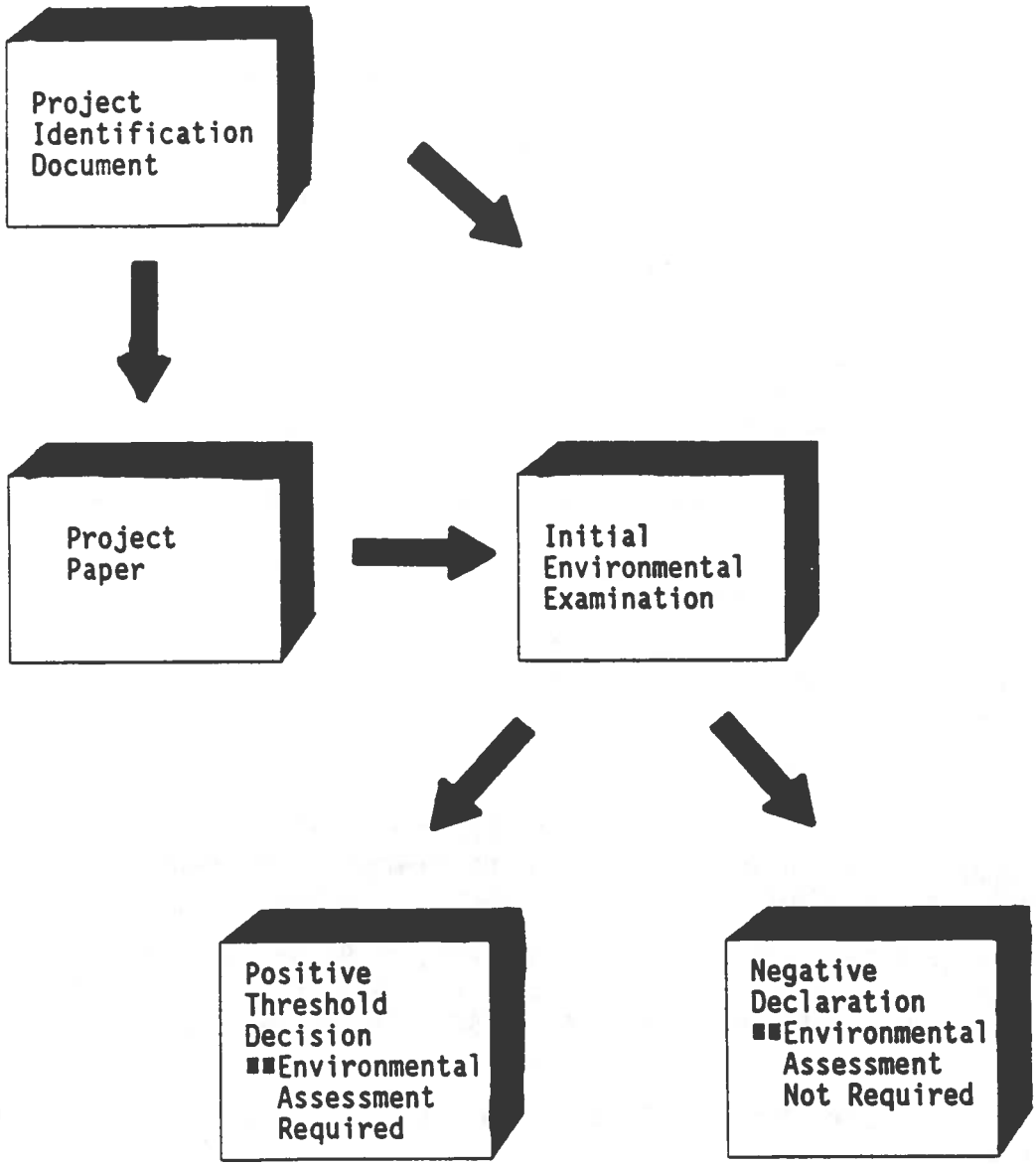

Table 1. Pesticides Classified According to Function

Pesticide	Pest group controlled or function of the pesticide
Acaricide	Mites, ticks, and spiders
Algicide	Algae
Attractant	Attracts pests (pheromones, baits, and miscellaneous chemicals)
Avicide	Birds
Bactericide	Bacteria
Defoliant	Removes plant foliage
Desiccant	Removes water from plants and arthropod pests
Fungicide	Fungi
Growth regulator	Regulates plant or animal growth
Herbicide	Weeds
Insecticide	Insects, mites, and related arthropods
Miticide	Mites
Molluscicide	Mollusks such as snails and slugs
Nematicide	Nematodes
Piscicide	Fish
Predacide	Vertebrate pests
Repellent	Repels animals
Rodenticide	Rodents
Silvicide	Trees and woody shrubs

WHAT IS NEEDED TO CONDUCT AN ASSESSMENT?

Conducting an Environmental Assessment of pesticide use requires access to a range of information appearing below. A check (√) appears by each of the essential documents.

A.I.D. Documents

- √ A.I.D. Environmental Procedures (22 CFR Part 216) (Source: A.I.D. Handbook No. 3, Appendix 2D). The Environmental Procedures appear in Annex 1 of this guide.
- √ The Project Identification Document, Project Paper, or other A.I.D. documents (Program Assistance Initial Proposal or Program Assistance Approval Document) that describe the proposed action (Source: A.I.D. Project Officer).
- √ The Initial Environmental Examination, if any (Source: A.I.D. Project Officer).
- √ Any earlier Environmental Assessments of the A.I.D. project (Source: A.I.D. Project Officer).

Table 2. Examples of Alternatives to Chemical Pesticides

Insects, mites, and other invertebrates	Plant diseases	Weeds	Vertebrate pests
Biological control Conservation, augmentation, inoculation, and habitat manipulation with parasites, predators, and pathogens Plant resistance Environmental manipulations Plant spacing Intercropping Timing of planting and harvesting Crop rotation Water management Fertilizer management Soil preparation Sanitation Trap crops Induced sexual sterility Physical and mechanical control Screens Traps Fly swatters Protective packaging Barriers Flaming and burning Hand picking Attraction and repellency Attractants Repellents Genetic manipulation of pest populations Lethal genes Male-producing genes Botanical insecticides	Disease resistance in host plants Reduction of losses by manipulations of plants and pathogens Control of plant pathogens by antagonists, hyperparasites, and natural enemies Disease- and nematode-free seed and propogating material Crop rotation and soil management Vector control Nematode attractants and repellents Sanitation Destruction of inoculum Roguing Intercropping Destruction of alternate hosts	Biological control Insects and other herbivores Diseases Environmental manipulation Choice of variety Seedbed preparation Method of seeding or planting Seeding rates and row spacing Fertilizer management Cultivation Irrigation and water management Erosion control Design of irrigation and drainage canals and ponds Managed grazing Sanitation Flaming and burning Natural stimulants and inhibitors Plant competition Revegetation of weed- and brush-infested grazing lands Breeding highly competitive forage species Oversowing Green manures and cover crops Crop rotations	Noise and physical repellents Chemical repellents Trapping and shooting Behavior Environmental manipulation Exclusion Visual repellents

Source: Modified from President's Science Advisory Committee. 1965. Restoring the quality of our environment. The White House. U.S. Government Printing Office, Washington, DC

- √ A.I.D.'s Endangered Species Act (Section 119 of the Foreign Assistance Act) (Source: A.I.D. Project Officer).

Technical References

- √ Local and international publications on pests, pesticides, alternative methods of control, and integrated pest management (Source: Libraries, universities, and host country ministries).

- √ Pesticide labels, container wrappers, or supplemental literature accompanying the proposed pesticides (Source: Pesticide manufacturers and dealers).

- √ Current Pesticide Chemical News Guide (updated periodically) (Source: Louis Rothschild, Jr., 1101 Pennsylvania Avenue, S.E., Washington, DC 20003, telephone: 202-544-1980).

- √ Title 40, Part 180 (pesticide tolerances for raw agricultural commodities) and Title 21, Part 193 (pesticide tolerances for processed foods) of the Code of Federal Regulations (updated periodically) (Source: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9371).

- √ Guide to Codex Maximum Limits for Pesticide Residues (updated periodically) (Source: Joint FAO/WHO Food Standards Programme, Codex Alimentarius Commission, Pesticide Residues, The Netherlands).

