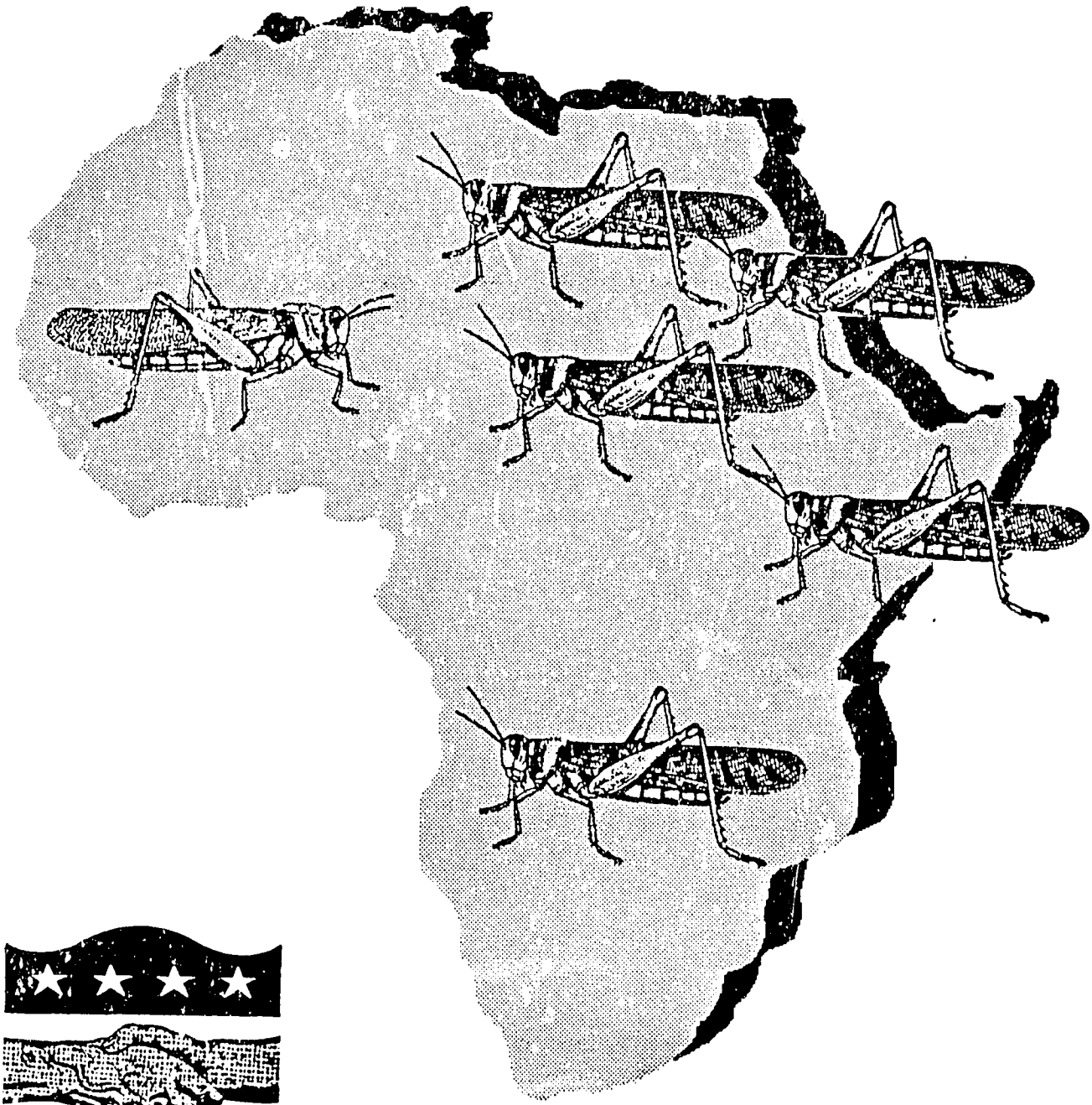
PN-ABC-136

LOCUST/GRASSHOPPER MANAGEMENT



UNITED STATES OF AMERICA

Agency for International Development

OPERATIONS GUIDEBOOK

January 1989

COPY #55

DEDICATION

This Guidebook is dedicated to Julia V. Taft, Director, Office of U.S. Foreign Disaster Assistance. It was due to Julia's leadership and commitment to carefully evaluate the results of the 1986 and 1987 locust/grasshopper control campaigns in Africa that this Guidebook exists today. She recognized that monitoring and evaluating the results of disaster assistance programs are as important as making the individual control responses. She strongly believed that the key participants in the control campaigns needed to be involved in a three day evaluation workshop in Harpers Ferry, West Virginia, in January 1988 to review the "Lessons Learned" and provide valuable guidance for a group of technical specialists who would prepare an operational Guidebook to assist the control actions of future campaigns. Julia's high level of energy and her understanding of the benefits of the review process assured that a productive environment existed for people to share ideas openly at Harpers Ferry.

Over the intervening months since Harpers Ferry, Julia has furnished unwavering support to the concept of producing a high quality Guidebook. Also, Bob Thibeault was instrumental in providing technical support, encouragement, and direction on a day-to-day basis as the Guidebook concept evolved towards a finished product. Future locust/grasshopper control specialists will benefit substantially from the legacy of the Guidebook--a Guidebook that has improved on the lessons of the past and transferred them to future users.

Acknowledgments

Many individuals and institutions assisted the Agency for International Development (A.I.D.) in the production of this guidebook. In Washington, personnel of the U.S. Office of Foreign Disaster Assistance, the Bureau for Africa and the Bureau for Asia and Near East had overall responsibility. Staff in these offices worked tirelessly to coordinate numerous activities relating to documenting and understanding the experience of control campaigns.

The U.S. Forest Service, Disaster Assistance Support Program, organized and managed the evaluation workshop in January 1988 at Harpers Ferry, West Virginia. At this workshop, personnel of the Agency for International Development and outside experts contributed much of the material for the guidebook. Jerry Williams skillfully guided the group discussions and coordinated the workshop. Personnel of the U.S. Forest Service kept accurate records of all meetings, providing authors with expert assistance in refining and clarifying presentations.

The U.S. Department of Agriculture, Office of International Cooperation and Development (USDA/OICD) made travel arrangements for participants and handled contracting with guidebook authors. A.I.D. missions in Morocco, Mauritania, Senegal, Mali, Niger, Cameroon, Chad, Sudan, Ethiopia and Zambia sent their locust/grasshopper project managers to the workshop. The perspectives of these field staff, who have experienced two years of emergency programs, provided valuable insights for future management.

Many entomologists, spraying experts, logistics experts and environmentalists contributed their frank assessments of the control campaigns. Field personnel, technical experts, host government counterparts and other donors responded to the evaluation questionnaire, sharing valuable information from their experiences. These responses have been synthesized into a separate volume.

A.I.D. expresses appreciation to the following individuals who wrote sections of the guidebook: Bob Adams, Renee Bafalis, George Cavin, Carroll Collier, Jack Drea, Richard Dyer, Kate Farnsworth, Arthur Feller, Bob Herald, Duane Herman, Dennis King and Carrol Voss. Other contributors include: Jim Akerman, Bessie Boyd, Carl Castleton, Ollie Davidson, Timm Harris, Gudrun Huden, Brian Kline, Ron Libby, Rob Merrigan, Bob Mutch, Paul Novick, Glenn Whaley, Shannon Wilson and Beverly Youmans. Millie Konan organized the original drafts into a coherent structure and edited the manuscript. JoAnn Fullerton Associates performed the word processing and Jerry Williams produced the final product for printing.

Through hard work, dedication and perseverance, these individuals and many more have made it possible to document the experience of the past and pave the way for more efficient and effective programs in the future.

Robert A. Thiebault

Table of Contents

	Page	Tab
I. Introduction		1
A. Purpose and Organization	I-2	
B. The 86-87 Campaign	I-2	
C. Locust and Grasshopper Pests	I-4	
II. Understanding Current A.I.D. Policies, Strategies and Guidelines		2
A. A.I.D. Policies and Strategies	II-2	
B. Determining Whether a Disaster Exists	II-5	
C. Guidelines for Action in Nonemergency Situations	II-6	
D. Guidelines for Action in Emergency Situations (Disasters)	II-9	
III. Coordinating With Host Country Organizations and Donors		3
A. Host Country Ministry of Agriculture	III-2	
B. Other Host Country Ministries	III-5	
C. Regional and Local Organizations	III-7	
D. Donors	III-8	
E. Social and Cultural Issues	III-9	
IV. Assessing Control Strategies		4
A. When are Control Efforts Justified?	IV-2	
B. Methods of Control	IV-4	
C. Strategies for Grasshopper Control	IV-8	
D. Strategies for Locust Control	IV-9	
V. Developing Plans for Action		5
A. Overview	V-2	
B. Program Development	V-3	
C. Communications	V-13	
D. Dealing with the Media During a Disaster	V-24	
VI. Surveying and Monitoring		6
A. Predicting Upsurges	VI-2	
B. Conducting Surveys	VI-4	
C. Surveying Locusts	VI-5	
D. Surveying Grasshoppers	VI-6	
E. Monitoring	VI-10	

Table of Contents (continued)

	Page	Tab
VII. Selecting and Handling Pesticides		7
A. Purchasing Pesticides	VII-2	
B. Determining Efficacy Against Locusts and Grasshoppers	VII-9	
C. Assessing Toxicity	VII-11	
D. Storing and Handling Pesticides	VII-15	
E. Disposing of Pesticides and Empty Containers	VII-17	
VIII. Selecting Equipment for Aerial and Ground Applications		8
A. What Kind of Equipment is Needed?	VIII-2	
B. Aerial Applications	VIII-3	
C. Ground Applications	VIII-18	
D. Ground Transportation	VIII-23	
APPENDICES		9
Appendix A. A.I.D./OFDA Guidelines and Sample Disaster Determination	A-1	
Appendix B. Locust Control Organizations	B-1	
Appendix C. U.S. Regulations on Pesticides and Environmental Procedures	C-1	
Appendix D. Guidelines for the Packaging and Storage of Pesticides	D-1	
Appendix E. International Code of Conduct on the Distribution of Use of Pesticides	E-1	
Appendix F. The Disposal of Waste Pesticide and Pesticide Containers	F-1	
Appendix G. Control Operational Requirements - Aerial	G-1	
BIBLIOGRAPHY.	Bi-1	10
REFERENCE MATERIALS: Acronyms, Glossary of Terms, Key U.S. Government Contacts for Locust/Grasshopper Control.	RM-1	11
SCOPES OF WORK		12

List of Figures

Page

III-1. Types of Personnel (Nonmanagerial) Needed for Locust/Grasshopper Control III-4
IV-1. Desert Locust Swarm Movement from Summer to Winter-Spring Breeding Areas IV-11
V-1. Suggested Organizational Chart for Large-scale Control Campaign Involving Aerial Spraying V-11
V-2. Single Command System Used by USAID/Senegal in Locust/Grasshopper Control in 1987 ..... V-12

List of Tables

Page

IV-1. Grasshoppers and Locusts Threshold Level Guidelines IV-3
V-1. Activities Calendar for Grasshopper Control Campaign in Senegal V-5
VII-1. FAO List of Chemicals Already Used On a Scale to Show Their Effectiveness VII-4
VII-2. Recommended Use Patterns for Listed Pesticides VII-8
VII-3. Dermal LD50s for Desert Locust Adults VII-10
VII-4. Toxicological Basis for WHO Hazard Classification VII-12
VII-5. Characteristics of Current Pesticides Used in Locust/Grasshopper Control VII-12
VIII-1. Average Load Capabilities for Several Types of Single-engine Aircraft VIII-4
VIII-2. Cost Estimates for 3 Turbine Thrush Fixed-wing Aircraft VIII-6
VIII-3. Theoretical Comparison of Dust Bags and ULV Application of Carbaryl (FAO, 1987) VIII-8
VIII-4. Types of Spraying and Dusting Equipment and Their Advantages/Disadvantages VIII-20
VIII-5. A Comparison of Operational Capabilities of Three Types of Ground Equipment Using Drift Spraying VIII-24

Table of Contents

Chapter I. Introduction

A. Purpose and Organization I-2
B. The 86-87 Campaign I-2
C. Locust and Grasshopper Pests I-4

1. Desert Locust I-5
2. African Migratory Locust I-5
3. Red Locust I-6
4. Brown Locust I-6
5. Senegalese Grasshopper I-6

Reference	Notes

A. Purpose and Organization

The purpose of this guidebook is to assist Missions to assess, prepare for, and organize locust/grasshopper control programs on an emergency and non-emergency basis. When locust/grasshopper problems arise, many decisions must be made. A.I.D. personnel often have little or no familiarity with locusts and grasshoppers or the range of issues involved in mounting a pest control campaign. The guidebook assembles relevant managerial and technical information to expedite and guide the decision-making process. It is based on experience and lessons learned during locust/grasshopper control efforts in 1986 and 1987.

STEPS TO SUCCESS

Mounting a successful control campaign involves four basic steps:

- Identifying the problem and clarifying responsibilities
- Forming a Country Coordinating Committee
- Assessing control strategies
- Developing an Action Plan

The organization of the guidebook follows these four steps. Chapters I and II present background information to help in identifying the problem and explain current A.I.D. policies and strategies. Chapter III describes the host country and donor organizations that can work with A.I.D. to plan and implement a successful campaign. Chapter IV presents information relevant to assessing various control strategies. Chapter V discusses the operational strategies that form Action Plans. The remaining three chapters present technical information relevant to the development of an Action Plan: Chapter VI focuses on surveying and monitoring; Chapters VII and VIII present guidance in selecting pesticides and equipment. Appendices A-G include supporting documents. Finally, the guidebook includes a bibliography and reference materials—a list of acronyms, a glossary of terms, and a list of key U.S. government contacts and their telephone numbers.

B. The 86-87 Campaign

1986-87 ACTIONS

Following a period of drought, rains fell over much of Africa in 1985, creating ideal environmental conditions for an upsurge of locust and grasshopper pests. The area affected stretched from Southern Africa to the Horn of Africa and from there, across the Sahel to Northern Africa.

Although locusts and grasshoppers are a constant threat to African agriculture, upsurges, if uncontrolled, can form populations of plague proportions. The Food and Agriculture Organization (FAO), the lead United Nations agency for the monitoring of the worldwide locust/grasshopper situation,

alerted countries to the potential magnitude of the 1985-86 upsurge. Most nations were recuperating from a drought which had cost thousands of lives and destroyed the livelihood of millions of rural farmers. In 1986, locusts and grasshoppers threatened to destroy all progress towards recovery in the rural areas.