- √ Suspended, Cancelled, and Restricted Pesticides (updated periodically) (Source: Office of Pesticides and Toxic Substances, Office of Compliance Monitoring (EN-342), U.S. Environmental Protection Agency, Washington, DC 20460, telephone: 202-382-3807).

- √ Current Report on the Status of Chemicals in the Special Review Program and Registration Standards in the Reregistration Program (updated periodically) (Source: Public Information Branch, Field Operations Division, Office of Pesticide Programs [H7506C], U.S. Environmental Protection Agency, Washington, DC 20460, telephone: 703-557-2805).

- √ Recent publications and maps that describe the natural environment where the proposed pesticides are to be used. A.I.D.'s environmental profiles of various developing countries are excellent references (Source: A.I.D. or host country).

- √ EPA Crop Groupings [40 CFR 180.34(f)(9)] (Source: Distribution [PM 215], U.S. Environmental Protection Agency, Washington, DC 20460, telephone: 202-382-2118).

- Current Farm Chemicals Handbook (updated annually) (Source: 37841 Euclid Ave., Willoughby, Ohio 44094, telephone: 216-942-2000, telex: 212556 MPCO, fax: 216-942-0662).

- Crop Protection Chemicals Reference (updated annually) (Source: MSDS Reference for Crop Protection Chemicals, c/o John Wiley & Sons, Inc., 605 Third Avenue, New York, New York 10157-0228).

- Recognition and Management of Pesticide Poisonings; 4th edition, March 1989 (Source: Public Information Branch, Field Operations Division, Office of Pesticide Programs [H7506C], U.S. Environmental Protection Agency, Washington, DC 20460, telephone: 703-557-2805).

Documents on Local Laws and Regulations

- √ Laws and regulations governing pesticide use in the host country (Source: Host country ministry of agriculture, ministry of natural

resources, or other ministry or office responsible for the laws and regulations).

- √ Laws and regulations on environmental protection, endangered species, or related environmental matters (Source: Host country ministry of natural resources or other ministry or office responsible for the laws and regulations).

- Lists of pesticides (by products) approved for use in country and (if available) quantities of pesticides imported to or produced in country for most recent year available (Source: Host country ministry of agriculture or other ministry or office responsible for compiling information on pesticides).

Other Sources

In addition, the following are useful and may be required to complete the assessment:

- Scientific publications on the impacts of pesticides on human health, environment, and socioeconomic factors (Source: Libraries).

- Residues in Foods (updated annually) (Source: U.S. Food & Drug Administration, Pesticide Program, 5600 Fishers Lane, Rockville, Maryland 20857, telephone: 301-443-1815).

- Health data on pesticide poisoning in country (Source: Host country ministry of health or other ministry or office responsible for health).

- PEST-BANK and CHEM-BANK databanks on CD-ROM (updated quarterly) (Source: SilverPlatter Information, Inc., One Newton Executive Park, Newton Lower Falls, Massachusetts 02162-1449, telephone: 800-343-0064, fax: 617-969-5554).

PEST-BANK and CHEM-BANK provide current information on pesticides registered by EPA. PEST-BANK provides information on residue tolerances for all EPA registered pesticides and is a good way to determine which pesticides are in EPA's restricted use category. CHEM-BANK provides toxicological data (human health and environmental effects) for some of the EPA-registered pesticides. The databanks are on CD-ROM disks accessed by computer.

Always Consult the Pesticide Label

The label includes all information printed on or attached to the pesticide container. The importance of the label cannot be stressed too often. If it is read and understood and all the directions are followed, the likelihood of misusing the material or of having an accident is greatly reduced. Unfortunately, many pesticides in developing countries are sold without labels, the labels are in a foreign language, or the labels are too difficult for applicators to understand. These problems are at the root of much of the pesticide misuse in developing countries.

Preparers of EAs must carefully assess all available label information. They must read and understand all directions on the label when developing the EA. They must determine if labels are understandable to farmers and other users.

A label for a pesticide registered by EPA includes the following information (see Glossary, page 28, for definition of terms):

- Brand name.
- Chemical name.
- Common name.
- Formulation.
- Ingredients.
- Contents.
- Manufacturer.
- Registration and establishment numbers.
- Signal word.
- Precautionary statements.
- Statement of practical treatment.
- Statement of use classification.
- Directions for use.
- Misuse statement.
- Reentry statement.
- Storage and disposal directions.
- Warranty.

GENERAL PROCEDURES

Briefing in Washington, DC

A briefing in Washington, DC is usually essential before beginning the EA. The briefing may be required to acquire critical A.I.D. documents. It is an opportunity to meet A.I.D. environmental officers, pest management advisors, and others who may be reviewing the EA. They will have made preliminary arrangements for the host country visit and usually can suggest useful contacts there.

Upon Arrival in Host Country

Upon arrival in the host country, contact the designated A.I.D. representative for briefing and instructions. The A.I.D. representative usually will identify host country counterparts or other collaborators. Give governmental and nongovernmental host country representatives ample opportunity to participate in developing the EA.

The Environmental Assessment's Content and Form

The Environmental Assessment should include the following:

1. Cover page: The cover shows the name of the A.I.D. project, mission, and country; name, professional discipline, and affiliation of each person responsible for conducting the EA; name and address of the contractor in charge of the EA; and date.

2. Summary: The summary presents the major conclusions, areas of controversy, if any, and the issues to be resolved.

3. Introduction: This section describes why the Environmental Assessment was developed. The Initial Environmental Examination in the A.I.D. Project Identification Document or Project Paper describes why a positive Threshold Decision was reached and the EA is needed.

4. Pesticide Procedures: This section addresses the following factors, a. to l., in accordance with 22 CFR 216, §216.3(b)(1):

   a. The EPA registration status of the requested pesticide(s).

   b. The basis for selection of the requested pesticide(s).

   c. The extent to which the proposed pesticide use is part of an integrated pest management program.

   d. The proposed method or methods of pesticide application, including availability of appropriate application and safety equipment.

   e. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed pesticide use and measures available to minimize such hazards.

   f. The effectiveness of the requested pesticide(s) for the proposed use.

   g. Compatibility of the proposed pesticide(s) with target and nontarget ecosystems.

   h. The conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.

   i. The availability and effectiveness of other pesticides or nonchemical control methods.

   j. The requesting country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide(s).

   k. The provisions made for training of users and applicators.

   l. The provision made for monitoring the use and effectiveness of the pesticide(s).

5. Summary of mitigative measures and requirements: This section summarizes measures to reduce negative environmental impacts and may include a budget of costs to implement the measures. Practical needs (training, research directed at finding nonchemical alternatives, safety equipment, storage facilities, pesticide enforcement procedures, new publications, etc.) should be emphasized.

6. References cited: This section should list citations of technical articles and other documents used as sources for all significant assertions and scientific data presented.

7. Collaborators and Persons Contacted: This section should list the names, disciplines, affiliations, and contributions of host country representatives, A.I.D. staff, EPA staff, and any others who provided information or were contacted about the EA.

8. Recommended Distribution: This section should identify the names and addresses of key host country representatives and A.I.D. contractors who should receive the approved Environmental Assessment. The list of persons to receive the EA should be compiled in consultation with designated A.I.D. personnel.

9. Annexes: If host country pesticide laws and regulations exist, they should be presented as annexes. Annexes should also include copies of labels of the proposed pesticides and a list of pesticides approved for use in country, if available.

Before Departing Host Country

The last step before departing the host country is to debrief designated A.I.D. personnel in the overseas mission. If the Environmental Assessment is not completed, inform them when it will be available. Also, determine if they expect any follow-up assistance in revising the EA, etc.

Debriefing in Washington, DC

A debriefing at A.I.D. in Washington, DC may be necessary or helpful.

STEP-BY-STEP PROCEDURES

Writing Style

When writing an EA:

- Clearly define words or terms that a lay person may not understand.
- Explain the dual naming systems used for both living things (Latin name and common name) and pesticides (common and trade names) and be consistent in use of names.
- Give a reference for all significant assertions and scientific data presented. The EA should have a list of references cited.
- Beware of making unfounded or possibly mistaken assertions.
- Do not use sexist language. When referring to farmers, for instance, use "they" instead of "he" or "she."

Pesticide Procedures

The Pesticide Procedures section (see page 9) of the Environmental Assessment should take the following form:

a. The EPA Registration Status of the Requested Pesticide(s).

This section should indicate for each proposed pesticide: (1) if EPA has registered the pesticide for the proposed use(s), (2) the EPA classification category, and (3) if EPA is presently reviewing the pesticide because of suspected problems. Copies of sample labels of the pesticides, obtained in the country of proposed use, should be attached as an annex of the EA.

EPA Registration Status

EPA is responsible under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for registering pesticides. FIFRA requires EPA to take into account economic, social, and environmental costs and benefits in making decisions. EPA may classify a product for "restricted use" if its toxicity warrants special handling. Use of one formulation of a pesticide may not be restricted but another formulation may be. EPA registers a pesticide according to its formulation and intended use.

In the U.S., only pesticide applicators who have been certified by law can purchase restricted pesticides. The restricted materials have a high potential for causing harm to humans and/or environment. They are too hazardous for general use in A.I.D. projects, but in exceptional circumstances they may be approved if their use is determined essential and the project includes a training component to minimize hazards.

The EPA registration status of all proposed pesticides must be determined, using one of the following sources:

- Pesticide labels. The labels of pesticides sold in the U.S. include the EPA registration number and indicate all uses for which registered. Foreign labels of the same pesticide chemicals may, but usually do not, include information on EPA registration.

- PEST-BANK. PEST-BANK (updated every 3 months) will provide all information needed on registration.

- Pesticide Chemical News Guide. This Guide (updated periodically) lists EPA tolerances (or exception from tolerances) for pesticides on specific crops. Inclusion of an EPA tolerance in the Guide indicates that the pesticide has been registered for that specific crop use.

- Crop Protection Chemicals Reference. This publication compiles information appearing on labels of EPA-registered pesticides. However, it does not include information for many EPA-registered pesticides and is only published once per year.

- Suspended, Cancelled, and Restricted Pesticides. This EPA publication lists those pesticides that EPA has suspended, cancelled, or restricted. The publication's limitation is that it is updated infrequently.

- EPA's Office of Pesticide Programs, Registration Division (telephone: 703-557-7700).

A.I.D. policy is to use unclassified (general use) pesticide chemicals that EPA has registered for the same or similar uses in the U.S. "Similar" refers to crops in related botanical categories (e.g., tuber crops). EPA Crop Groupings [40 CFR 180.34(f)(9)] provides guidelines on crop groupings.

Pesticides not registered by EPA or registered in EPA's restricted use category may be considered for approval on human and animal food crops in A.I.D. projects if the following provisions are met:

- For restricted use pesticides, there must be a training component in the project to assure proper use.

- For pesticide chemicals without EPA tolerances, the chemicals must have an acceptable daily intake (ADI) and maximum residue limit (MRL) established by the FAO/WHO Codex Alimentarius Commission for the crop(s) in question and use patterns must assure that those tolerances will not be exceeded (see discussion under Tolerance Requirements).

- For all pesticides, the chemicals must not have been cancelled, withdrawn, or suspended in the U.S. because of health or environmental concerns.

However, in these cases approval will depend on current information about the chemicals in question and whether they can be used properly under the particular circumstances.

Tolerance Requirements

The tolerance of a pesticide is the minute trace permitted to remain in or on raw agricultural commodities or processed foods. Some pesticides are sufficiently low in hazard to be exempt from tolerance requirements. Tolerances are set by EPA for each individual crop or food type. Some pesticides have no tolerances because EPA has not established them yet.

The following sources indicate if EPA has established tolerances for specific pesticides on specific crops or other commodities:

- The labels of EPA registered pesticides.

- Title 40, Part 180 (raw agricultural commodities) and Title 21, Part 193 (processed foods) of the Code of Federal Regulations.

- Pesticide Chemical News Guide.

- PEST-BANK.

Tolerances are assigned by crop. EPA has established crop groupings that link major crops with minor crops (including many tropical crops) having similar growth and consumption patterns. A tolerance that applies to one crop in a group can be extended to the others. The crop groupings are given in 40 CFR 180.34(f)(9).

The Food and Drug Administration is mandated by law to monitor foods imported into the United States. One objective of the monitoring is to insure that EPA tolerances for pesticide residues are not exceeded and that residues of pesticides not registered by EPA for use on a particular product are not present. It is therefore important that only EPA-registered products are used on crops for export to the U.S. and that the rates and frequency of application, together with the prescribed harvest intervals, do not result in residues exceeding such tolerances.

The FAO/WHO publication, Guide to Codex Maximum Limits for Pesticide Residues, recommends tolerances for specific pesticides on specific crops. The Guide includes tolerances for pesticides on crops for which EPA tolerances do not exist. Pesticides with FAO/WHO-recommended tolerances may be used in A.I.D. projects, but treated crops should not be exported to the U.S. unless the FAO/WHO tolerances have been approved by EPA. EPA's Office of International Activities, telephone: 202-382-4870, should be contacted if there is a question about EPA-approval of FAO/WHO-recommended tolerances.

EPA Special Review Program

EPA's Special Review program (formerly called Rebuttable Presumption Against Registration) studies pesticides to determine if their use presents unacceptable risks. The criteria for initiating a Special Review of pesticide uses include:

- Potential acute toxicity to humans or domestic animals.
- Potential adverse chronic effects in humans.
- Hazards to nontarget organisms.
- Separate criteria for hazards to threatened or endangered species.
- Other adverse effects that would permit EPA to initiate a Special Review in circumstances where potential risks may not be anticipated by specific criteria.

The Special Review study may take several years. At the end of the study, EPA may decide to cancel (ban) the pesticide or restrict its use, or may take no action if the Special Review fails to confirm substantial risks. The use in A.I.D. projects of pesticides under Special Review should be avoided if acceptable alternatives are available. They may be harmful, and if they are canceled or restricted during the life of a project, alternatives will have to be found and substituted quickly.

The following EPA publication lists the pesticides in the Special Review program and why the pesticides are being reviewed:

- Report on the Status of Chemicals in the Special Review Program and Registration Standards in the Reregistration Program (updated periodically).

EPA's Office of Pesticide Programs, Registration Division (telephone: 703-557-7700) should be contacted about questions concerning the Special Review status of a pesticide or recent changes in its registration.

The EA should indicate if any of the proposed pesticides are in the Special Review program and why EPA has put them in Special Review, as indicated in the EPA publication above. The EPA rationale for the review may include one or more of, but not necessarily be limited to, the factors in Table 3 (see Glossary, page 28, for unfamiliar terms).

Format

Much of the data for section a. of the Pesticide Procedures can be summarized in a table such as Table 4. If EPA has not established tolerances for a pesticide on a crop but FAO/WHO has established ADI/MRL levels, indicate so in a table footnote.

b. The Basis for Selection of the Requested Pesticide(s).

This section should briefly explain what criteria were used to select the proposed pesticide(s), for example:

- Because of local availability, effectiveness, and past experience.
- Because small plot experiments showed the pesticide(s) to be promising.
- Because there are no known chemical or nonchemical alternatives.
- Because of low mammalian toxicity.

c. The Extent to Which the Proposed Pesticide Use Is Part of an Integrated Pest Management Program.

A.I.D. policy is to promote integrated pest management to the extent possible. Pesticides normally will be approved only if the EA shows that the proposed pesticide use will be in accordance with IPM principles.

IPM is a pest control system that uses the "best mix" of two or more control methods based on criteria of crop yield, profit, and safety. Pesticides are used only when cost-benefit analyses show that use is truly justified and will produce beneficial results.

IPM can decrease pest losses, pesticide use, and costs and increase crop yield and stability. Successful IPM programs have been developed for insects and mites, plant diseases, weeds, vertebrates, and snails and slugs attacking various crops. Some IPM technology as conceived by research workers is too complex for farmers in developing countries. However, numerous IPM systems developed in close collaboration with farmers have been widely adopted in many of these countries.