Most of the countries in the potential invasion zone of the insects were unprepared to deal with a control campaign of the magnitude forecast by the FAO. One after another, countries in the Sahel, East, and Southern Africa issued requests for assistance to the donor community. Donorresponse was generous and immediate. The Office of U.S. Foreign Disaster Assistance (OFDA) responded to disaster declarations in Senegal, Gambia, Mali, Mauritania, Niger, Burkina Faso, Chad, Cameroon, Sudan, Ethiopia, andTanzania. The donor response continued through 1987 with the Office of U.S. Foreign Disaster Assistance committing over $6.9 million to the Sahel, East, and Northern Africa and the Africa Bureau Office of Emergency Operations (OEO) providing over $3.9 million of assistance for a donor total of $21 million (U.S.). Experts predicted that the problem would continue at least through 1988.

The U.S. Government's (USG) investment in helping control the grasshopper and locust problem involved more than OFDA funding for aircraft and technical assistance or OEO funding of training programs. The demands on the field missions were enormous. In-house disaster committees were formed to regularly review and direct the work of the campaign. Locust/grasshopper program staff handled a flood of cable traffic (often equaling over 50 percent of all mission cables) and spent up to 80 percent of their time managing the USG portion of the multidonor programs. In addition, technical experts were mobilized from other branches of the U.S. Government, the U.S. Department of Agriculture, the Environmental Protection Agency, and the U.S. Geological Survey. The leading American experts in agro-aviation, entomology, pesticide handling, and locust and grasshopper control were contracted directly or through the Consortium for International Crop Protection to provide assistance to the emergency programs.

In Rome, the FAO set up the Emergency Center for Locust Operations (ECLO) to coordinate with donor capitals on pledges and commitments. The Center also issued regular reports on the Africa-wide locust and grasshopper situation. Within the affected countries, Steering Committees of donors, FAO, and host government officials were organized to coordinate commitments, arrivals of donations, and control operations.

In 1986 and 1987, FAO sponsored country evaluations for each program, and in January 1988, A.I.D./W expanded on these evaluations by organizing a

separate in-house evaluation workshop in Harpers Ferry, West Virginia. The three-day conference was designed specifically for Mission personnel, A.I.D./W staff, and experts who worked on the 1986-87 emergency programs. One of the main goals of the workshop was to synthesize the knowledge and the lessons learned over the last two years by field Missions and experts in order to produce this guidebook for use by Missions.

MAJOR PESTS

C. Locust and Grasshopper Pests

More than 300 species of locusts and grasshoppers are known to exist in Africa but only a few species are major pests. Most species are sedentary, living in a rather confined area throughout their life cycle. A few species are highly mobile, migrating from one location to another where ecological conditions are suitable for food and reproduction.

Locusts and grasshoppers have caused periodic devastation since the beginning of recorded history. Carved images of locusts are found on tombs at Saggara, Egypt. The Old Testament describes the ravages of locusts: "The land is as the garden of Eden before them, and behind them a desolate wilderness, yea, and nothing shall escape them." (Job I:2-3) Control strategies vary by species and involve manipulating factors in the insects' annual and daily cycle. By preventing plagues, control efforts can protect and conserve the environment that provides the livelihood for most people in affected nations.

The life cycle of all species of grasshoppers and locusts consists of three stages: egg - nymph - adult. For the sake of clarity, most locust nymphs are referred to as hoppers.

True locusts differ from grasshoppers by their ability to change behavior, physiology, color and shape in response to change in their population density. Individuals of the grasshopper-like form are known as solitarious, while those of the aggregating and swarming form are known as gregarious. Intermediate forms are known as transiens.

In Africa, four species of locusts and the Senegalese grasshopper are major pests. The locust species are:

Desert Locust - Shistocerca gregaria (Forsk.)
African Migratory Locust
- Locusta migratoria migratoriodes (R. & F.)
- Locusta migratoria capito (subspecies in Madagascar)
Red Locust - Nomadacris septemfasciata (Serville)
Brown Locust - Locustana pardalina (Thun.)

1. Desert Locust

DESERT LOCUST

The most feared of all the locusts worldwide is the Desert Locust. The total area invaded during Desert Locust plagues extends over some 29 million square kilometers involving more than 60 nations. Between plagues it occupies an area of approximately 14 million square kilometers of desert and subdesert (Waloff, 1976). Crowding for more than one generation is required to produce fully gregarious characteristics. This happens when either a prolonged rainy season allows the production of several successive generations in the same area, or when a population that has begun to aggregate moves to an alternative seasonal breeding area with conditions continuing to favor gregarious forms. Otherwise, the population may revert to a partially or wholly solitarious type (Roffey, Popov and Hemming, 1970).

The Desert Locust must breed continually or die out. Eggs can only survive in soil with adequate moisture; during a prolonged dry spell, they die. The maximum period of viability is 10-12 weeks. Under favorable conditions maturation occurs about 45 days after reaching the adult stage. In unfavorable conditions maturation may not be reached for six months.

The Desert Locust is known for its long-range pattern of migration, as much as several thousand kilometers within a single generation. In the absence of controls, Desert Locust plagues last seven to eight years, generally followed by a prolonged period of recession, dependent upon rainfall.

2. African Migratory Locust

AFRICAN MIGRATORY LOCUST

The African Migratory Locust has a wide-ranging environment. The northern half of its range in the Sahel is mostly elevated dunes of permeable, sandy soils and open areas with tussocks and bare patches. In the extreme north, its range is low-lying areas of runoff and heavy, water-retaining, clay soils. In the southern Sahel, the African Migratory Locust lives in cropland. In the southern part, in the Sudan, where levels of rainfall are high and vegetation is very dense, it lives in recently fallowed land (Batten, 1967). The African Migratory Locust cannot tolerate a long period of unfavorable conditions. Populations must breed continually or die out.

Since much of the habitat of the African Migratory Locust has been converted to cropland, this locust seems to have lost some of its gregarious behavior. Some FAO experts believe its status should now be relegated to that of a grasshopper.

3. Red Locust

RED LOCUST

Although gregarious forms of the Red Locust occur nearly every year, it has not reached plague status in over 44 years. The International Red Locust Control Organization carries out a highly successful control program. Continual surveys, primarily by helicopter, provide guidance for rapid control as the Red Locust becomes gregarious. The pattern of migration also contributes to the decline of plagues because swarms often go to areas unfavorable for reproduction.

The recession area of the Red Locust comprises 7,800 square kilometers in nine locations in and along the Rift Valley of Eastern Africa. The invasion area is approximately 1,000 times as large.

The Red Locust has only one generation per year with a long pre-reproductive period of eight to nine months coinciding with the dryseason.

4. Brown Locust

BROWN LOCUST

Outbreaks of the Brown Locust initiate in the Karoo of the Union of South Africa and southern Botswana. If uncontrolled they can spread north as far as southern Zambia. The progeny eventually return to the Karoo in a circular pattern through Namibia. The Brown Locust's habitat ranges from semiarid to semidesert.

Brown Locusts normally produce two generations during the rainy season, but quite often a third and sometimes a fourth. Incipient outbreaks have practically all arisen from areas with a high solitarious population two seasons before, suggesting that Brown Locusts may lay eggs 18 to 20 months prior to hatching.

5. Senegalese Grasshopper

SENEGALESE GRASSHOPPER

The Senegalese grasshopper affects all of the Sahelian nations including the Cape Verde Islands, and extends beyond to parts of North Africa and southwest Asia. Its habitat is limited to approximately the 200-1,000 millimeter mean annual rainfall zone. It occurs principally in open or lightly wooded savanna, steppe, or ephemeral prairies with sandy soil.

The Senegalese grasshopper manifests notable phase attributes, but at a lower level of gregariousness than in true locusts. At higher densities, nymphs may aggregate in groups when roosting and occasionally form marching bands. Adults may form loose swarms that may fly by day, but more frequently by night (Riley and Reynolds, 1983).

14

Normally, the Senegalese grasshopper has three generations per year. Eggs laid between mid-August and early September enter obligatory diapause until the next rainy season. Eggs may remain in diapause morethan one year. About 75 percent of the diapausing eggs are laid in the 750-1,000 millimeter annual rainfall zone.

Adults of the Senegalese grasshopper migrate north following the northerly progression of the Inter-Tropical Convergence Zone (ITCZ) to its northern terminus and thence southward following its retreat.Prolonged stagnation and oscillations of the ITCZ in northern latitudes may result in scattering, mortality of adults, and laying under adverse conditions, ultimately leading to a decline in grasshopper numbers (Duranton, Launois et al., 1982).

Table of Contents

Chapter II. Understanding Current A.I.D. Policies, Strategies and Guidelines

A. A.I.D. Policies and Strategies II-2

1. Who is Responsible for Locust and Grasshopper Control? II-2
2. Foreign Disaster Relief II-2
3. Response Coordination II-3
4. Continuing Crop Protection Responsibility II-3
5. USG Environmental Regulations II-4
6. Environmental Impact II-4
7. Pesticide Standards II-4
8. Use of Excess Pesticides II-5

B. Determining Whether a Disaster Exists II-5

C. Guidelines for Action in Non-emergency Situations II-6

1. Management II-6
2. Responsibilities and Authorities II-7

D. Guidelines for Action in Emergency Situations (Disasters) II-9

1. Management II-9
2. Responsibilities and Authorities II-11
3. Desert Locust Task Force II-18

Reference	Notes

The first step in responding to a Host Government's request for assistance is to identify the extent of the problem and clarify who is responsible for what. This chapter outlines current A.I.D. policies and strategies, explains how to determine whether a disaster exists, and presents guidelines for action in both non-emergency and emergency situations.

Missions should keep in mind that whenever possible, it is advisable to encourage the Host Government to deal with the locust/grasshopper infestations locally, using resources readily available in-country. When a government makes a request to the Mission for assistance in their program, the Mission should assess the possibility of using local currency/local experts. As the Mission calls A.I.D./W offices and resources into action, the management and reporting responsibilities and requirements will increase accordingly. Missions should make every effort to anticipate a potentially serious infestation by maintaining contact with Host Government counterparts and the local FAO office.

A. A.I.D. Policies and Strategies

1. Who is Responsible for Locust and Grasshopper Control?

RESPONSIBILITY

Policy: The primary responsibility for handling locust/grasshopper problems lies with the National Crop Protection Services within the affected countries. These services are supported by regional organizations that provide services to dues-paying member countries. When these bodies are unable to handle the locust/grasshopper infestation, the Host Government (HG) requests assistance from the donor community. The USG may support preparedness or control operations on an emergency or non-emergency basis (A.I.D. Africa Bureau Strategy Paper, 1987, Handbook 8).

Strategy: Under the authority of Handbook 8, the Office of U.S. Foreign Disaster Assistance (OFDA) will provide funds to countries suffering serious locust/grasshopper infestations when a Disaster Determination is made by the U.S. Ambassador (see section B). On a non-emergency basis, A.I.D./Washington's Africa and Asia Near East Bureaus (AFR/TR/ANR and ANE/TR/ARD) will provide limited support for bilateral locust/grasshopper control programs. Missions are expected to program locust/grasshopper monies to the extent possible, using Country Program (OYB) funds for bilateral or multilateral programs, as the situation warrants.

2. Foreign Disaster Relief

RELIEF

Policy: In the event of a foreign disaster, as defined in Handbook 8, the United States may provide emergency relief assistance as a humanitarian

service consistent with U.S. foreign policy goals. Assistance shall, to the greatest extent possible, reach those most in need of relief and rehabilitation. U.S. assistance supports and encourages host country participation in disaster preparedness activities and supplements rather than replaces host country disaster relief resources (Handbook 8).

Strategy: Emergency relief can be made available normally during an initial 60-day period following sudden onset of disaster. During this period, the Chief of Mission may commit up to $25,000. Commitments in excess of the initial $25,000 and/or extension of the emergency phase beyond 60 days require prior approval of A.I.D./W's Office of U.S. Foreign Disaster Assistance. (A locust/grasshopper infestation may warrant an extension beyond the 60-day period.) Missions should submit detailed budgets and Action Plans for OFDA review. OFDA assistance to locust/grasshopper programs may consist of provision of technical assistance, contracting of aircraft, and the purchase of pesticides and equipment.

3. Response Coordination

COORDINATION

Policy: A.I.D. gives a high priority to joint donor participation and international coordination of all aspects of locust/grasshopper programs.

Strategy: A.I.D. will participate in host country locust/grasshopper steering committees of donors, FAO and HG officials and in donor meetings sponsored by FAO or the international organization coordinating locust/grasshopper efforts, and will provide resources in response to country action plans approved by the Country Coordinating Committee. The U.S. Government may also make contributions to international organizations handling locust/grasshopper programs. Contributions made to an international organization do not preclude the U.S. Government from providing relief for the same disaster on a bilateral basis (Handbook 8:17:066.8).

4. Continuing Crop Protection Responsibility

LONG TERM PROTECTION

Policy: A.I.D. believes that over the long term, national and regional crop protection groups must ultimately address Africa and Near Eastern locust/grasshopper problems (A.I.D. Africa Bureau Strategy Paper, 1987).

Strategy: A.I.D. will provide medium/long-term bilateral resources for host country institutional development from AFR/ANE bureau funds, if available, in those cases when USAID operational plans demonstrate that marginal inputs to specifically identified activities will increase the host country or regional organizations' ability to handle locust/grasshopper problems. Often A.I.D. support for medium/long-term institution building will follow the nor-

mal process for project development, i.e., USAID preparation of bilateral project proposals for funding under normal country program levels.

5. USG Environmental Regulations

USG REGULATIONS

Policy: In the field of pesticide use and safety, A.I.D. requires that locust/grasshopper programs adhere to USG Regulation 16 pertaining to the choice, use, and handling of pesticides in development assistance programs (see Chapter VII, section A1). In the case of emergency programs, a waiver to Regulation 16 is acceptable. Selection of pesticides must be in conformance to USG regulations. To the extent possible, pesticides must be purchased in the U.S. USG funds may not be used to support the procurement or application of chemicals disapproved by EPA.

Strategy: Missions that become involved in programs which require the purchase or use of pesticides should become familiar with USG regulations on this issue. A.I.D./W believes that Missions must consider from the very beginning of the project development process such issues as the choice and safe handling of chemicals, training of applicators, storage and security of chemicals, the disposal of containers, and the provision of protective clothing to pesticide handlers.