Table 3. Examples of Criteria that EPA Considers When Initiating a Special Review of Pesticide Uses

Oncogenicity	Acute toxicity
Mutagenicity	Thyroid effects
Teratogenicity	Acute and chronic toxicity to nontarget organisms
Fetotoxicity	Reduction in nontarget organisms
Reproductive effects	Testicular effects
Hazards to wildlife	Avian hazard
Toxic effects in liver and kidney	Hazard to aquatic organisms
Ecological effects	Neurotoxicity
Ground water contamination	Reduction in endangered species
No antidote	Bioaccumulation
Carcinogenicity	Chronic effects
Emergency treatment	

Table 4. Example of a Table for Summarizing the EPA Registration Use Category, Tolerances, and Special Review Status of Each of the Proposed Pesticides

Pesticide names[1]	EPA registration category		Status of tolerances for crops for which requested:[2]			EPA Special Review status
	General use	Restricted use	Millet[3]	Beans	Cabbage	
Fungicides						
Copper oxychloride (Cupravit)	X			E	E	
Herbicides						
Bentazon (Basagran)[4]	X			T		5
2,4-D (Acme), emulsifiable concentrate	X			NT[6]		7
Insecticides						
Bacillus thuringiensis (Dipel)	X		E		E	
Chlorpyrifos (Counter)	X		T			

[1]Approved common name in the Pesticide Chemical News Guide and (in parenthesis) the trade name. A pesticide may have one or more trade names.

[2]T=EPA Tolerance established; NT=No EPA tolerance; E=Exempt from EPA tolerance. (Pesticide Chemical News Guide 1988).

[3]Millet is in cereal grains crop category of EPA's Crop Grouping [40 CFR 180.34(f)(9)], which includes the commodity corn. Status of tolerances for millet is based on tolerances established for corn.

[4]Bentazon will be used only in research demonstration plots under careful supervision by project supervisors.

[5]Bentazon is under Special Review because of suspected ground water contamination.

[6]No FAO/WHO recommended tolerances either. Treated beans will not be consumed; 2,4-D is to be included only as a reference treatment in farmer field trials.

[7]2,4-D is under Special Review because of suspected oncogenicity.

The EA should encourage the development and use of IPM. It should descril the existing use of IPM and indicate any requirements (including budget) for IPM training, research, etc. The requirements should be described in the EA's summary of mitigative measures and requirements.

Guidelines for IPM Programs

The EA should briefly describe the IPM program and how the proposed pesticide use will be integrated into it. Use of monitoring, nonpesticidal methods, and other features of the IPM program should be discussed along with pesticide use.

Specifics of an IPM program will depend on the crop, cropping system, pest complex, economic values, social conditions, availability of personnel, and other factors. The general steps for developing an IPM program appear in the boxes on the following pages.

d. The Proposed Method or Methods of Pesticide Application, Including Availability of Appropriate Application and Safety Equipment.

This section should describe the method or methods of application, availability of application equipment, and need for and availability of safety equipment. Before developing this section, the EA preparer should visit project sites to observe how the farmers apply pesticides and the safety practices they use, and to determine needs.

The equipment should be suited to local conditions. Large, powerful, or expensive equipment usually is impractical in developing countries where farmers commonly use small, hand-operated sprayers or dusters. Indicate all needs for equipment and spare parts in the EA's summary of mitigative measures and requirements.

This section should also describe availability and additional need for clothing and equipment to protect applicators, others, and environment. The pesticide label is an excellent information source: it includes a precautionary statement of the pesticide's hazards and describes clothing and equipment that should be used to reduce the hazards. Table 5 is a protective clothing and equipment guide developed by the California Department of Food and Agriculture for pesticides in EPA toxicity categories I-III. Note, however, that local climatic or economic conditions may preclude the use of protective clothing. Protective clothing recommended for temperate areas may be physically unbearable in tropical climates. If the necessary protective clothing is physically unbearable, then pesticides requiring this clothing should not be proposed.

The EA should clearly summarize precautions and safety information indicated on the pesticide labels, such as:

- How to avoid drift to nontarget areas.
- The need to avoid smoking or eating while using pesticides.

- The need to prevent unprotected persons and livestock from entering treated areas until enough time has passed for them to be safe. The pesticide label indicates how much time is required.
- How to clean contaminated clothing.
- How to clean up pesticide spills.
- How to maintain the pesticide application equipment.
- How to dispose of unused pesticide and pesticide containers.
- How to store and transport the pesticides.

e. Any Acute and Long-Term Toxicological Hazards, Either Human or Environmental, Associated With the Proposed Pesticide Use and Measures Available to Minimize Such Hazards.

The purpose of this section is to point out potentially harmful acute (short-term) and long-term effects of the proposed pesticides and outline measures to reduce the effects. A table (see Table 6 for example) showing the pesticides' acute oral LD_{50} values, EPA toxicity categories, and signal words and reasons for EPA Special Review, if any, should be included. If any pesticides are under EPA Special Review, the reasons for the review should be discussed thoroughly in relation to their proposed use.

Acute Toxicological Hazards

Examples of acute effects on humans include problems related to absorption through skin, inhalation, or eye contact. Examples of acute environmental hazards include problems of toxicity to honey bees, fish, birds, or other wildlife. Other potential acute effects would include chemical explosions during fires. The pesticide label, CHEM-BANK, and Crop Protection Chemicals Reference are sources for information on the short-term effects.

A pesticide's acute oral LD_{50} is the best indication of its potential short-term toxicity to humans. It is the amount of the chemical necessary to kill 50% of the test animal population (usually laboratory rats). The acute oral LD_{50} is based on unit weight of pesticide per unit body weight of the test animal (mg/kg) when swallowed. Pesticides with the lowest LD_{50} values are potentially the most toxic to humans (see Table 7). Ingestion of just a few drops to a teaspoon of a pesticide with an oral LD_{50} of less than 50 might be sufficient to kill an adult person. An adult may have to consume 16 tablespoons to 0.5 kilogram or more of a pesticide with an oral LD_{50} of 5000 before dying.

However, the pesticide's formulation and percentage active ingredient and other factors such as health of the person determine its actual hazard level. A pesticide formulation with 15% active ingredient would be potentially more hazardous than a formulation of the same pesticide chemical with 5% active ingredient.

STEPS TO IPM

STEP 1: IDENTIFY THE MAJOR PESTS AND ESTABLISH ECONOMIC INJURY LEVELS

Dozens of potentially harmful species may infest a crop. However, only a few serious pest species normally recur regularly. The serious pests--known as key, primary, or chronic pests --that recur regularly at intolerable levels are the focal organisms for IPM programs.

The criterion that determines whether taking action to control a harmful species is profitable is called the "economic injury level". The economic injury level may be expressed in different ways depending on the crop and the pests. For example:

- Numbers of insects per plant.
- Percentage of fruit damaged by a given pest.
- Numbers of weeds per square meter.

The economic injury level is the "break even point" in pest management. Below this level, the cost of control is not justified. Above this level, control may be profitable.

Several factors will influence the economic injury level for a specific pest: crop variety and stage of development, economic value of crop, presence of natural enemies, cost of the control measure, external costs to health and environment, etc. The economic injury level depends on the damage function (the relationship between pest intensity and yield loss) as well as the economics of reducing the damage. It therefore will change as these variables

(continued)

EPA has grouped pesticides into four toxicity categories according to their potential for causing injury to people and assigned them signal words ("Danger", "Warning", or "Caution") corresponding to their toxicity categories (see Table 7). Category I pesticides are most toxic or hazardous and their use is normally restricted. These are too toxic for general use in A.I.D. projects. Many Category II pesticides are also too toxic. They are acceptable only if the EA indicates that project use patterns will adequately mitigate hazards.

The following sources can be used to determine a pesticide's oral LD_{50}, EPA toxicity category, and EPA signal word:

- Oral LD_{50}: Farm Chemicals Handbook and CHEM-BANK.
- EPA toxicity category: The pesticide label, Crop Protection Chemicals Reference, Farm Chemicals Handbook, and PEST-BANK or CHEM-BANK.
- EPA signal word: The pesticide label, Crop Protection Chemicals Reference, Farm Chemicals Handbook, and PEST-BANK.

The EA should highlight special needs for avoiding short-term hazards. Some general suggestions appear on the pesticide label, under:

- Precautionary Statements.
- Statement of Practical Treatment.

STEPS TO IPM

change. Economic injury levels developed in one area will not likely be appropriate for use in another area.

Research is needed to determine the initial economic injury levels. Then, before economic injury levels are recommended for wide-scale use, they should be tested on a few farmers' fields to verify their effectiveness. The levels can be refined as more information becomes available.

By inspecting fields regularly and basing pesticide applications on economic threshold criteria, pest control costs (and pesticide use) usually can be reduced and profits increased.

STEP 2: SELECT THE BEST MIX OF CONTROL TECHNIQUES

All methods and practices (see Table 2, page 5) should be considered for the IPM program. First consideration should be given to the use of preventive measures, namely:

- Resistant crop varieties.
- Biological control (conservation or augmentation of natural enemies already present or introduction of new natural enemies).
- Cultural control (cultivation, crop rotation, use of pest-free seed and planting stock, fertilizer management, intercropping, etc.).

(continued)

- Directions for Use.
- Reentry Statement (the amount of time that must elapse before a person enters an area treated with a pesticide).
- Storage and Disposal Directions (special instructions on storage and disposal).

Long-Term Toxicological Hazards

Examples of long-term (delayed) human health effects include oncogenicity, teratogenicity, carcinogenicity, and mutagenicity (see Glossary, page 28, for explanation). Examples of long-term ecological effects include decrease in biodiversity and ecological stability and contamination of aquifers. Years of continuous observation and complex research are often necessary before long-term effect on humans or ecosystems are known.

CHEM-BANK is a good source for information on long-term effects. The EPA Report on the Status of Chemicals in the Special Review Program and Registration Standards in the Reregistration Program identifies suspected long-term effects of those pesticides in EPA Special Review program.

STEPS TO IPM

Farmers may already be using one or more of these preventive measures. It is therefore important to survey the farmers before determining which measures are needed.

Pesticides should be used only if no practical, effective, and economic nonchemical control methods are available. Then they should be applied only to keep the pests from reaching economic injury levels. The pesticides and application techniques selected should cause minimal harm to humans, livestock, honey bees, natural enemies, and the environment.

STEP 3: MONITOR THE FIELDS REGULARLY

The growth of pest populations usually is related closely to stage of crop growth and weather conditions. However, it is difficult to predict severity of pest problems accurately in advance. The crops must be inspected regularly to determine the levels of pests, natural enemies, and crop damage.

Extension and commodity organization personnel can assist with field inspections. They can train the farmers how to separate pests from non-pests and natural enemies and to determine when crop protection measures, perhaps including pesticides, are necessary. This approach has been very effective in many developing countries.

(continued)

f. The Effectiveness of the Requested Pesticide(s) for the Proposed Use.

The effectiveness of a pesticide is its ability to produce a desired effect on a target organism. Effectiveness is difficult to measure and expert opinions are often biased. Weather conditions, level of resistance in the pest, methods of application, and other factors will determine how effective a pesticide is.

What to Report on Effectiveness

The EA should include the following for the proposed pesticides:

- Why the pesticides are being proposed. Are efficacy data available? Are the pesticides superior to nonchemical control measures or other pesticides? If efficacy data are not available, have pest control experts or farmers had experience using the pesticides?
- How will pesticide efficacy be monitored?
- Is pest resistance to pesticides a problem? Pesticide resistance is one of the most serious factors affecting pesticide use. Worldwide, over 600 species of pests have developed resistance to one or more chemical pesticides. The problem is so serious in some areas that effective pesticides are no longer available for some major pests, such as the diamondback moth attacking cabbages and other plants of the mustard family. Malaria eradication programs in many countries are in disarray because vector mosquitoes are no longer adequately controlled with available insecticides. Combatting resistant strains is not easy, and there may not always be solutions. The best strategy is to avoid the

STEPS TO IPM

STEP 4: USE ALL CONTROL METHODS CORRECTLY AND SAFELY

Each pest control method has both advantages and disadvantages. Extension personnel and others advising farmers should learn the advantages and disadvantages. They should develop educational programs to teach farmers how to use the control methods correctly and safely.

STEP 5: COMPLY WITH ALL LEGAL CONTROLS

Legal controls result from laws and regulations and include:

- Quarantines to prevent the entry and establishment of new pests.
- Local laws and regulations that govern pesticides.
- Pesticide restrictions and regulations in projects financed by outside donors.
- Laws relating to international transport and marketing of produce.

All local pesticide laws and regulations as well as A.I.D. regulations must be followed. The EA should determine what laws and regulations exist, assess enforcement, and recommend appropriate changes.

STEP 6: DEVELOP EDUCATIONAL, TRAINING, AND DEMONSTRATION PROGRAMS FOR FARMERS AND EXTENSION WORKERS

Implementation of IPM depends heavily on education, training, and demonstrations to help farmers and extension workers develop and evaluate the IPM methods. Practical hands-on training conducted in farmers' fields (as opposed to classroom) is a must. Special training for extension workers and educational programs for government officials and the public are also important.

problem of resistance by using pesticides sparingly and as a last resort in IPM systems.

g. Compatibility of the Proposed Pesticide(s) With Target and Nontarget Ecosystems.

This section should point to potentially harmful effects of pesticide use in the target (crop) ecosystem itself or surrounding crops or natural ecosystems.

This section requires site visit work to assess potential hazards to nontarget organisms, water, and other elements in the target crop and associated environment. Nontarget organisms such as natural enemies, honey bees, and other pollinators that inhabit target crops especially may be vulnerable. However, pesticides sometimes drift long distances. Highly volatile pesticides discharged from high pressure sprayers with small nozzles during windy conditions are the most prone to drift long distances.

The potential hazards in the treated area and in other areas where drift may be a problem should be described clearly.

Table 5. Protective Equipment and Clothing Guidelines For Pesticides in EPA Toxicity Categories I-III

Summarized label statement	Mixer-loader		Applicator	
	I-II	III	I-II	III*
Precautions should be taken to prevent exposure	A,B,C,F,G,H,R**	A,B,C,F,G,H	B,C,F,G,H,R**	C,F,H,R,**
Protective clothing or protective equipment is to be worn	A,B,C,F,G,H,R**	B,C,F,G,H,4**	B,C,F,G,H,R**	C,F,H,R**
Clean clothing is to be worn	C	C	C	C
Contact with clothing should be avoided	A,B,C	B,C	B,C	C
Contact with shoes should be avoided	B	B	B	B
Rubber boots or rubber foot coverings are to be worn	B	B	B	B
Contact with skin should be avoided	A,B,C,F,G,H	B,C,F,G,H	B,C,F,G,H	C,F,G,H**
A cap or hat is to be worn	H	H	H	H
An apron is to be worn	A	A		
Rubber gloves are to be worn	G	G	G	G
Contact with eyes should be avoided	F	F	F	F
Goggles or face shield are to be worn	F	F	F	F
Avoid inhalation	R	R	R**	R**
A respirator is to be worn	R	R	R**	R**

A Waterproof apron made from rubber or synthetic material. Use for mixing liquids.

B Waterproof boots or foot coverings made from rubber or synthetic material.

C A daily change of clean overalls or clean outer clothing. Wear waterproof pants and jacket if there is any chance of becoming wet with spray.

F Face shield, goggles, or full face respirator. Goggles with side shields or a full face respirator are required if handling or applying dusts, wettable powders, or granules or if being exposed to spray mist.

G Waterproof, unlined gloves made from rubber or synthetic material.

H Waterproof, wide-brimmed hat with nonabsorbent headband.

R Cartridge type respirator approved for pesticide vapors when label specifies another type of respirator such as a dust mask, canister type gas mask, or self-contained breathing apparatus.

* If the Category III pesticide application is being made in an enclosed area such as a greenhouse, or if the application consists of a concentrate spray of 100 gallons-per-acre or less in a grove, orchard, or vineyard, then use the guidelines for Category I-II pesticides.

** Use these guidelines when there is likelihood of exposure to spray mist, dust, or vapors.

Source: P. J. Marer (author), M. L. Flint (technical editor), M. W. Stimmann (Statewide Pesticide Coordinator, OPIC). The safe and effective use of pesticides. Pesticide Appl. Compendium 1. U. Calif. Statewide Integrated Pest Management Project, Div. Agr. Nat. Resources. Publ. 3324.

Table 6. Example of a Table for Summarizing Toxicities of the Proposed Pesticides

Pesticide names[1]	Acute oral LD_{50} (mg/kg)[2]	EPA Toxicity Category[3]	EPA Signal Word[3]	Reasons for EPA Special Review, if any
Fungicides				
Copper oxychloride (Cupravit)	ca. 1000	III	Caution	
Herbicides				—
Bentazon (Basagran)[4]	2063	II	Warning	Suspected ground water contamination
2,4-D (Acme), emulsifiable concentrate	1780	III	Caution	
Insecticides				
Bacillus thuringiensis (Dipel)	15000	III	Caution	

[1]Approved common name in the Pesticide Chemical News Guide and (in parentheses) the trade name. A pesticide may have one or more trade names. Only show trade names of products to be used.