6. Environmental Impact

ENVIRONMENTAL EFFECTS

Policy: When using pesticides, A.I.D. policy is to strengthen host country capacity to appreciate and evaluate the potential environmental effects of the pesticides and to select, implement and manage effective environmental impacts resulting from such activities, and to promote Integrated Pest Management (IPM) to the maximum extent possible.

Strategy: A.I.D. will support pesticide residue testing and analysis to evaluate the environmental effects of pesticides used in locust/grasshopper programs.

7. Pesticide Standards

EPA REGISTRATION

Policy: The policy of the Africa and Asia/Near East Bureaus is that any A.I.D.-financed pesticides for locust/grasshopper control be registered with the Environmental Protection Agency (EPA) and have a tolerance established for at least one food use, or meet the established acceptable daily intake and maximum residue level recommended by the Joint Meeting on Pesticide Residues to the FAO/WHO Codex Committee on Pesticide Residues.

8. Use of Excess Pesticides

EXCESS PESTICIDES

Policy: Discourage the stockpiling of chemicals beyond their shelf- life under tropical conditions.

Strategy: A.I.D. encourages Host Governments to avoid storing more pesticides than can be used in the next season's control program. Missions should explore the willingness of the Host Government to donate unused locust/grasshopper pesticides to a neighboring country in need, or to consider its use for other pest applications within the country, according to label directions. Disposal of overage pesticides should follow recommended procedures established by FAO, A.I.D., and the International Pesticide Manufacturers Association (GIFAP).

B.Determining Whether a Disaster Exists

When a Host Government asks USAID for assistance with a locust/grasshopper problem, the Mission must assess the extent of the problem and decide whether the problem constitutes an emergency (disaster), or is merely a continuing problem that can be addressed over the medium/long term through regular Mission programming (non-emergency).

DISASTER EXISTS

A disaster exists if:

- The situation is of such magnitude that it is beyond the ability of the Host Government to respond adequately; and
- Disaster assistance is desired by the Host Government; or
- It is in the interests of the U.S. Government to provide assistance.

DISASTER DEFINED

A disaster is defined as:

- A violent act of nature such as flood, hurricane, fire, earthquake, volcanic eruption, landslide;
- An act of man such as civil strife, border conflict, riot, displacement of large numbers of people, explosion, fire;
- An accident of serious proportions;
- A slowly developing catastrophe caused by nature or man's neglect, or both, such as drought, famine, epidemic; or

• A potential calamity, including ecological threats, menacing lives and property and requiring prevention or monitoring measures (Handbook 8:13:3F).

C. Guidelines for Action in non-emergency Situations

1. Management

NON-EMERGENCY

The major decision to be made in setting up a non-emergency program is whether to plan a bilateral or multilateral program. This decision on the part of the Mission should be based on a review of past Mission experience managing bilateral programs, Mission experience working through international bodies such as the FAO, and arrangements being made with other donors who are also supporting similar activities. A careful assessment of Mission resources (both personnel and support facilities) should be made, taking into consideration the different requirements for procurement under bilateral and multilateral programs, and the extent to which the Mission plans to take the lead in implementation.

MANAGEMENT TASK LIST

The following list presents a brief overview of management tasks in a non-emergency situation. It is based on experience during the 86-87 campaign. Relevant A.I.D. Handbooks are 1, 8 and 13. (For details, see Chapter V.)

a. Assign action/project manager. Determine if Mission resources are sufficient to manage the program, and what additional resources might be required.

b. Program funding level in Mission OYB. Try to estimate values of services and commodities required. Consider possible uses of local currency in program.

c. Prepare project documents. Plan for survey, procurement, customs clearance, personnel, transport, equipment, field communications, control activities, funding, and training.

d. Begin periodic situation report cables to keep bureaus advised of program progress and any new needs. In a non-emergency, the Offices of Technical Resources in the Africa and Asia/Near East Bureaus are the designated action bureaus. Information copies of all cables should also go to OFDA and the Country Desk, and to any appropriate European capitals and neighboring or potentially affected country Missions.

e. Material to cover in a situation report: summary of locust/grasshopper movements and control, logistics operations, finances, donor coordination/pledges, etc. Format can be similar to that of emergency reporting cables, but will probably be of a more general nature and submitted less frequently.

f. Maintain records of arrivals/departures of technical assistance; arrival dates of commodities; dates and contents of significant decisions; and general chronology of events.

g. Monitor the situation carefully; if an emergency develops despite all efforts, OFDA assistance is available upon declaration of a disaster.

2. Responsibilities and Authorities (non-emergency Situations)

Action Office	Responsibility	Authority
Mission	Inform A.I.D./Technical (AFR/TR, ANE/TR) and Country Desk Officer of the perceived problem and Host Government (HG) request for assistance.	
	Conduct assessment of locust infestation and HG capability to handle problem. Decide level of Mission involvement.	
	Coordinate/cooperate with Host Government agencies, FAO, UNDP, and other donors in monitoring the infestation and planning and implementation of program.	
	Assign staff and project manager. (See Section on Management Guidelines.)	
	Design and implement project following regular project development procedures or buy-in procedures.	Handbook 3, Chapters 4, 5, 6, 8
	Prepare and manage grants to Host Government and/or public international organizations.	Handbook 3, 3:19 App. 9A-2, Handbook 13, Ch. 5 Handbook 1, Supp. B Ch. 16C

MISSION ACTIONS

23

	Procure project inputs.	Handbook 14	
AFR/TR ANE/TR	Respond to Mission cables. Designate appropriate action officers within TR Bureau. Identify experts as requested by Missions. Facilitate travel of experts and provide other A.I.D./W backstopping as needed. Establish liaison with Office of Procurement to assist Missions requiring assistance in identifying sources of inputs. Monitor campaign and coordinate with other bureaus (e.g., OFDA) tracking locust/grasshopper movements. Ensure program compliance with U.S. pesticide regulations in procurement. Provide assistance in preparing environmental assessments related to the use of pesticides.		BUREAU ACTIONS
Geographic Offices	Monitor country situation. Follow up with action offices in Bureaus, for example, AFR/TR and ANE/TR, to be sure A.I.D./W actions are taken.		GEOGRAPHIC OFFICES
REDSO	Provide services of regional environmental officer/projects officer as requested. Monitor regional situation and assist in information sharing as appropriate. Provide assistance as requested in preparing environmental assessments related to the use of pesticides.		REDSO

S&T Bureau	Support developmental activities on a regional or bilateral basis, designed to improve capabilities and capacities of regional or national institutions. Provide technical backstopping on questions of pesticides, pesticide disposal, Integrated Pest Management (IPM) programs, and plans for research on a bilateral basis.	
Host Government	Survey and report on locust/grasshopper situation. Provide Mission and donors with information on in-country resources of plant protection department. Identify and prepare requests to donors/FAO. Ensure that importation and handling fees are waived on all donations as appropriate, and that landing/handling expenses are minimized. Provide in-country expertise to guide program. Organize Coordinating/Steering Committee.	

S & T BUREAU

HOST COUNTRY

D. Guidelines for Action in Emergency Situations (Disasters)

DISASTER

1. Management

The following list presents a brief overview of management tasks in a disaster situation. It is based on experience during the 86-87 campaign. A.I.D. Handbook 8 is a reference. (For details, see Chapter V.)

MANAGEMENT TASK LIST

a. Prepare a Disaster Determination. The Disaster Determination must be prepared before any OFDA funds can be made available to the country. A Disaster Determination should contain certain information as required by OFDA. (See guidelines and a sample Disaster Determination in Appendix A.)

b. Assign action/project manager. Initiate emergency operations procedures such as reassignment of additional staff, establishment of filing system, request shorter cable approval process. Organize Mission disaster committee as per Mission Disaster Plan. Members might be Representative from Director's Office, Technical Office, Management Office, Controller's Office, Program Office. Ask the following questions: Are Mission resources adequate? What external assistance is required to effectively manage the program (entomologist, logistician/coordinator, researchers)?

c. Develop budget and Plan of Action for submission to OFDA. If dollar values are unknown, indicate kinds of services and commodities required. Consider possible uses of local currency in program.

d. Establish procedures for Mission management of finances and funds disbursal.

e. Decide on procurement method: Mission/OFDA/HG. Under an emergency, OFDA can procure and ship inputs very swiftly.

f. Initiate numbered situation reports to be submitted regularly to A.I.D./W. OFDA should be designated as the action addressee ("A.I.D./W for OFDA"), with info copies to AFR/TR, AFR/EA or ANE/TR, ANE/MENA as appropriate, cooperating European capitals (e.g., Rome- "Rome for FODAG," Paris- "Paris for Club de Sahel," Brussels- "Brussels for USEC"), as well as neighboring and potentially affected country Missions. In a regionwide disaster, A.I.D./W may assign a collective slug-line for all cables - AIDAC/LOCUST, for example. This should be adhered to until A.I.D./W informs the field otherwise.

g. Cover the following items in a situation report: recent information on locust/grasshopper movements and control, logistics operations, finances, donor coordination/pledges, etc. (See Appendix A for guidance.)

h. Maintain records of arrivals/departures of technical assistance; dates and contents of significant decisions; general chronology of events, contributions of all donors. This will be useful in preparing the final report required by OFDA.

i. Make Mission resources available as appropriate, especially for short-term technical assistance: vehicles, international and internal travel arrangements and clearances, maps, secretarial services.

j. Obtain briefing materials on locust/grasshopper to facilitate Mission orientation to the problem.

k. Use the telephone, as necessary, to ensure prompt disaster response; however, all information communications should be confirmed by cable.

l. Plan for the following activities: survey, procurement, personnel, transport, equipment, field communications, control activities, customs clearance, training, and funding.

m. Develop organization chart and delineate lines of responsibility within the Mission.

n. Establish logistics plan, field support plan, and communications systems (including operations and logistics).

o. Plan for media coverage. (See Chapter V, section D.)

2. Responsibilities and Authorities (Disasters)

Action Office	Responsibility	Authority
Mission	Begin reporting cables as soon as potential disaster begins to develop.	Handbook 8 Chapter 3
	Assign Mission action officer.	
	Assess in-country resources and capability to handle the disaster.	
	Confirm assessment, or request A.I.D./W that consultant verify other donor/HG findings.	
Chief of Mission	Prepare Disaster Determination cable to OFDA.	
	Obligate up to $25,000 (U.S.) for immediate or disaster preparedness activities. The Disaster Assistance Authority allows the Chief of Mission to obligate up to $25,000 for emergency or immediate disaster preparedness activities without prior approval from A.I.D./W.	

MISSION ACTIONS

	Note: Access to these funds is triggered by the Disaster Determination. The funds may be used at the discretion of the Chief of Mission as a direct cash donation to the Host Government for commodity purchases, to finance technical assistance for the Mission for disaster assistance or management. The funds should be obligated and expended quickly as they are designed to permit a rapid response to immediate needs. (See Appendix A for guidance on the content of a Disaster Determination.)	Handbook 8 Chapter 3	
OFDA/ Mission	A.I.D. may make cash grants to voluntary agencies for foreign disaster assistance purposes. Decisions on grant assistance are made on a case-by-case basis and depend on the structure and capabilities of the agencies to launch and carry out anticipated projects.	Handbook 8:17:066.7, p. A-3	
Mission	Initiate numbered situation reports to both A.I.D./W and other Missions which are affected or potentially affected by the Disaster. (OFDA guidance, A.I.D. Handbook 8, Appendix F, on preparing reporting cables and sample Locust/ Grasshopper reporting cable are in Appendix A.) Notify U.S. Information Service (USIS) of Disaster and design plan for handling the media. Forward photos/videos of operations to OFDA, if possible. Coordinate with other donors in response and in urging Host Government to create Country Coordinating Committee (CCC). Identify immediate program needs, additional budget request for funds over and above $25,000 obligation, justification, scopes of work for technical assistance, etc.		

	Backstop technical assistance (TA). Identify training, long-term, post-emergency activities. Prepare final report on emergency program for OFDA.		
USIS	Coordinate communications between media and Mission.		USIS
OFDA	Study and analyze the causes of disasters for the purpose of planning in advance the type of U.S. assistance that may be needed when disaster occurs. Conduct disaster preparedness or mitigation activities such as training foreign nationals, vulnerability and risk analysis, public awareness, damage assessment, promoting bilateral, regional and international information exchange, conducting disaster-related research and applying technology (e.g., satellite early warning, tracking and monitoring systems), developing operational disaster plans and providing emergency relief in coordination with other governments, international agencies, U.S. voluntary agencies and U.S. and foreign private assistance. Respond to perceived need and requests for pre-Disaster Declaration assessments by Missions to validate situation. Assign backstop officer. Send cable acknowledging Disaster Determination. Send funding citation for $25,000 (U.S.) authority (within 48 hours).	Handbook 8 8:13 Department of State Delegation of Authority No. 104 of November 3, 1961, delegated to the Administrator, Agency for International Development, provides authority for funding and operational coordination of emergency disaster operations and disaster preparedness. This authority is derived from the Foreign Assistance Act of 1961, as amended (22 U.S.C. 2292), (FAA) and from the Agricultural Trade Development and Assistance Act of 1954, as amended	OFDA

	In preparation for first planning meeting, prepare disaster action folder: cables, background information, record of daily activities, formal and informal contacts. Print out disaster history, case reports, country profile, etc. Convene planning meeting (Invitees: A.I.D., State Desk Officer, Regional Environmental Officer, etc.). Seek information from Mission (if not already provided) on - transport facilities - communications - airports, airstrips - availability of ground/aerial equipment - pesticide storage facilities (see chapter) - history of safety in pesticides handling/ management - Department of Defense acceptance Contact regional, international organizations, and three other donor capitals to coordinate response. Procure all USAID-funded supplies unless otherwise advised (after waivers have been signed by Administrator). Address safety planning needs, from the beginning to the end of the campaign, for pesticide handling; plan public service announcements for passive population.	(P.L. 480, 83rd Congress; (7 U.S.C. 1704; 1721), FAA Section 106. This section authorizes the President to furnish assistance for programs of reconstruction following natural or man-made disasters. FAA Sections 491-493. These sections provide the basic authorities and guidelines for the Agency's involvement in disaster relief, rehabilitation, preparedness, prediction, and contingency planning. Section 493 authorizes the President to appoint a Special Coordinator for International Disaster Assistance. (Handbook 8:17, pp. A-1, A-2).	
Department of Defense	Department of Defense (DOD) Coordinator responds to OFDA requests for assistance by providing and coordinating available U.S. military resources (equipment, supplies, transport, personnel) that are necessary for relief operations.	Department of Defense Directive 5100.46 of December 4, 1975, authorizes the designation ofa Foreign Disaster Relief Coordinator. Handbook 8: App B.	DEPARTMENT OF DEFENSE