[2]Based on toxicity to rats. LD_{50} values vary with formulation.

[3]See Table 7.

[4]Bentazon will be used only in research demonstration plots under careful supervision of the project supervisor.

Table 7. Criteria that EPA Uses to Establish Pesticide Toxicity Categories

Hazard indicators	Category I Danger	Category II Warning	Category III Caution	Category IV Caution
Oral LD_{50} of active ingredient	50 mg/kg or less	50-500 mg/kg	500-5000 mg/kg	>5000 mg/kg
Inhalation LD_{50}	0.2 mg/liter or less	0.2-2 mg/liter	2.0-20 mg/liter	>20 mg/liter
Dermal LD_{50}	200 mg/kg or less	200-2000 mg/kg	2000-20000 mg/kg	>20000 mg/kg
Eye Effects	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

Special Requirements to Preserve Endangered Species and Biodiversity

The EA must give special attention to A.I.D. policy on endangered species and biodiversity. Section 119 of the Foreign Assistance Act requires that proposed actions by A.I.D. do not endanger wildlife species or habitats critical for them, harm protected areas, or adversely affect biodiversity (species richness). The EA should identify any species that may be endangered or threatened by the proposed pesticide use. It should also point to any potential harm to wildlife habitat, protected areas (wildlife preserves, parks, etc.), or biodiversity. The appropriate host country ministry or government office should be contacted for information and regulations on endangered species, protected areas, and biodiversity. Advice from local environmental organizations should be sought also.

h. The Conditions Under Which the Pesticide Is to Be Used, Including Climate, Flora, Fauna, Geography, Hydrology, and Soils.

This section should describe the environment where proposed pesticides will be used. The description can be rather general except when detailing hazard situations. A.I.D.'s environmental profiles, available for some of the A.I.D. countries, are good sources for preparing this section. Host country universities and ministries and environmental organizations are other sources.

It is important to include a description of any protected areas such as wildlife preserves and parks. Include maps to show the exact locations.

i. The Availability and Effectiveness of Other Pesticides or Nonchemical Control Methods.

This section should discuss the availability and effectiveness of nonchemical alternatives such as shown in Table 2 (page 5). Explain to what degree, how, and where nonchemical alternatives are presently being used and how effective they are. Availability, costs, and feasibility for use in the project should be described.

The section should also discuss the availability and effectiveness of other pesticides. The reason for doing this is to alert A.I.D. and host country officials to potential alternatives that could be considered if use of the proposed pesticides is not approved, if stocks of project pesticides run low, or if a change in regulations renders them unacceptable. Identify the alternatives by both common and brand names. Information on their effectiveness should be included. If effectiveness is suspected but not determined for the target crop or pest, recommend needed trials.

j. The Requesting Country's Ability to Regulate or Control the Distribution, Storage, Use, and Disposal of the Required Pesticide(s).

The purpose of this section is to describe the preparedness of the host country to enforce effective pesticide management. The discussion should address appropriate pesticide laws and regulations and the roles of relevant institutions associated with the project in regulating and controlling pesticide use.

Pesticide regulatory and enforcement procedures vary considerably among developing countries. Many countries have pesticide laws on the books, but few have the means for effective enforcement.

This section should briefly summarize provisions of the pesticide laws and regulations (e.g., authority for pesticide registration, importation, manufacture, storage, transportation, sale, and use of pesticides) and indicate the government offices in charge of enforcement. Also, state whether the country is presently capable of adequately enforcing the laws and regulations and complying with correct pesticide practices. Attach copies of the laws and regulations as an annex to the EA. Use of pesticides should not be proposed unless a country is capable of enforcing the laws and regulations or unless all aspects of their use will be closely supervised by trained project personnel.

If the country is not likely to enforce the pesticide law, indicate what is needed to achieve enforcement at project level. Personnel, other needs, and budgeting requirements should be included in the summary of mitigative measures and requirements.

k. The Provisions Made for Training of Users and Applicators.

This section should include a detailed training plan showing who should be trained (farmers, extension officers, etc.), specific type of training (pesticide safety, IPM, biological control, etc.), how the training is to be done (where, when, and who will do the training), and cost requirements. Such plans can be included in the EA as mitigative action. Personnel and other resources necessary to implement the training should be identified in the summary of mitigative measures and requirements.

How much impact the EA has in promoting safer and improved pest and pesticide practices will depend heavily on the A.I.D. project's training component. Pay particularly close attention to this section.

l. The Provisions Made for Monitoring the Use and Effectiveness of the Pesticide(s).

This section should identify the needs and provisions being made for monitoring of the following:

- Use patterns (frequency of and interval between applications) of the requested pesticide(s).
- Pesticide safety practices during transportation, storage, application, and disposal.
- Pesticide effectiveness.
- Environmental impacts.
- Public health impacts.

The monitoring plan should include a description of the specific kinds of monitoring, who will do it, and who will be responsible for correcting any unsafe pesticide practices or problems found during monitoring.

HOW TO SUMMARIZE THE MITIGATIVE MEASURES AND REQUIREMENTS

This section should briefly summarize all mitigative measures needed to reduce negative environmental impacts. A budget of costs should be included. This is a critical section of the EA and should be written carefully and clearly. The following example shows the form that this section might take:

1. Nonchemical methods of control and IPM systems will be emphasized.

Project training and demonstrations will emphasize nonchemical methods of control and IPM systems. All project personnel and farmers using pesticides in the project will receive training on use of nonchemical methods and IPM. IPM will be demonstrated and evaluated on selected farms.

2. Selection of pesticides.

The pesticides to be used in the A.I.D. project:

- Have no acceptable nonchemical alternatives.
- Are EPA registered for the same or similar use or have the requisite tolerances established.
- Have low human toxicities, present no unacceptable acute or long-term toxicological hazards, and have not been classified by EPA for restricted use.
- Are relatively non-persistent in the environment and present no unacceptable hazards to the environment or nontarget organisms.
- Have not been withdrawn, suspended, or canceled in the U.S. and are not under EPA Special Review.

3. Provide pesticide training and protection to project personnel and participating farmers.

All project personnel and farmers using pesticides in the project will receive training on correct transportation, storage, application, and disposal of pesticides, worker and applicator protection, how to recognize and treat pesticide poisoning, and environmental protection. The training will include instruction on local laws and regulations regarding pesticides, human protection, and environmental protection.

A.I.D. will provide safety equipment and protective clothing to all persons who use pesticides in the project. The equipment and clothing will comply with recommendations on pesticide manufacturers' labels and be feasible for use in the particular climate and social setting.

4. Monitor pesticide use.

Project personnel will regularly monitor project use of pesticides on farmer's fields and demonstration sites and enforce their proper use.

5. Comply with local laws and regulations.

Project supervisors will enforce compliance with all relevant laws and regulations on pesticides, human safety, and environmental protection.

6. Cost requirements.

Include a budget to show the cost for each mitigative measure.

GLOSSARY OF TERMS COMMONLY ENCOUNTERED IN ENVIRONMENTAL ASSESSMENTS[1/]

Acaricide. A pesticide used to control mites.

Acceptable daily intake (ADI). The level of pesticide residue that may be consumed each day over the course of an average human life span without appreciable risk.

Active ingredient (a.i.). The material in the pesticide formulation responsible for the toxic (or other desired) effects on a target pest.

Acute dermal LD_{50}. The dose of a pesticide absorbed through the skin that kills 50% of a population of test animals; usually expressed in milligrams of pesticide per kilogram of body weight of test animal.

Acute effects. The immediate effects (as opposed to delayed effects) of a pesticide.

Acute oral LD_{50}. The dose of a pesticide ingested by mouth that kills 50% of a population of test animals; usually expressed in milligrams of pesticide per kilogram of body weight of test animal.

Acute (short-term) toxicological hazards. The immediate hazards of a pesticide.

Agroecosystem. The ecological community and physical environment in an agricultural land unit.

A.I.D. mission. The A.I.D. representation in a foreign country.

A.I.D. Endangered Species Act. Section 119 of the Foreign Assistance Act.