ANE AFR/TR Bureaus	Monitor campaign. Prepare Regulation 16 waivers. Coordinate actions within AFR and ANE bureaus, i.e., with Desk, PD and DP. Liaise with Desert Locust Task Force (DLTF) to identify technical assistance and other resources as necessary. Develop appropriate medium and long-term programs. Conduct programmatic environmental assessments and Integrated Pest Management activities.		BUREAUS' ACTIONS
S&T	Technical assistance on environmental and scientific aspects of emergency programs. Participate in operations meetings at OFDA. Provide technical backstopping on questions of pesticide disposal and Integrated Pest Management (IPM) programs.		S & T BUREAU
PPC	Participate in operations meetings at OFDA. Provide guidance on issues involving funds availability and other policy matters.		PPC
External Affairs	Participate in operations meetings at OFDA. Coordinate with press. Report to OFDA on media/congressional interest in program. Collaborate with OFDA in preparation of press releases.		EXTERNAL AFFAIRS

LAC	Report to OFDA on congressional interest in locust program.		LEGISLATIVE AFFAIRS
United Nations (FAO, UNDP)	Handle donor coordination. Provide regular updates on a regional basis; alert countries to potential problems. Provide technical assistance to plan/ implement campaign, forecasting.		
Regional Organiza-tions	DLCO/EA (Desert Locust Control Organization for Eastern Africa - Headquarters in Addis Ababa, Ethiopia) Respond to Member Country requests for emergency assistance (Djbouti, Ethiopia, Sudan, Somalia, Kenya, Tanzania, Uganda). Provide aircraft, pilots, regional reporting. OCLALAV (Organization de Lutte Antiacr-idi- enne et de Lutte Antiaviare - Headquarters in Dakar, Senegal) Respond to Member Country requests for assistance (Chad, Cameroon, Dahomey, Ivory Coast, Mali, Mauritania, Niger, Senegal, Burkina Faso). IRLCO-CSA (International Red Locust Control Organization for Central and Southern Africa - Headquarters in Lusaka, Zambia) Respond to Member Country requests for assistance (Kenya, Uganda, Tanzania, Zambia, Malawi, Rwanda, Burundi, Zimbabwe, Angola, Botswana, Swaziland, Lesotho).		

	FAO Commission for Control of the Desert Locust in the Near East (Headquarters in Jeddah, Saudi Arabia) Promotion of coordination between Member Countries (Sudan, Syria, Turkey, Egypt, Yemen Arab Republic, Bahrain, Iraq, Jordan, Kuwait, Lebanon, Qatar, Saudi Arabia, South Yemen). FAO Commission for Control of the Desert Locust in Southwest Asia Promotion of coordination and exchange of information between Member States (Afghanistan, India, Iran, Pakistan). FAO Commission for Control of the Desert Locust in Northwest Africa (Headquarters in Algiers, Algeria) Promotion of coordination and exchange of information between Member States (Morocco, Algeria, Tunisia, Libya). CILSS Committee International de Lutte Contre la Secheresse au Sahel) Coordinate Sahelian country programs during an emergency. Coordinate donors through Club de Sahel.		

THE TASK FORCE

3. Desert Locust Task Force

The A.I.D. Administrator formed the Interagency Desert Locust Task Force (DLTF) in July 1988 to coordinate U.S. government participation in the desert locust campaigns. DLTF operates under the umbrella of OFDA to respond to the short-term emergency nature of the locust campaigns.

The efforts of DLTF are intended to complement the ongoing programs of A.I.D.'s regional bureaus. Regional bureau programs are designed to improve the overall abilities of national crop protection services to combat pest infestations, conduct environmental assessments and continue applied research.

DLTF chairs weekly interagency meetings of A.I.D. geographic and technical bureaus, Bureau for External Affairs, Directorate for Program and Management Services, Office of Procurement (M/SER/OP), Department of State and U.S. Department of Agriculture. Among the specifically- assigned responsibilities of the Desert Locust Task Force are:

- Policy coordination
- Budget estimates/projections for emergency aid
- Development of guidelines and standards for the safe and efficacious application of pesticides
- Support for surveys and assessing survey results
- Coordination of U.S. participation in control efforts
- Monitoring of control efforts
- Procurement of pesticides, aerial spray services, and communications equipment, as needed
- Provision of technical assistance and assessment teams, as needed
- Participation at international conferences
- Coordination with other donors and FAO

Table of Contents

Chapter III. Coordinating With Host Country Organizations and Donors

A. Host Country Ministry of Agriculture III-2

1. Crop Protection Service III-2
2. Agricultural Research Institute III-3
3. Agricultural Extension Service III-3
4. Forestry Service III-3

B. Other Host Country Ministries III-5

1. Civil Aeronautics Agency III-5
2. Public Health Service III-5
3. Weather Bureau (Meteorology) III-5
4. Customs Service III-5
5. Foreign Affairs Ministry III-6
6. Communications Ministry III-6
7. Police and Military III-6
8. Transportation Ministry III-6
9. Environmental and Wildlife Agencies and National Park Service III-7

C. Regional and Local Organizations III-7

1. Regional Control Organizations III-7
2. Village Brigades III-8

D. Donors III-8

E. Social and Cultural Issues III-9

1. Religious III-9
2. Language III-9
3. Social III-10
4. Travel III-10

Reference	Notes

In order to implement a successful locust/grasshopper control campaign, USAID personnel must work with personnel in host country organizations connected with crop protection or pest control operations. This chapter identifies relevant host country organizations and explains how they can be helpful.

1986-87 SUCCESS

In the 86-87 campaign, most successful control efforts were planned by a Country Coordinating Committee (CCC), composed of representatives from relevant host country and donor organizations. The form or organization and leadership of the Country Coordinating Committee is immaterial; the important point is that there must be an in-country group established to enable all involved donors to coordinate their resources in response to the jointly perceived pest problem.

The CCC provides a mechanism for developing a coordinated response among host country and donor organizations and a useful forum for the exchange of technical and financial information. In providing assistance, the CCC must consider the social and cultural practices within the nation that may restrict control efforts.

DESIRED RESULT

The objective of the control program is to protect and conserve the agro-silvo-pastoral environment that constitutes the livelihood of a major portion of the populace of the affected nations. Consequently, the final result of a control activity must be **better conditions for the people** with a minimal disruption of their way of life. Close contact with knowledgeable individuals within the host country is essential.

The responsible USAID officer must be fully acquainted with every aspect of the control program. Cooperation must be established with other agencies and donors for mutual support, project implementation, and termination. Public relations is a key factor.

A. Host Country Ministry of Agriculture

The Ministry of Agriculture, Ministry of Rural Development or other Ministry responsible for agriculture on a national level includes several agencies or bureaus that are connected with crop protection or pest control operations.

1. Crop Protection Service

Within the host country's Ministry of Agriculture, the National Crop Protection Service (CPS) is the responsible organization for locust/grasshopper control. Its role will depend on its financial and logistical support, the

technical expertise of its staff and its geographical network. Of particular interest is the number of CPS employees who can be assigned full-time to the locust/grasshopper control effort, their technical competence and their experience with large-scale pest control programs.

PLAN FOR CAPACITY

If too few qualified persons are available, then the CPS and USAID must look elsewhere for the necessary support personnel. The area planned for treatment should not exceed the capacity of the people involved to assure that the program operates efficiently and without costly mistakes. Figure III-1 presents a list of the types of people required, except managerial personnel.

2. Agricultural Research Institute

LOCAL KNOWLEDGE USEFUL

Personnel of the Agricultural Research Institute provide information relevant for planning and implementing control efforts. Their knowledge of pest biology can be helpful in scheduling treatments. Their knowledge of soil and vegetation types within the country can appreciably reduce the area requiring survey. Their knowledge of pesticides can assist program managers to select the correct material and dosage and means of application and its timing. Also, the Agricultural Research Institute can provide information on whether certain pesticides may be phytotoxic to specific crops or crop stages.

3. Agricultural Extension Service

SOURCE OF PERSONNEL

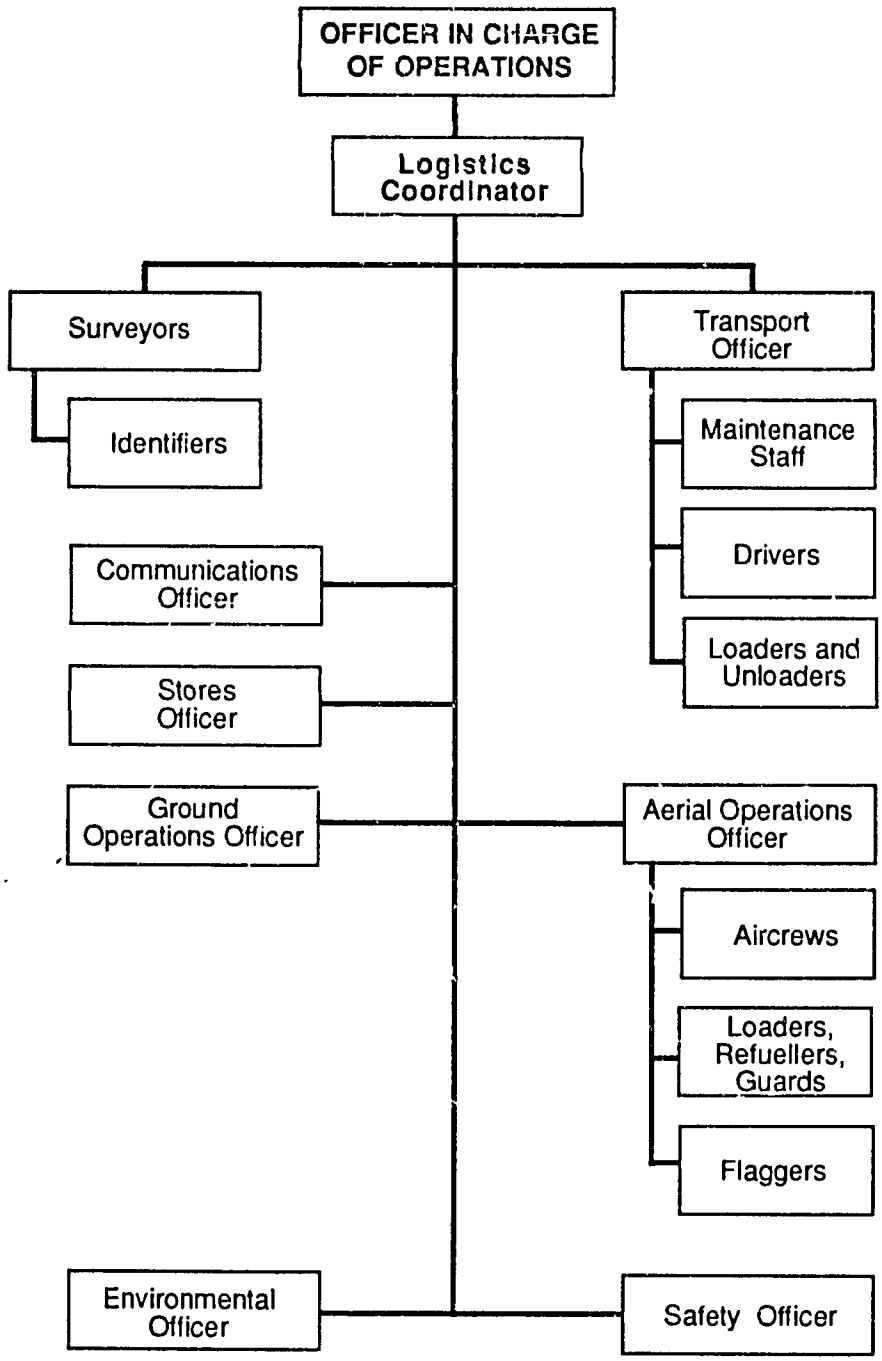
The Agricultural Extension Service is often able to provide large numbers of personnel for locust/grasshopper control programs. Extension Service personnel are in daily contact with the farmers within their work area, and have an intimate knowledge of locust/grasshopper habitats within that area. They provide a primary source for the gathering and dissemination of locust/grasshopper infestation data. Their educational backgrounds enable them to be quickly trained in survey techniques, population estimation, and reporting procedure. They are the logical technicians for training individual farmers in the protection of their own fields and the supervision of these treatments.

4. Forestry Service

EXPERIENCED PERSONNEL

Personnel within the Forestry Service provide services similar to those of the Extension Service. Often the grasslands within forested areas are devastated, particularly by grasshoppers. Forest lands are also the source of infestations which migrate into farmers' green fields as vegetation within the forest dries out or cures. Forest Service personnel are normally experienced in large-scale pest control programs or other emergency actions and so can be easily trained for a variety of locust/grasshopper control activities.

Figure III-1. Types of Personnel Needed for Locust/Grasshopper Control



B. Other Host Country Ministries

1. Civil Aeronautics Agency

AVIATION INFORMATION

Aircraft spraying is likely to be required in any large-scale locust/grasshopper control program. The Civil Aeronautics Agency can provide advice on registration requirements for aircraft used in the host nation, and information such as whether the agency inspects aircraft upon arrival, whether it requires advance approval for the use of airports and landing strips, and whether it requires advance notification when operations are moved from one airstrip to another. The Civil Aeronautics Agency can also provide preplanning information on location and conditions of airstrips, services available (jet fuel, aviation gas or none), and hazards that may be present within the proposed treatment area (power lines and communications towers).

If an accident occurs involving an aircraft, the Civil Aeronautics Agency must be notified immediately.

2. Public Health Service

INVOLVE PUBLIC HEALTH

The Public Health Service should be informed and involved in any major control effort where pesticides are used. Doctors, hospitals, and clinics throughout and adjacent to the control area must be notified of the pesticide to be used, toxicity symptoms to humans, and antidotes (if they exist). Public Health should make radio broadcasts and/or other media announcements to alert the populace of the toxic symptoms, and actions they should take if such symptoms were to appear.

3. Weather Bureau (Meteorology)

WEATHER INFORMATION NEEDED

Daily weather forecasts as well as long-range forecasts are a necessary part of any control effort using pesticides. Rains control the location and rate of locust/grasshopper hatch. Rains also wash insecticides off the vegetation. Rains are often accompanied by high winds; high winds during application can drift the insecticide far off the target. High winds can also do serious damage to aircraft unprotected on an outlying airstrip. Many locust/grasshopper species migrate downwind towards areas of low-level wind convergence. Knowledge of the locations of these convergence systems can appreciably enhance the possibilities of the insects' detection.

4. Customs Service

The Customs Service must be contacted early in the planning phase because imported equipment and materials must be expedited through the

customs process free of import duties. The Customs Service must be notified of the types and quantities of materials to be imported and their origin. Customs must also be requested to provide immediate notification when goods arrive so they may be moved quickly to the worksite.

NOTIFY CUSTOMS

5. Foreign Affairs Ministry

With an understanding of the seriousness of the problem, the Foreign Affairs Ministry can expedite the issuance of visas for technical personnel who must be brought into the country on short notice. The Ministry of Foreign Affairs can also assist in the speedy evacuation of persons who may be seriously injured during the course of the work.

VISA ASSISTANCE

6. Communications Ministry

In an emergency locust/grasshopper control program, radio communication is usually essential. Often the necessary equipment must be brought into the country. The Communications Ministry must approve the types of equipment and assign useable frequencies (see Chapter V). The Communications Ministry will be aware of other communications systems operational within the country that may also be utilized for communications needs.

RADIO FREQUENCIES

7. Police and Military

The police and military units of the government must be notified of the personnel from the outside of the country who will be participating in the program and the location in which they will be working. On a daily basis, police and military must be informed of the location of spray aircraft and their approximate worksite. The police may have telephone or radio networks which can be utilized. The military may be able to assist with helicopters or small aircraft for survey or aerial spraying. They may also be able to assist in the transportation of materials or personnel for aircraft guidance. In addition, the military can provide information on hazardous and prohibited areas.

KEEP THEM INFORMED !!

8. Transportation Ministry

The Transportation Ministry can assist in expediting the movement of pesticides and other materials within the host country. If government transport is not available, the Ministry can provide guidance in the procurement of transportation. The Ministry can also provide information on road conditions (some roads become impassable during the rainy season). The Transportation Ministry usually has jurisdiction over principal airstrips and airports. Thus, they are responsible for waiving all landing fees, fuel taxes, and aircraft tie-down fees for aircraft financed by A.I.D. and other donors.

WAIVING LANDING FEES

9. Environmental and Wildlife Agencies and National Park Service

PESTICIDE RESTRICTIONS

Environmental and Wildlife Agencies and the National Park Service should be involved in initial program planning and briefed on provisions of the environmental impact statement or waiver within which A.I.D. operates. The host country agencies can provide information on national restrictions on pesticides and pesticide use. If these restrictions are more stringent than the restrictions of the environmental impact statement, A.I.D. respects the host country's restrictions and determines whether effective control operations can be mounted within these restrictions. Host country environmental agencies should also participate with USAID in determining the program's impact on nontarget organisms.

C. Regional and Local Organizations

1. Regional Control Organizations

Although there are a number of regional organizations dealing with locust problems, none in the Africa and Near East Regions deals exclusively with the grasshopper problem.

REGIONAL ORGANIZATIONS

The FAO has acted as the lead group for coordination of locust/grasshopper control programs since 1952. Three Desert Locust Control Regional Organizations operate under the umbrella of FAO. These are: Northwest Africa Regional Commission; Near East Regional Commission; and Southwest Asia Regional Commission. Each commission has established a trust fund that is used principally to finance training, research, and emergency assistance until other financial sources can be found.

Three independent Regional Control Organizations are also operational: the Desert Locust Control Organization for Eastern Africa (DLCO-EA), Organization Commune de Lutte Antiacridienne et de Lutte Antiaviare (OCLALAV) in West Africa, and the International Red Locust Control Organization for Central and Southern Africa (IRLCO-CSA). These independent organizations are financed and managed by their member nations but each has a relationship agreement with FAO.

The Comite Permanent Interetats de Lutte Contre le Secheresse dans le Sahel (CILSS) and its associated Agrometeorological organization (AGRHYMET) have had considerable experience in pest control problems and their control in the African Sahel. They can supply research, monitoring, control and historical data on past locust/grasshopper problems. Daily weather reports are a necessity for any control operations. Individual country weather bureaus rely on AGRHYMET for much or all of their historical records and weather predictions.

2. Village Brigades

Village Brigades (Phytosanitary Intervention Cells or similar village groups) exist in some localities. Usually, they are organized by the national extension or crop protection services and have some training in crop protection, including pesticide application and pesticide safety. Village Brigades can be very helpful in areas where grasshoppers are infesting or threaten to migrate into croplands. They may have enough mechanical applicating equipment to apply dusts, emulsifiable concentrate sprays and perhaps even baits. The Country Coordinating Committees should evaluate the number of teams available or needed, their level of training, the technical and logistical support received by these teams, and their capabilities.

LOCAL HELP

In cropland, grasshopper control is primarily an individual farmer problem. However, under outbreak conditions farmers are unable to do a satisfactory job without assistance to prevent migrations from outside their field boundaries into their fields. To maximize farmer participation, control efforts must assess farmer requirements for equipment, protective clothing, supplies and additional training.

FARMER PARTICIPATION

Both individual farmers and farmer brigades can be of great help in reporting economic infestation levels of grasshoppers and locating locust hopper bands and swarms. They may need training in reporting their observations.

D. Donors

Of the wide array of bilateral donors, international and regional organizations, and private and voluntary agencies who are working on the locust/grasshopper problem, many have had extensive experience working with the Africa and Near East nations on the control of these pests. They have a unique contribution to make to its resolution. (See Appendix B.)

The FAO has acted as the lead group for coordination of locust/grasshopper control programs since 1952. FAO coordinates donor aid from the international community and acts as a forum for discussion of comprehensive questions.

FAO COORDINATION

Other donors include (but are not limited to) Belgium, Canada, China, Denmark, the European Economic Community (EEC), France, Greece, German Federal Republic, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Saudi Arabia, the United Kingdom, and the United States. In addition, the following organizations have provided assistance: the United Nations Development Programme (UNDP), the World Health Organization (WHO), the Organization of Petroleum Exporting Countries (OPEC)

fund, Oxfam, Band Aid, CARE, Cooperation Suisse, Norwegian Church Aid, Save the Children, and World Vision International.

PRIMARY RESPONSIBILITY

A.I.D. gives high priority to the support of interorganizational networking. A.I.D. experience suggests that other organizations contribute to the thorough analysis of the problem and the development of a workable resolution. If A.I.D. feels that the networking process has not generated an adequate response, A.I.D. has a responsibility to take actions that may differ from those resulting from such collaborative efforts.

A.I.D.'s position is that primary responsibility for treating pest infestations resides with the farmers and governments of the countries in which they occur. If external assistance is appropriate and requested, it must be approved by the host country. Country Coordinating Committees (CCC) provide a useful forum for the exchange of technical and financial information among host country and donor organizations, and provide a mechanism for developing a coordinated response among donors and the host country. The CCC meets periodically to coordinate the use of the various components of the donor assistance such as allocation of funds, equipment, chemicals and the maintenance of an inventory of donor assistance.

E. Social and Cultural Issues

1. Religious

RELIGIOUS CONSIDERATIONS

The locations of sacred shrines and grounds, and the activities associated with feast days and holy days may impose limitations on control activities and require special authorization from state and/or religious leaders before control activities can commence. Such restrictions may limit work days or vary work days and must be included in invitations to bid so that potential contractors are aware and can make appropriate provisions.

2. Language

LANGUAGE PROBLEMS

A vast mosaic of languages and dialects exists in the countries subject to locust/grasshopper infestations. Control programs must ensure that the language of instructions and safety announcements corresponds to the language of the people in the area involved. Also, language issues must be resolved in aerial application when the pilot in the air and the control tower or the flagger or surveyor in the field speak different languages.

3. Social

SOCIAL CONSTRAINTS

The way of life within each geographic area of operation can and will vary according to social obligations, restrictions, and priorities at the local level. These may be based on religion, geography, climate or socioeconomic factors and may directly impact on all aspects of the control program. National holidays may limit action. Contact with individuals of certain social levels or gender may be taboo. Knowledge of these issues can facilitate and expedite both planning and implementation.

4. Travel

TRAVEL LIMITATIONS

Travel within areas proposed for control may be limited for military, religious, geographical or physical reasons. Areas may have restricted access, be off-limits to air or ground travel or be unsafe because of internal or external hostile activities. Temporary military movements may also delay control efforts. Areas accessible only to members of certain groups may be off-limits to outsiders. Finally, implementation efforts may be limited by the lack of roads, rail facilities, or airstrips, and the difficult or dangerous physical and/or climatic features of the areas to be treated.

Table of Contents

Chapter IV. Assessing Control Strategies

A. When are Control Efforts Justified? IV-2

B. Methods of Control IV-4

1. Chemical IV-5
2. Biological IV-5
3. Cultural IV-5
4. Integrated Pest Management IV-6

C. Strategies for Grasshopper Control IV-8

1. Two-Phase Strategy IV-8
2. Early Intervention Strategy IV-8

D. Strategies for Locust Control IV-9

1. Desert Locust IV-9
2. African Migratory Locust IV-11
3. Red Locust IV-11
4. Brown Locust IV-12

Reference	Notes

GOAL

The goal of all locust/grasshopper control efforts is to attack the problem at the earliest possible stage of development of an upsurge so as to minimize the control costs, the area requiring treatment, and the potential for crop and grassland damage. This chapter explains when control strategies are justified, discusses methods of control, and outlines strategies for controlling both grasshoppers and locusts.

BACKGROUND

Historically, control organizations and systems have been developed and then disbanded once the immediate problem disappeared. The end result has been the need for repeated emergency action whenever the next upsurge occurred. During years when the grasshopper/locust population is in recession, nations have little incentive to maintain more than a core of trained technical personnel. Equipment and material for one campaign becomes worn-out or obsolete before the next major campaign occurs. Control efforts must recognize this reality and address both short-term and long-term needs.

For both grasshoppers and locusts, adequate rainfall is the key factor in population upsurges. The same pesticides and equipment are used against both, but the method of use and timing of application are quite different.

Although some grasshopper species migrate north and south along with the north-south progression of the Inter-Tropical Convergence Zone (ITCZ) most are sedentary, living out their lives within a relatively short distance of their site of emergence. Grasshoppers are mainly graminivorous. They feed on grasses, damaging the pasturelands, but when weather conditions are suitable, they may leave the grasslands or other noncultivated areas and invade crops.

Locusts are an international threat. In times of recession, small numbers of insects may exist over widely scattered areas. When suitable rainfall and other favorable climatic conditions occur, their numbers can increase extremely rapidly and they then become GREGARIOUS. Gregarious locust swarms migrate downwind, often great distances to areas of low level wind convergence where favorable rainfall for breeding and further multiplication occurs. En route they pass through agricultural areas where they cause great damage.

A. When Are Control Efforts Justified?

JUSTIFICATION

Pest control costs money and involves time and effort. Some loss will occur regardless of what one does. ***Control efforts are only justified*** when estimates suggest that, without controls, a pest population will reach or exceed acceptable levels of economic damage.

Table IV-1 presents economic threshold levels for locusts and grasshoppers. Note that specific guidelines exist for grasshoppers, guidelines that vary depending on the stage in the life cycle. No actual number can be assigned to designate the economic threshold for locusts.

Table IV-1. Grasshoppers and Locusts Threshold Level Guidelines.

Species	Croplands Seedlings	Rangeland Vegetative Stages	and Wasteland
Locusts	Any gregarious forms, bands of hoppers or swarms of adults		
Grass-hoppers Adults or Nymphs	6-10 per m2	15-20 per m2 vegetation is drying and movement to crops seems imminent, or if forage production is low and over-grazing is likely.	10-20 per m2 if
Young Hoppers	15-30 per m2	30-60 per m2	20-60 per m2

Control efforts are justified, whenever locusts become gregarious. Chapter VI explains how surveys and monitoring provide the evidence needed to determine economic threshold levels.

GREGARIOUS LOCUSTS

The selection of a control strategy must be based on knowledge of expected economic, environmental and sociological consequences and on the recognition that a certain amount of loss is to be expected when crops are grown. Two concepts assist in the determination of when control measures need to be applied:

ECONOMIC LEVELS

- Economic Injury Level (EIL) - The lowest pest population density that will cause economic damage.

- Economic Threshold Level (ETL) - The pest population density at which control measures are employed to prevent an increasing population from exceeding the economic injury level.

Since it is desirable to prevent a pest population from reaching or exceeding the economic injury level, control measures against grasshoppers are

generally applied at a level below the EIL, the level of the Economic Threshold (ETL).

For locusts a different criterion is generally employed in determining when control efforts are justified. Some regional organizations and crop protection services classify locust populations controllable when they reach levels of 1,000 to 5,000 individuals per square kilometer (km2) even though they may still be in the solitarious phase. A more valid criterion is to use phase transformation. Solitarious phase locusts tend to isolate themselves, and remain that way until the population reaches the point where they cannot avoid close contact with other locusts. When this point is reached aggregation occurs and gregarious tendencies become evident. Control efforts are then considered justified to prevent swarming and long range migration. No actual number can thus be assigned to designate the economic threshold. It must be based on the characteristics of phase transformation.

The change-over from solitarious phase to gregarious phase for most locusts involves a decided color change. For example, with the Desert Locust, solitarious phase hoppers are green, but some may turn brown in the later instars. Adults are pale grayish brown, buff or peach with some mature males pale yellow. Gregarious hoppers are mostly black in the early instars, turning yellow and black in the later instars. Immature adults are pink to reddish brown. Mature adults are bright yellow.

Even more striking than coloration are the behavioral changes. Aggregation and the formation of marching bands is typical of the hopper stage, while swarm formation and long distance flight is typical of the adults.

CONTROL EFFECTIVENESS

The ability to control all or only a portion of the infested area must be determined. It is often more effective to obtain 90 percent control over 100 percent of an infested area than it is to obtain 100 percent control on only 99 percent of the area (Knipling, E.F.). As an example, if the infested area involves 500,000 hectares at a population of 30 insects per square meter and control is 90 percent, the population remaining will be 3 or less per square meter, well below the economic threshold. However, if 100 percent control is obtained over only 99 percent of the infested area, there still remains about 5,000 hectares with the original 30 per square yard population, far above the economic threshold for those 5,000 hectares.

B. Methods of Control

Managers may wish to incorporate some or all of the following methods into their overall program strategy.

However, at the present time, biological and cultural controls will be ineffective in suppressing populations over wide areas and must therefore be merely supplementary to chemical controls.