A.I.D. Environmental Procedures. Procedures of Title 22 of the Code of Federal Regulations, Part 216, to ensure that environmental factors and values are integrated into the A.I.D. decision making process.

A.I.D. Handbook 3. Project Assistance. A.I.D.'s official manual on the requirements for analysis, authorization, development, implementation/ monitoring, and evaluation of projects supported by A.I.D.

Application equipment. Equipment for applying pesticides (may range from hand-held sprayers to aircraft sprayers).

Applicator (of pesticides). Any person who applies pesticides.

Aquatic. Pertaining to water.

[1/]The glossary is based, in part, on terms in the publication by Marer, Flint, and Stimmann (1988) cited in Table 5 (page 22).

Attractant. A substance that attracts a specific species of animal to it. When manufactured to attract pests to traps or poisoned bait, attractants are considered to be pesticides.

Avian. Relating to birds.

Avicide. A pesticide used to control pest birds.

Bait. A food or foodlike substance that is used to attract and, often, to poison pest animals.

Beneficial. Helpful in some way to people, such as a beneficial plant or insect.

Bioaccumulation. The gradual buildup of certain pesticides within the tissues of living organisms after they feed on lower organisms containing smaller amounts of these pesticides. Animals higher up on the food chain accumulate greater amounts of these pesticides in their tissues.

Biodiversity. The richness or abundance of species of organisms or biotic life forms.

Biological control. The use of natural enemies (predators, parasites, or disease agents) to control pests.

Brand name. See Trade name.

Broad-spectrum pesticide. A pesticide that is capable of controlling many different species or types of pests.

Calibration. The process for measuring the output of pesticide equipment so that the proper amount of pesticide can be applied to a given area.

Carcinogenicity. The cancer-causing potential of a substance.

Caution. The signal word on labels of pesticides in EPA toxicity Category III or IV; these pesticides have an oral LD_{50} greater than 500 and a dermal LD_{50} greater than 2000.

CD-ROM. Compact disk-read only memory.

CHEM-BANK. A database of SilverPlatter Information Services that provides environmental and toxicological data for some of the EPA-registered pesticides.

Chemical name. Name of the chemical ingredients of a pesticide.

Chronic. Pertaining to long duration or frequent recurrence.

Chronic effects. Long-term or recurring effects.

Climate. The prevailing or average weather conditions of a place as determined by temperature and meteorology over a period of years.

Common name. An approved nontechnical name of a pesticide product. An approved nontechnical name of an organism.

Compatibility. In A.I.D. Environmental Assessments, refers to the degree of known hazards to the target ecosystem (crops to be treated) or nontarget ecosystems (surrounding noncropping environment or crops not to be treated).

Contents. All that is contained in a pesticide container.

Corneal opacity. The eye's imperviousness to rays of light.

Corrosive. Having the power to corrode or wear away by chemical action.

Cultural controls. Crop management and other practices that make the environment less favorable for pests, e.g., field sanitation, crop rotation, diversification, harvesting practices, time of planting, trap crops.

Danger. The signal word used on labels of pesticides in EPA toxicity Category I pesticides with an oral LD_{50} of 50 or less or a dermal LD_{50} less than 200 or having specific, serious health or environmental hazards.

Delayed effects. Effects of pesticides that occur later (sometimes years later) and not immediately.

Dermal. Pertaining to the skin. One of the major ways pesticides can enter the body.

Dermal LD_{50}. See acute dermal LD_{50}.

Disposal (of pesticides). Destruction of left-over pesticides or pesticide containers.

Distribution (of pesticides). The process by which pesticides get from their point of entry (into a country, for example) to their final destination.

Dose. The measured quantity of a pesticide.

Directions for use. Statements on the pesticide labels describing use.

Drift. The movement of pesticide dust, spray, or vapor away from the application site.

Ecological. Consideration of the interrelationship between living organisms and the environment.

Economic damage. Damage caused by pests to plants, animals, or other resources that results in loss of income or a reduction of value.

Economic injury level. The point at which the value of the damage caused by a pest exceeds the cost of controlling the pest.

Ecosystem. An ecological community together with its physical environment.

Effectiveness (of pesticides). See efficacy.

Efficacy. The ability of a pesticide to produce a desired effect on a target organism.

Endangered species. A species in danger of extinction.

Environment. All of the living organisms and nonliving features of a defined area.

Environmental Assessments. In A.I.D. projects a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment of a foreign country or countries.

Environmental Impact Statement. A detailed study of the reasonably foreseeable environmental impacts, both positive and negative, of a proposed A.I.D. action and its reasonable alternatives on the United States, the global environment, or areas outside the jurisdiction of any nation.

EPA Signal Word. See Signal Word.

EPA Toxicity Category. Four categories used to indicate the potential hazard of EPA-registered pesticides; Category I uses the signal words "Danger" and "Poison" to signify highly toxic compounds (acute oral LD_{50} mg/kg), Category II uses the word "Warning" to signify moderately toxic compounds (acute oral LD_{50} 50-500 mg/kg), Category III uses the word "Caution" to signify slightly toxic compounds (acute oral LD_{50} 500-5000 mg/kg), and Category IV uses the word "Caution" and must state "Keep Out Of The Reach Of Children" (acute oral LD_{50} >5000 mg/kg).

Exempt from tolerance. Indicates that EPA has determined that minute amounts of pesticide residue on foods will cause no adverse effects to humans.

Fauna. Animal life.

Fetotoxicity. Pesticide toxicity to the unborn fetus.

FIFRA. The Federal Insecticide, Fungicide, and Rodenticide Act of 1947. Governs the licensing, or registration, of pesticide products.

Flora. Plant life.

Formulation. A mixture of active ingredients combined during manufacture with inert materials. Inert materials are added to improve the mixing and handling qualities of a pesticide.

Fumigant. Vapor or gas form of a pesticide used to penetrate porous surfaces for control of soil dwelling pests or pests in enclosed areas or storage.

Fungicide. A pesticide used for control of fungi.

General use (unclassified) pesticide. A pesticides that has been designated by EPA for use by the general public as well as by licensed or certified applicators.

Geography. The physical features (especially the surface features) of a region, area, or place.

Groundwater. Fresh water trapped in aquifers beneath the surface of the soil and used for drinking, irrigation, and manufacturing.

Habitat. The place where an organism lives.

Herbicide. A pesticide used to control weeds.

Host. A plant or animal species that provides sustenance for another organism.

Host country. The country hosting an A.I.D. project.

Host resistance. The ability of a host plant or animal to ward off or resist attack by pests or to be able to tolerate damage caused by pests.

Hydrology. The science dealing with water, its distribution, and the evaporation and precipitation cycle.

Inert ingredient. A substance (such as a solvent) contained in a pesticide formulation, which by itself does not add materially to the pesticide's effect on a pest.

Ingredients. The chemical composition of the pesticide. See Active ingredient and Inert ingredient.

Inhalation. Entering the body through breathing. One of the routes of entry of pesticides into the body.

Initial Environmental Examination. The first review of the reasonably foreseeable effects of a proposed action (in an A.I.D. project) on the environment.

Insecticide. A pesticide used to control insects. Some insecticides are also labeled for control of ticks, mites, spiders, and other arthropods.

Integrated pest management (IPM). Use of a variety of biological, cultural, and chemical control methods in a cohesive management scheme designed to maintain pest populations at levels below those causing economic injury.

Interval. The legal period of time that must elapse between the application of a pesticide and worker reentry into the treated field or the harvesting of produce. See Preharvest interval and Reentry interval.

Invertebrate. An animal that has no backbone (e.g., insect).

IPM. Integrated pest management.

Irreversible. An effect that is not reversible or cannot be repealed or annulled.

Knapsack sprayer. A small portable sprayer carried on the back of the person making a pesticide application. Some knapsack sprayers are hand-operated and others are powered by small gasoline engines.

Label signal words. See signal word.

LC_{50}. The lethal concentration of a pesticide in the air or in a body of water that will kill half of a test population. LC_{50} values are given in micrograms per milliliter of air or water.

LD_{50}. Abbreviation of median lethal dose, MLD. A dose of a pesticide that kills 50% of a population of test animals; usually expressed in milligrams of pesticide per kilograms of test animal body weight.

Lethal. Capable of causing death.