1. Chemical

CHEMICAL

Chemical methods for controlling grasshoppers and locusts include the hand application of dusts and baits, the motorized ground application of pesticides, and aerial spraying and dusting. The technique or variety of techniques to be used will depend upon the species and its stage of development, the severity of the infestation, the progression of the season, and the type of vegetation to be protected.

The application of pesticides is the only grasshopper and locust control method that has proven effective. It is the only method available at this time which can show immediate economic benefits over a rather wide area.

2. Biological

BIOLOGICAL

Several microorganisms have been found to infect locust/grasshopper species throughout the world, but only the microsporidia, Nosema locustae, is commercially available for field use. It has been extensively tested in the United States and is registered for use for grasshopper control in the United States and marketed under the name of "NOLOBAIT."

A field trial with Nosema locustae was conducted on Santiago Island in Cape Verde and in Mauritania, near Kaedi, against some of the more sedentary grasshoppers. The data show 6-12 percent infection at 21 days and 12-15 percent infection at 42 days post-application, in Cape Verde. In Mauritania, infection levels were 10-26 percent at 28 days post-application. No data have been presented as to the degree of population suppression achieved. Additional research is necessary before Nosema locustae can be considered an effective tool for control of African grasshoppers.

3. Cultural

CULTURAL

Cultural control measures are generally used by individual farmers or by groups of farmers working together. They are most effective in rather confined areas against species of grasshoppers that have reached economic threshold levels. Cultural controls have only limited applicability in widespread infestations involving extensive pasture or rangeland.

Control measures

Cultural control measures include:

- Early planting so that plants are beyond the seedling stage at the time of grasshopper hatch (this requires gambling on the weather)

- Late planting after the migratory species have left the area

- Plowing to expose egg pods to the elements (inappropriate for control of the Senegalese grasshopper because its eggs are resistant to exposure and drought) (this technique may also leave the soil exposed to wind erosion)

- Deep plowing to bury eggs deep so that the young nymphs cannot reach the soil surface when they hatch (equipment usually unavailable to African farmers)

- Trenches dug around crops and filled with water or oil to drown or repel invading grasshopper nymphs

- Destruction of egg pods (especially useful against the Variegated grasshopper which lays its eggs in close-knit colonies or groups)

- Use of fire and smoke to repel swarming grasshoppers/locusts

- Hand collection (locusts are sometimes collected by nomadic tribes for food)

- Bagging of the maturing grain heads

- Use of neem extract as an antifeedant

4. Integrated Pest Management

I.P.M. DEFINED

Integrated Pest Management (IPM) simply means using the best mix of available control methods for achieving the most effective, cheap, safe, and sociologically and environmentally sound pest control possible. (Note that IPM is often misinterpreted to mean nonchemical control.) IPM involves taking advantage of ecosystem features to maintain pest populations at economically safe levels. IPM techniques include altering conditions to augment populations of parasites, predators and pathogenic organisms and combining such techniques with a variety of management tools, including genetic, cultural, chemical and regulatory methods. IPM emphasizes agroecosystem ecology and containment rather than complete elimination of pest populations.

A.I.D. POLICY

A.I.D. supports Integrated Pest Management as a part of its agricultural program. A.I.D. policy is:

- To establish programs aimed at helping developing countries design and operate environmentally sound integrated pest management systems and procedures in which pesticides are used only when necessary

- To discourage requests for pesticides unless they are used in economically sound integrated pest management systems

- To exert international leadership by communicating U.S. policies and experience on pest control and pesticide problems to other nations and international organizations

CHEMICALS ONLY

The concept of IPM is met by the sole use of chemical pesticides for locust/grasshopper control when:

- Only recommended chemicals and minimum dosages are used

- Control decision making is based on the use of economic thresholds

- Treatment is timed so that only the minimum area requires treatment

- Applications are only made under appropriate weather and wind conditions

- Application equipment to be utilized is appropriate for the intensity and extent of the problem

- Application equipment is properly calibrated and in good repair

- All safety precautions have been taken and inhabitants within the treatment area notified

- Program personnel have been provided adequate training

- Critical habitats and other ecologically sensitive and environmentally hazardous areas have been mapped and marked for avoidance during application

C. Strategies for Grasshopper Control

GRASSHOPPERS

Two basic strategies for control emerged as a result of the 86-87 control program in the Sahel. Both strategies rely almost exclusively on chemical pesticides for control.

1. Two-Phase Strategy

Two phase strategy

The Food and Agriculture Organization of the United Nations (FAO) recommends a two-phase strategy, with control efforts based on the two phenological stages of millet. Millet is the principal crop host of the Senegalese grasshopper, the major grasshopper pest.

Phase I

Phase I controls occur between June and early August and are essentially aimed at minimizing damage to germinating sorghum and millet. Farmers treat infestations in and around their cultivations, using dusts. Where necessary, crop protection service personnel assist them with mechanized ground equipment.

During August and early September, millet and sorghum plants increase in size. The larger plants can withstand considerable amounts of leaf damage. Also, at this time of the year, wild annual vegetation becomes available to grasshoppers as an alternate source of food.

Phase II

Phase II controls are a widespread operation against nymphs and adults of the second, or subsequent generations of the Senegalese grasshopper. At this stage, the grasshoppers feed preferentially on the millet heads. Phase II usually involves aerial application of chemical pesticides but may also involve ground equipment in areas where aircraft are not available or crops are directly at risk.

2. Early Intervention Strategy

Early intervention strategy

A.I.D. and several other donor nations recommend the early intervention strategy. It is based on the assumption that the best time for conducting control operations is at the beginning of the rainy season, shortly after the first generation of Senegalese and other grasshoppers hatch. Although most grasshopper species in the Sahel emerge within a short period of each other, their continuing biology can vary markedly. The early intervention strategy times treatments to coincide with the development, breeding and migratory habits of both Senegalese grasshoppers and other grasshopper pests.

A majority of grasshopper eggs hatch within about 15 days following summer rains in excess of 25-35 millimeters. Natural mortality may exceed

90 percent in the early instars, so treatments should be withheld until the third instar. First, farmers treat their infested crops with chemical insecticides. Second, the Crop Protection Service applies baits or liquid sprays to surrounding accessible fallow fields, grasslands and forest lands. Third, infestations in less accessible grass and forest land and crops are sprayed from the air.

Early intervention effectively reduces or eliminates grasshopper populations, preventing serious crop loss. Logistically, control operations are easy during the dry season because they are not hampered by the heavy and frequent late season rains and denser vegetation.

D. Strategies for Locust Control

LOCUSTS

Strategies for locust control aim to prevent plagues by manipulating the insect's annual and daily cycle of activities. Control strategies vary by the species of locust involved.

1. Desert Locust

DESERT LOCUST

The Desert Locust has no clearly identifiable outbreak areas. Between plagues, it occurs in low numbers throughout a 14 million square kilometer habitat. During plagues, its invasion area extends to 29 million square kilometers. Primary breeding and reproduction areas include: the Red Sea coastal areas of Sudan, Saudi Arabia, Yemen and Ethiopia; the northern Somalia coast; the Tibesti mountains of Chad; Air of Niger; Adrar des Iforas of Mali; Ahaggar of Algeria; the Sind and Rajistan Deserts of Pakistan and India, respectively. Control strategies for these areas call for treatment of hopper bands. Two systems can be utilized.

Direct application

- Insecticide can be applied directly to the individual bands. This technique is applicable only if the bands are readily visible. Only the area occupied by the band requires treatment. Both dusts and liquid sprays applied by air or ground are applicable.

Barriers

- Barrier strips with a persistent stomach poison can be used. Either liquid sprays or baits can be utilized. Most commonly used bait materials are wheat bran, rice hulls and peanut hulls. Large flake wheat bran has provided the best results, but is difficult to obtain.

In the Sahelian and Saharan zone control is difficult, expensive and highly inefficient; control efforts have seldom shown any appreciable effect on plague prevention or plague elimination. Since parts of the area serve as critical habitats for certain threatened animals and plants, the use of pesticides must be avoided in some habitats.

Plague prevention

A proven plague prevention strategy is the use of terrain features that inhibit the migration of swarms. Locations within Africa and the Near East where terrain features can be used are: the Atlas Mountains of Morocco and Algeria; the Northern Ethiopian (Eritrean) highlands; the Western Saudi Arabia escarpment (Tihamat); and the mountains of Yemen. Migrating Desert Locusts can be trapped in these and other similar locations where the weather is cold.

During the winter months, the activity and movement of locust swarms in these locations is limited to very short periods of time in the middle of the day or not at all. Once detected, swarms become ideal aerial and ground spray control targets as they may remain at the same site or in the same general location for many days. Control measures concentrated in these areas during the winter months have proven far more effective than control efforts at other locations during the warmer months of the year.

Swarm control

Swarm control may be accomplished in two ways: flying swarm control and settled swarm control. Flying swarm control involves aerial application of a quick-acting contact insecticide to a flying swarm of locusts.

Flying swarms

Research has shown flying swarm control to be highly efficient, but under actual field conditions rapid fluctuations in swarm size and density often diminish effectiveness. Flying swarm control is also dangerous. Flying locusts, impinging on the aircraft windshield, impair the pilot's vision. Locusts also pack up in the airscoops of the aircraft and between the engine and the nacelle sending engine temperatures soaring.

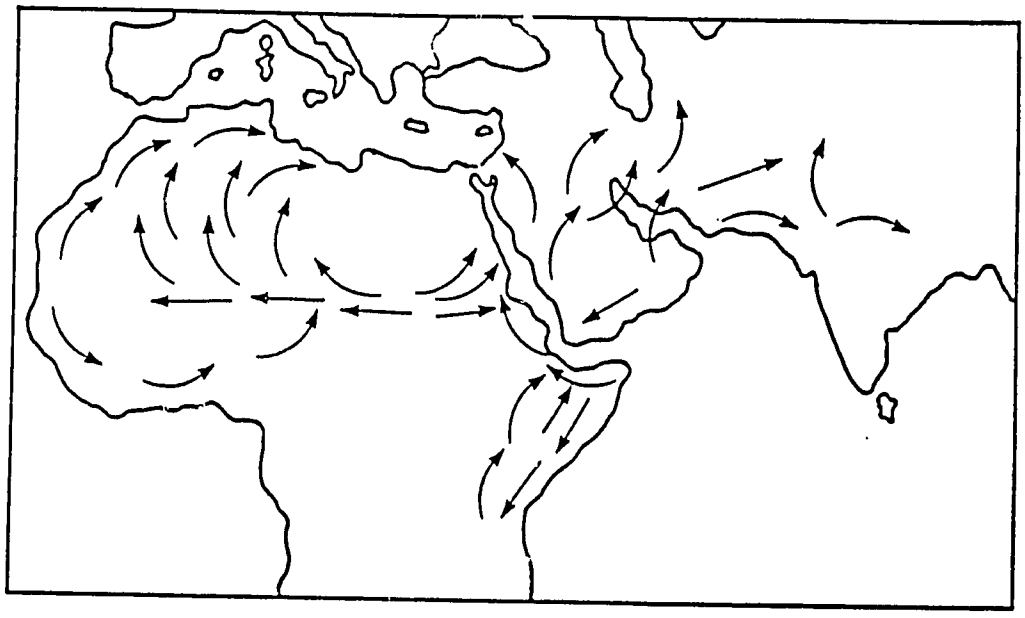
Settled swarms

Settled swarm control involves the application of insecticide to swarms that are settled in one location. Cold temperatures hamper locusts as they move to traditional winter breeding areas. They are able to fly only short distances and then for only a short period within the warmest part of the day. During cold *snaps* they may remain in one location for days at a time.

Settled locust swarms are highly concentrated, occupying an area 3 to 10 times smaller than flying swarms. Settled swarm control is most efficient when undertaken in and around the winter and spring breeding areas of the Mediterranean and Red Sea Coasts (see Figure IV–1).

Swarm control in the northern Ethiopian highlands must be supported by control of hopper bands that may develop on the Red Sea coastal areas of Sudan, Ethiopia, Saudi Arabia and Yemen and the Gulf of Aden coast of northern Somalia. Swarm control may also be required along the Ethiopian railway line and in the mountains of Yemen. This Central Region can produce as many as six generations of Desert Locust per year and has historically been the source of most Desert Locust upsurges.

Figure IV-1. Desert Locust Swarm Movement from Summer to Winter-Spring Breeding Areas.



2. African Migratory Locust

AFRICAN LOCUST

The principal outbreak area for African Migratory Locusts is in Mali. At the end of the rainy season, solitary adults move to the flood plains after the waters have receded. There, they breed during the dry season when conditions elsewhere are unfavorable. Control efforts focused on these residual dry season populations can be effective. Before the start of the first rains, hoppers are aggregating and the breeding sites are accessible.

3. Red Locust

RED LOCUST

The recession or outbreak area of the Red Locust comprises 7,800 square kilometers in nine locations in eastern Africa. The Red Locust invasion area is approximately 1,000 times larger. The most efficient control strategy is to maintain the locust within its outbreak area and prevent swarms from escaping. The outbreak area is lowland characterized by impeded or enclosed drainage and subject to extremes of flood and drought. The floodplains are the important locust habitat.

Egg laying begins and hatching occurs during the rainy season (October-January). The newly hatched hoppers disperse but then concentrate again at about the third instar. The hoppers begin to disperse again during the fifth and sixth instars, prior to fledging. Controls should therefore be implemented against the third to the fifth instars.

Since the period for most effective control occurs during the middle of the rainy season, access to the outbreak areas by ground is extremely difficult. Controls must be conducted in most cases with aircraft. Helicopters work well in this situation as every effort must be made to prevent contamination of the surrounding rising waters.

4. Brown Locust

BROWN LOCUST

The outbreak area of the Brown Locust is confined to the Karoo area of the Union of South Africa and extends slightly into the extreme southeastern portion of Botswana. Brown Locust plague prevention rests almost entirely on the effectiveness of control efforts in South Africa. When this system breaks down and outbreaks occur, as was the situation in 1985-86, then swarms invade Botswana. Thus, control strategies in Botswana and other nations must be defensive.

Attacking swarms

Aerial application techniques are required to attack the incoming swarms while they are in the settled state. At times it may also be necessary to attack flying swarms, if they are an immediate threat to cropland.

Since some swarms may lay eggs before they are controlled, barrier spraying, both ground and aerial, may be required against hopper bands of the new generation. Wheat bran baits or a relatively persistent liquid pesticide such as carbaryl should be utilized.

Table of Contents

Chapter V. Developing Plans for Action

A. Overview V-2

1. A.I.D.'s Approach V-2
2. A.I.D.'s Operational Authorities V-2

B. Program Development V-3

1. Country Coordinating Committee V-3
2. Country and Mission Action Plans V-4
3. Organizing and Training Personnel V-7
4. Selecting a Control Strategy V-8
5. Establishing a Control Operations Center V-9
6. Phasing Out V-12
7. Developing Host Country Institutions V-13

C. Communications V-13

1. Meeting Communication Needs V-13
2. Basic Requirements for Radio Communications V-15
3. Assistance Available from OFDA V-16
4. Questions to Answer Before Requesting Assistance V-16
5. Characteristics of Several Radio Systems V-19
6. Glossary of Technical Terms V-21

D. Dealing with the Media During a Disaster V-24

1. Who is Responsible? V-25
2. Obtaining Video Coverage V-25
3. Talking to the Media V-25
4. Preparing Press Kits V-26
5. Making Public Service Announcements V-27
6. Monitoring the Media V-27

Reference	Notes

A. Overview

1. A.I.D.'s Approach

A.I.D. APPROACH TO PROBLEM

A.I.D.'s approach to locust/grasshopper problems calls for the provision of assistance over the short, medium and long term. Given the cyclical nature of major infestations, actions taken during the early months of an upsurge are critical. Early action can contain the initial emergency and establish a program for long-term control and management of locusts and grasshoppers.

A.I.D.'s approach calls for the following activities:

- Providing early warning, through monitoring of potential pest problems in individual countries (and specific areas in those countries).

- Establishing standards and criteria for determining when and where to apply strategies for control.

- Providing technical, financial, and material resources for timely, efficient, and cost-effective pest survey and control activities that take U.S. environmental concerns and legislation into account.

- Supporting adaptive research needed to take advantage of recent advances in pest identification, survey, early warning, and control technologies.

- Training and developing a host country human resource base that can help maintain control of the threat posed by locusts and grasshoppers.

- Encouraging neighboring countries to plan and agree on cross-border operations.

2. A.I.D.'s Operational Authorities

A.I.D. AUTHORITIES

Within A.I.D., several internal units divide operational responsibility. In the short term, the Office of U.S. Foreign Disaster Assistance (OFDA) has the authority and responsibility to apply its resources to:

- Pest emergency situations in a host country (up to 90 days in duration) when a disaster has been declared by the U.S. Ambassador to that country (when a determination is made that the situation poses a serious threat to the economy and requires resources beyond those available to that country).

- The mitigation of potential disaster situations (preventative measures where there is a known or predictable disaster threat)

- Recovery and rehabilitation activities (90 to 180 days) designed to prevent secondary disaster effects

In the medium term, A.I.D.'s Regional Bureaus have the authority and responsibility to use their regular resources to:

- Implement nondisaster project activities required to put immediate pest situations back under control

- Restore a positive milieu for the implementation of normal, longer-term development initiatives

LONG TERM ACTIVITIES

In the long term, A.I.D.'s Regional Bureaus and the Bureau for Science and Technology have the responsibility and authority to use their resources to improve the capabilities of national and regional institutions. Activities may be bilateral or regional and may include long-term Integrated Pest Management programs covering all forms of pests, including locusts and grasshoppers.

B. Program Development

1. Country Coordinating Committee

CCC HAS LEAD

The Country Coordinating Committee (CCC), composed of representatives from relevant host country and donor organizations, provides a mechanism for developing a coordinated response to locust/grasshopper problems. After an emergency situation has been recognized, the CCC must take the lead in providing the planning, initiative, and momentum necessary to facilitate and conduct a successful control campaign. Facts must be gathered to determine the scope of the problem. The objectives of the campaign must be specifically defined in principle and in detail. The CCC must establish the organizational structure that will guide the program's operations, set priorities for donor support, and target areas for survey and control. The CCC must have the authority and resources to establish needs and see to it that they are met.

CCC ACTIVITIES

The CCC should maintain up-to-date records of all supplies, pesticides, manpower, and equipment on hand and on order. It should know the sources for personnel training, the location of pesticide storage facilities, airports and airstrips, available communications systems, and a source for timely meteorological data. To develop this needed information the CCC must be functioning well in advance of the beginning of control operations.

The CCC must set out a clear and comprehensive list of all tasks, functions, and needs to be accomplished during the campaign year, together with deadlines for completing each function. Responsibility for each task or function must be specifically assigned to a named individual, group or organization, and progress monitored on a frequent schedule.

The Country Coordinating Committee should establish a technical subcommittee to work with the host country director of operations on a day-to-day basis. This subcommittee should be composed of technical advisors and implementation personnel from donor and host country organizations and should guide the actual implementation of the overall control operation.

2. Country and Mission Action Plans

AID RESPONDS TO COUNTRY ACTION PLANS

A.I.D. resources should be provided in response to Country Action Plans approved by the CCC and representing the policy of the host government. Country Action Plans should be forwarded to the Food and Agriculture Organization (FAO), as a basis for issuance of an appeal for donor support. Table V-1 is an example of an activities calendar, the basis for development of a Country Action Plan.

A.I.D. does not require FAO's technical review. If a host country asks A.I.D. to respond in a manner that differs from that recommended in the Country Action Plan, A.I.D. may elect to do so.

MISSION ACTION PLAN

In order to receive A.I.D. resources, USAID Missions with an actual or potential locust/grasshopper problem should prepare their own Action Plans. These Plans should consider the requirements identified in the Country Action Plans and propose initiatives for A.I.D. funding over the short, medium, and long term. A.I.D./W will review these plans for adherence to policy guidelines, establish priorities among competing demands, and allocate appropriate resources within available funds.

Developing a Mission Action Plan involves defining the job to be accomplished, selecting methods to accomplish the task, and drafting a plan that specifies:

- What is to be carried out?
- Why is the action required?
- Where is the work to be undertaken?
- When is the work to be done?
- Who is to do the work?

Table V-1. Activities Calendar for Grasshopper Control Campaign in Senegal.

Activities	J	F	M	A	M	J	J	A	S	O	N	D
1. Elaboration of a 1987-1988 Action Plan												
2. Creation of an Operational Structure												
3. Assignment of CPS Agents in the Regions												
4. Periodic Meetings with Donors												
5. Training Program												
a) Training of Trainers												
b) Technicians												
c) Pesticide Applicators												
d) Farmers												
e) Long-term Training												
f) Rural Radio Broadcasting Program												
6. Signals Network												
7. Surveys Program												
a) Grasshoppers Nymph and Adult												
b) Egg-Mass												
8. Logistic Operation												
a) Stock inventories (Pesticides, vehicles, etc.)												
b) Pesticide & Equipment purchase												
c) Vehicles & Equipment repair												
d) Logistics												
9. Crop Protection Intervention												
a) Phase I (Mid-June-Mid-August) South Center Peanut Basin Basin, Northern Zones (Linguère, Matam, Dagana) Southern zones of the North Peanut Basin (Diorbel, Mbacké, Touba, Déali ...) Ground and Air Control												
b) Phase II (Mid-Aug-October) Northern Peanut Basin, Matam, Bakel, River Valley, South Area Ground and Air Control												
c) Phase III (October-November): Clearing of treated areas in Phases I & II - River Valley, Recession crop Ground and Air Control												
10. Evaluation of Results												
11. Campaign Evaluation Annual Report												

Every incident needs some form of an action plan. For small incidents of short duration, the plan need not be written. Action plans should be used when resources from multiple agencies are being used, when several jurisdictions are involved, and when an incident will require changes in shifts of personnel and/or equipment.

DEVELOPING A PLAN

In order to develop an Action Plan, Missions must identify the problem and clarify responsibilities (see Chapters I and II), coordinate with relevant host country and donor organizations (see Chapter III), and assess alternative control strategies (see Chapter IV). The work of the Country Coordinating Committee may facilitate this task.

Tasks identified in the Mission Action Plan should be clearly understood and agreed upon by all concerned. The aims should be reasonable and achievable, given existing financial, technical, and time restraints. The Plan should begin the process of organizational planning, select a method or methods of control, and establish a Control Operations Center with adequately trained personnel and facilities for decision making and monitoring (see sections 3, 4 and 5 following). The Mission Action Plan must also present plans to phase out the program, evaluate results, and develop the capability of host country institutions to address future outbreaks (see sections 6 and 7 following).

REMAIN FLEXIBLE

Although the Mission Action Plan must be detailed, it should remain sufficiently flexible to allow for necessary changes as the program progresses. OFDA support is only available after an emergency has been recognized and declared. Operational support (equipment, pesticides, aircraft, fuel, technicians) may arrive barely in advance of impending need. Careful planning is necessary to identify problems so they can be confronted in a timely fashion.

DISASTER RESPONSE TEAM

In some cases A.I.D./W may wish to send a team of experts to work with the USAID Mission in the development of the Mission Action Plan. Disaster response teams vary according to need, but would likely consist of a Team Leader (A.I.D./W representative), Entomologist (locust/grasshopper control expert), Logistician, Communications expert, Aerial control expert (if aircraft spraying or dusting is contemplated), and an Environmentalist.

PLAN ROUTING

Action Plans should be routed through the appropriate institutions that will be participating in the program:

- Agricultural Research Institutes
- Public Health Departments
- Environmental Protection Agencies and Environmental Groups
- Agricultural Extension Services
- Federal Aviation Agencies

- Meteorological Agencies
- Political Action Groups
- Media

Action Plans must be continually monitored and adjusted, as necessary, during the entire life of the control effort.

3. Organizing and Training Personnel

Relatively small operations relying solely on ground application can generally be handled by the host country plant protection service, with A.I.D. having only oversight responsibilities. In contrast, a large-scale locust/grasshopper control campaign requires experienced staff to effectively cover all operational and support roles.

ADEQUATE, WELL-TRAINED STAFF ESSENTIAL

Personnel costs may be a major component of the control operation's budget. A large, well-trained staff, overseen by a core of experts, is essential. Large-scale operations often involve hundreds of thousands of hectares and many aircraft. Problems of logistics, human health hazards, and environmental contamination are serious. Skimping on personnel may be false economics because mistakes caused by inadequate guidance are very costly. For example, one large planeload of insecticide sprayed in the wrong area may waste tens of thousands of dollars.

Training is required at different levels, in different languages, and with different program content. Training is essential to transfer the latest research findings and to refresh the knowledge of field staff who have very little access to current literature. Short-term, practical, hands-on courses should be emphasized. Long-term university-level training is applicable to institution building but inappropriate to short-term emergency action.

PERFORMANCE BASED TRAINING BEST

In general, training should be performance-based, rather than educational. It should be targeted to the audience. The audience should represent those personnel who are expected to do the job for which the training is provided. (If female farmers are applying pesticides, then female farmers should attend the training program.) Some audiences such as those loading aircraft with pesticides will need considerable detailed training because the work is hazardous. Others may require only practical knowledge such as how to mark an aircraft swath and how to guide the pilot along those swaths.

Farmers (both men and women) who are actually applying the pesticides or mixing chemicals, and loading sprayers or aircraft are in continual contact with the toxic materials being used. Many manuals deal with oral, dermal and respiratory exposure, the use of protective clothing, safety precautions in

mixing and filling tanks, and cleanup procedures. These include the "Pesticide Users Guide for Extension Workers in West Africa" by W. Overholt, 1984; "An Agromedical Approach to Pesticide Management" by Davies, Freed, and Whittemore available from A.I.D./W; and "Pesticide Safety Guidelines for Personnel Protection" by J. Singer, U.S. Forest Service, Davis, California.

Field workers, though not handling pesticides, may receive exposure through residues on the plants or through drift during application. Training for field workers should emphasize the need to delay entry into treated areas for a safe period of time, avoidance of drift, and removal of residues from the body by washing. Additionally, the worker must be apprised of the contamination of clothing and the need for frequent change and laundering.

Aerial operations personnel should be experienced and trained for their duties. The potential for training in-country pilots should be explored. The number of pilots available and their level of interest may be low. Those who train as agricultural pilots may have little future in the business once the emergency is over.

Personnel in storage facilities must be trained in the construction of pesticide storage facilities, pesticide storage procedures, pesticide stores management, and logistics of distribution. Knowledge of pesticide safety, pesticide spillage cleanup, and pesticide disposal procedures is sorely lacking in most pesticide storage facilities.

Transport personnel should also be trained in pesticide management, the cleanup of leaks and spills, and procedures to follow in the event of chemical fires and other pesticide emergencies.

Survey personnel need training in survey techniques, insect biology, and insect identification. Surveyors include crop protection and extension service personnel, other host government personnel, and local farmers. In some instances, U.S. government and other donor government personnel might be included. Train-the-Trainer programs conducted in the Sahel proved successful in training large groups of people as surveyors.

4. Selecting a Control Strategy

TWO CHOICES

For locust/grasshopper problems affecting local areas or individual farmers, several methods of control exist (see Chapter IV, Section B). For large-scale infestations, there are only two alternatives: take no action, or apply pesticides.

No action simply means that A.I.D. would no longer participate in locust/grasshopper control efforts no matter the severity of the outbreak and its damage potential to the food and pasture crops of the affected nation or region, and regardless of the foreign policy implications. Obviously, selection of this criterion, except in only exceptional circumstances, would be an abrogation of A.I.D.'s operational authorities and responsibilities.

NO ACTION

Pesticide application is the only proven effective course of action. The success of pesticide chemicals has led to a heavy reliance on them, yet their efficacy and their continued use is challenged by two developments:

APPLY PESTICIDE

First, public concern about the impacts of toxic chemicals on health and the environment has led to more stringent regulation. The use of some chemicals has been outright prohibited. Although regulations are necessary to protect society, they may require the substitution of more expensive or less effective alternatives, or cause reliance on a few compounds. An example is the controversy over the use of dieldrin, banned in the U.S. and many other nations.

PUBLIC CONCERN

Second, genetic resistance in pest species and the disruption of natural control mechanisms constitute rising threats to the continued success of control technologies. Fortunately, locust/grasshopper outbreaks are sporadic and individual areas do not receive repeated, frequent pesticide applications. Nevertheless, the potential for major problems remains, meriting continual oversight by trained personnel.

GENETIC RESISTANCE

The decision to employ pest control practices is a complex one. It depends on both the availability of a technology to control the pest and the expected rate of return from employing that technology. The decision maker may be motivated by any of several considerations such as risk minimization, cost reduction, or yield increase. For locust/grasshopper control, the rationale is principally to prevent further loss than has already occurred or to prevent loss in areas where insects are expected to migrate. In the 86-87 campaign, Missions often had difficulty convincing local farmers and even national governments of the ultimate benefits of preventing insects from flying off to their neighbors' fields.