Long-term (delayed) toxicological hazards. Hazards occurring over or involving a relatively long period of time.

Manufacturer. The company manufacturing the pesticide product.

Maximum residue limit (MRL). The maximum residue level likely to arise when a pesticide is used according to recommendations reflecting good agricultural practices.

Misuse statement. Statement on a pesticide label that indicates when the pesticide is used incorrectly and the potential consequences.

Mites. Tiny, sometimes microscopic, relatives of insects that belong to the order Acari of the arthropod phylum.

Mitigative measure. Action taken to avoid, reduce, minimize, repair, or compensate for an adverse environmental impact.

MLD. Median lethal dose. See LD_{50}.

Mode of action. The way a pesticide reacts with a pest organism to destroy it.

Monitoring. Sampling or observations of pesticide use, pesticide residue, natural enemies, etc.

Mutagenic. A chemical that is capable of causing mutations in the cells of living organisms.

Mutagenicity. The degree to which a compound can cause a biological mutation.

Natural enemies. Predators, parasites, and microorganisms that cause the death of pests; biological control agents.

Negative Declaration. A finding that the proposed A.I.D. action will not have a significant effect on the environment.

Nematicide. A pesticide used to control nematodes.

Nematode. Elongated, cylindrical, nonsegmented worms. Nematodes are commonly microscopic; some are parasites of plants or animals.

Nonchemical method. Any method other than a chemical pesticide used to prevent or control a pest. Same as Nonpesticidal method.

Nonpesticidal method. Same as Nonchemical method.

Nontarget ecosystem. An ecosystem not intentionally receiving a pesticide application.

Nontarget organism. Animals or plants within or outside a pesticide treated area that are not intended to be killed or injured by the pesticide application.

Nozzle. A short tube at the end of a sprayer hose that breaks up a pesticide spray into small droplets and directs it toward the target area.

Oncogenicity. A measure of the tendency of a compound to cause tumors.

Oral. Through the mouth. One of the routes of entry of pesticides into the body.

Organism. Any living thing.

Parasite (parasitoid). An organism that grows and feeds in or on a host; often used in biological control programs to suppress pest populations.

Pathogen. A microorganism that causes a disease.

PEST-BANK. A database of SilverPlatter Information Services that allows access to information (registration status, residue tolerances, etc.) on EPA-registered pesticides.

Pest control practice. An action taken (such as plowing, rotating crops, etc.) to reduce a pest problem. Sometimes used interchangeably with Tactic.

Pest control tactic. See Tactic.

Pest management. Any deliberative action to prevent or reduce the density or harmful effects of a pest population.

Pesticide. Any substance or mixture of substances intended for harming, destroying, repelling, or mitigating the effects of pests (insects, rodents, nematodes, fungi, weeds, or any other forms of life declared to be pests); and any other substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

Pesticide formulation. The pesticide as it comes from its original container, consisting of the active ingredient blended with inert materials.

Pesticide label. Information on a pesticide container required by EPA.

Pesticide management. Deliberate actions to reduce the harmful effects of pesticides; includes legislation and regulations as well as safe application, storage, and disposal.

Pesticide resistance. Genetic qualities of a pest population that enable individuals to resist the effects of certain types of pesticides that are toxic to other members of that species.

Pheromone. A chemical substance given off by one individual that causes a specific reaction by other individuals of the same species, such as sex attractants.

Phytotoxic. Injurious to plants.

Positive Threshold Decision. A finding that the proposed A.I.D. action may have a significant effect on the environment.

Practice. See Pest control practice.

Precautionary statements. Statements on a pesticide label that give precautions for using the product.

Predator. An organism that lives by preying on animals (prey); often used in biological control programs to suppress pest populations.

Preharvest interval. A period of time set by law that must elapse between pesticide application to an edible crop and harvesting of the crop. Pesticide labels provide information on preharvest intervals.

Prey. Animals that serve as food for predators.

Product. A commercial formulation of a pesticide.

Project Identification Document. An internal A.I.D. document that initially identifies and describes a proposed project.

Project Paper. An internal A.I.D. document that provides the definitive description and appraisal of a project, particularly the implementation plan.

Rate. The quantity or volume of pesticide that is applied to an area over a specified period of time.

Reentry interval. The period of time specified by law that must elapse after a pesticide is applied before people can resume work in the treated area.

Reentry statement. Statement on the pesticide label concerning the time between application of the material and safe entry into the treated area.

Registration and establishment numbers. The registration number assigned to the product by EPA. For regular registrations, the number preceding the hyphen represents the registering company (establishment).

Reproductive effects. Effects of a pesticide on reproduction in animals.

Residue. Traces of pesticide that remain on treated surfaces after a period of time.

Resistance. See Pesticide resistance and Host resistance.

Respirator. A device worn over the nose and mouth to prevent inhalation of toxic substances.

Restricted-use pesticide. A pesticide, usually in EPA toxicity Category I, that is available for purchase and use only by applicators who have a valid Certified Pesticide Applicator license, or by persons under their direct supervision.

Reversible. Opposite of irreversible.

Rodenticide. A pesticide used to control rats and other rodents.

Rope wick applicator. A device used to apply contact herbicides onto target weed foliage with a saturated rope or cloth pad.

Safety equipment. Face masks, goggles, respirators, etc. to reduce exposure to and risks from pesticides.

Safety apparel. Clothing (coveralls, hat, boots, gloves, etc.) to reduce exposure to and risks from pesticides.

Selective pesticide. A pesticide that has a mode of action against only a single or small number of pest species.

Signal Word. The word "Danger", "Warning", or "Caution" that appears on the label of an EPA-registered pesticide to signify how toxic the pesticide is and what toxicity category it belongs to.

Significant effect. Significant harm to the environment.

Slugs. Any of the gastropod land mollusks with rudimentary internal shells in their mantles.

Snails. Gastroped mollusks living on land or in water and having a spiral protective shell.

Special Review. A process to determine if certain EPA risk criteria are exceeded by a particular registered pesticide. If the Review determines that a pesticide exceeds the risk criteria, the pesticide is presumed unsuitable for registration unless that presumption is rebutted.

Statement of practical treatments. Statement on a pesticide label of acceptable procedures for treating people poisoned by or contaminated with the material.

Statement of use classification. Statement on a pesticide label to make proper use of the material understandable.

Storage (of pesticides). The way pesticides are kept when not being used.

Tactic. Any method (pesticide, biological control agent, etc.) used to reduce a pest problem.

Target. Either the pest that is being controlled or surfaces within an area that the pest will contact.

Target ecosystem. An ecosystem intentionally receiving a pesticide application such as crop ecosystem.

Target pest. A harmful organism at which a pesticide or other pest control tactic or practice is directed.

Teratogenicity. A measure of a compound's tendency to cause physical birth defects in the offspring of exposed parents (male or female).

Testicular effects. Effects of a pesticide on male testes.

Threatened species. Any species of fish, wildlife, or plant listed as having its existance threatened.

Threshold Decision. A decision to determine if a proposed A.I.D. action will or will not have a significant impact on the environment.

Thyroid effects. Effects of a pesticide on the thyroid gland.

Tolerance. The pesticide residue level permitted in or on raw agricultural commodities or processed foods.

Toxicity Category. See EPA Toxicity Category.

Trade name. Trademark (brand) name of a pesticide, formulation, or other product.

Toxicity. A pesticide's potential for causing harm.

U. S. Environmental Protection Agency (EPA). The federal agency responsible for regulating pesticide use in the United States.

Ultra-low-volume (ULV). A pesticide application technique in which very small amounts of liquid spray are applied over a unit of area; usually 2 liters or less of spray per acre in row crops to about 20 liters of spray per acre in orchards and vineyards.

Unclassified (general use) pesticide. See General use pesticide.

User (of pesticides). Any person using (storing, mixing, applying, transporting, or disposing of) a pesticide.

Vertebrates. The group of animals that have an internal skeleton and segmented spine, such as fish, birds, reptiles, and mammals.

Virus. A very small organism that multiplies in living cells and is capable of producing disease symptoms in some plants and animals.

Volatile. Readily vaporizable at a relatively low temperature.

Warranty. The manufacturer's guarantee of the integrity of a pesticide product.

Warning. The signal word used on labels of pesticides in EPA toxicity Category II, having an oral LD_{50} between 50 and 500 and a dermal LD_{50} between 200 to 2000.