COMPLEX DECISION

5. Establishing a Control Operations Center

Large-scale control efforts require a Control Operations Center (COC), a central office for program decision making and monitoring. The COC should be under the direction of a senior crop protection specialist from the host country and staffed by specialists from the host nation, major donor nations, and international organizations. The COC should be centrally located for

COC A MUST

ready access to representatives from each of the participant parties. Care should be taken to establish common terminology for organizational functions, resource elements, and facilities in order to minimize misinterpretation.

NEED ADEQUATE COMO

The COC should have an adequate communications system installed (telephone and/or radio), capable of maintaining continual contact with all facets of field control operations. Also, the COC should have ready access to daily weather predictions and the ability to communicate with hospitals and doctors in the event of accident. Neighboring nations with similar problems also need communications facilities so they can be contacted (for details, see Section C).

PROGRESS MAPS

The COC should have a large map of the treatment area on which progress can be charted daily. Although technical staff in the field make many day-to-day operational decisions, the COC retains responsibility over program direction and execution, over purchases and distribution of equipment, pesticides and other materials, and over personnel. The host government representative directing the activities of the COC should be charged with reporting to the Country Coordinating Committee on progress, needs, and major problems encountered.

ADEQUATE SAFETY

The COC should assure that adequate safety precautions are maintained throughout the life of the program and that operational field personnel are adequately protected from pesticide exposure. It should develop guidelines for field use, including survey procedures to be used, specifications for temporary pesticide storage, treatment procedures within or adjacent to inhabited areas, national parks, water bodies, critical wildlife habitats, and other environmentally sensitive areas. The A.I.D. representative at the COC is responsible for ensuring adherence to the provisions of the Environmental Impact Statement.

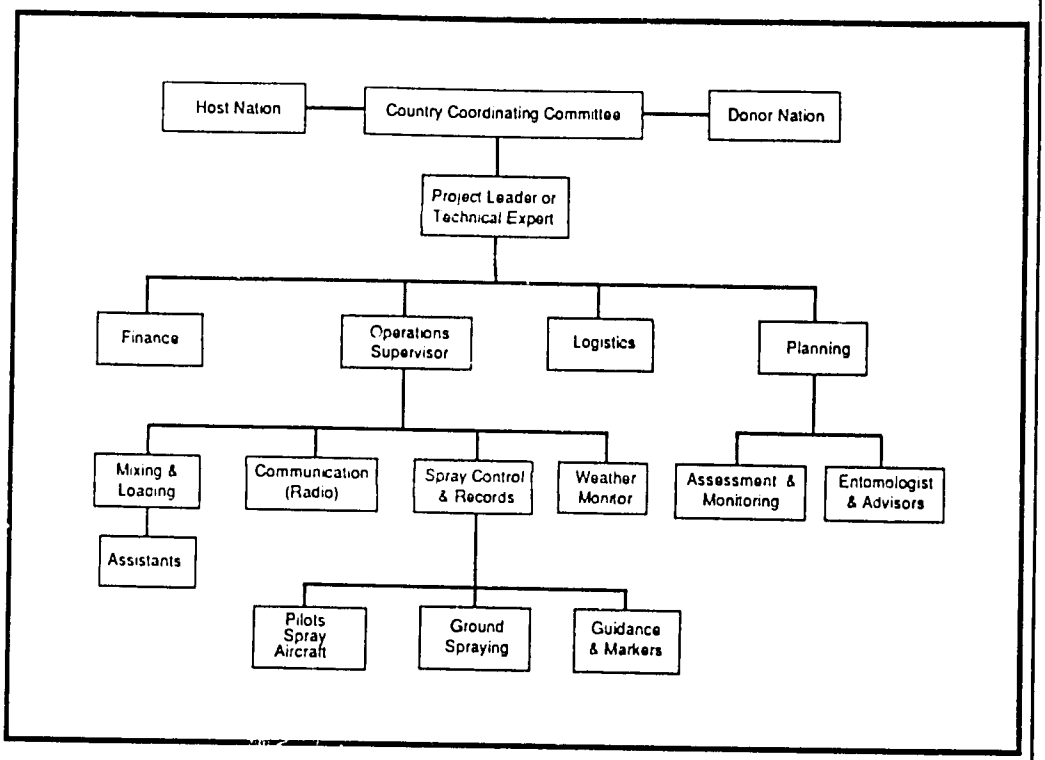
NOTIFY MEDICOS

The COC should alert doctors, hospitals, and clinics within and adjacent to the treatment area as to the pesticide or pesticides to be used and their prescribed antidote. A list of these facilities should be provided to each field operations base.

The COC is the heart of control operations. The Mission should ensure that senior host government officials delegate sufficient responsibility to the COC Director so that the operation can be safe, efficient, and cost-effective.

If aerial spraying is the principal control technique, an organization similar to that depicted in Figure V-1 may be necessary.

Figure V-1. Suggested Organizational Chart for Large-scale Control Campaign Involving Aerial Spraying.



When the host government, many donor governments and international organizations are involved, a unified command structure may be preferred. In a unified command structure, the individuals designated by their jurisdictions jointly determine objectives, strategy and priorities. A single operations chief has responsibility for implementation of the plan.

UNIFIED COMMAND

Within USAID, a single command structure may be appropriate. If jurisdictional boundaries do not overlap, a single incident commander can be designated. A Single Command system used by the USAID/Senegal in 1987 is depicted in Figure V-2.

SINGLE COMMAND

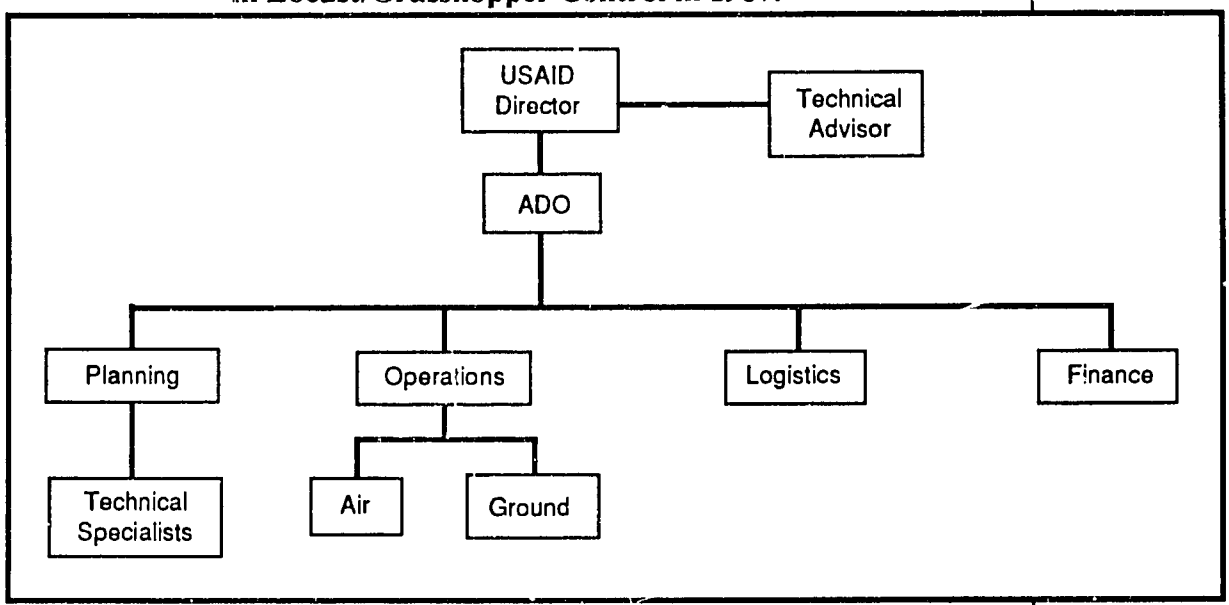
The planning section is responsible for the gathering and analysis of all data regarding incident operations and assigned resources, developing alternatives for tactical operations, conducting the planning meetings, and preparing the action plan for each operational period.

PLANNING SECTION

The operations section includes all activities that are directed toward reduction of the immediate hazard, establishing situation control, and restoration of normal operations. Tactical operations may be organized and operated in many ways. The specific method selected will depend upon the type of incident (sedentary grasshoppers or migrating locusts), the organizations and governments involved, and the objectives and strategies selected.

OPERATIONS SECTION

Figure V-2. Single Command System Used by USAID/Senegal in Locust/Grasshopper Control in 1987.



LOGISTICS SECTION

The logistics section is responsible for providing all support needs. The logistics section locates, assesses needed facilities, transportation, equipment maintenance and fueling, communications, and medical services, and facilitates the ordering of needed equipment and supplies.

FINANCE SECTION

The finance section is established only when there is a specific need for financial services. If only one specific function is required, a position could be established as a technical specialist in the planning section.

6. Phasing Out

After treatments cease, the control effort is not over. Several activities must be carried out before a control program can be considered complete.

FOLLOWUP SURVEYS

A survey of the treatment area must be undertaken to evaluate program effectiveness. Adult surveys are required in order to detect areas with populations of locusts/grasshoppers sufficient to cause problems in the next generation. These areas must be closely mapped for follow-up egg surveys. If species are migratory, their flight should be followed and route recorded so that information can be forwarded to neighboring nations subject to invasion.

Surveys of crop damage should be conducted to assist the host nation in assessing its losses, determining the effect on the economy, and planning to meet possible food needs in affected areas.

PESTICIDE RETRIEVAL & STORAGE

The retrieval and storage of unused pesticides is an important task. Usually, pesticide stocks have not been completely used. They must be properly inventoried and moved to well-protected and covered storage to preserve shelf life. Broken or punctured drums or bags may require decanting into new drums or rebagging. These new containers must be properly labeled. All A.I.D.-procured pesticide containers must be collected and destroyed (see Chapter VII).

CLEANUP

Equipment must be returned to its place of origin, cleaned and safety-packaged, or stored in a manner to ensure its efficient operation during the next time of need. Particular care must be taken to ensure that no pesticide residues remain in storage tanks, pumps and hoses, and ground application equipment.

SPILLS

Any pesticide spills must be cleaned up. Pesticides are sometimes spilled during aircraft and control equipment loading operations.

REPORT AND ASSESSMENT

A final report of the operation must be written, including lessons learned.

A.I.D./W may also desire an assessment by an outside team to evaluate the efficiency of supervision and determine whether the program was conducted according to the protocol set forth in advance.

7. Developing Host Country Institutions

BUILD/ COUNTRY CAPABILITY

The USAID Mission should review its program of institutional development to determine what measures may be taken to build the host nation's capability to address future outbreaks. In the past, many efforts have been made to strengthen host government capabilities, including the creation of pest-specific national and regional organizations. Generally, during long periods of relative inactivity, resources have been diverted from these organizations to other activities. Also, equipment has deteriorated or become obsolete and trained, experienced personnel have moved to more rewarding positions. USAID Missions must determine how or if additional input can leverage governments to provide an adequate response in future emergencies.

C. Communications

1. Meeting Communication Needs

COMO ESSENTIAL

An efficient communications systems is essential for the proper functioning of any large-scale pest control operation, especially in the remote areas of Africa and the Near East where locust/grasshopper emergencies are most likely to occur.

To the extent possible, existing communications systems should be utilized. In some nations, the telephone system is adequate, at least for communicating between major cities and towns and between the COC and outlying centers of operations. Outside these areas, the use of radios is the most common form of communication.

COMMUNICATION NEEDS

Field operations sites (airstrips) also require communication facilities to keep in touch with surveyors and aircraft guidance personnel in the field, aircraft on spraying operations, other field operations sites, and the operations center for the control district.

Surveyors in the field need communication systems for security in the event of breakdown and to relay information on existing infestations. They must be able to communicate with their district operations center, field operations sites, and with other surveyors in the field.

Field control personnel **must be able to communicate** directly with the spray aircraft and the airstrip in order to:

- Report on treatment area weather conditions to airstrip.
- Report to the pilot when weather conditions turn unsuitable for treatment.
- Report to the pilot on skips in the application, degree of drift, leaks in the spraying system, and hazards within the treatment area (such as power lines).
- Assist pilots in locating treatment areas and treatment area boundaries.
- Communicate between ground control teams to review areas to be treated and strategy for treatment and report on locations of hazardous areas such as wells and other water sources.
- Communicate between ground control teams and the district operations center.

COMMUNICATION SPECIALIST

Several types of communication equipment (radios) may be required to meet all the program needs. The OFDA Communications Specialist can assist in the design of specific communications networks, but working with local experts is always preferred because they have much better knowledge of local conditions (see Sections 3 and 4).

2. Basic Requirements for Radio Communications

COMMUNICATION SYSTEMS

All disaster assistance field operations require certain communication functions. The following systems may be operated by the host government, an international organization, the USAID Mission, OFDA, or some other entity such as FAO:

- *Command communication,* to link the overall manager, key staff members, section chiefs, other supervisors, assessment specialists and Embassy/Mission liaison.

- *Logistics communications,* to link those responsible for handling supply and services resources and other command or nontactical functions.

- *Support communication,* (off site) to link the communication network with people working outside the area being treated.

- *Tatical communication,* to link individual members of teams to each other directly. Several tactical communication systems may be established for different geographical operating areas, different agencies, or specific functions.

- *Ground-to-air communication,* to coordinate aircraft with the ground.

- *Air-to-air communication,* for safety and other coordination among aircraft.

- *Radio navigation communication,* for safety and accurately locating positions.

NETWORKS AND PROBLEMS

The communication systems will probably be organized into networks of stations. If the operation is small, several communication functions may take place on the same network. In large systems, functions should not be combined on the same network; too many people trying to communicate at the same time causes interference.

Special problems may arise if different pieces of radio equipment are not compatible. Good communication system planning can minimize this problem. Also, the people involved may have extensive experience with radio systems, or none at all. Telling the experts from the novices may be difficult. Both may talk a good line.

3. Assistance Available from OFDA

OFDA CAN HELP YOU

OFDA can assist in the following ways:

- Communication system planning
- Radio system design including:
  - radio system and equipment specifications
  - antenna specifications
  - installation suggestions
  - technical advice for troubleshooting
- Information about operating practices and procedures
- Equipment source identification and procurement
- Equipment loans for short periods from OFDA and other sources
- Coordination among donors for radio system design and equipment procurement

Remember that OFDA helps in disaster situations and for disaster preparedness only. Although OFDA can respond very quickly to most requests, response still takes time.

BEFORE CONTACTING OFDA, DO THIS

Before contacting OFDA about radio communications, Missions should try to answer the questions in the following section. OFDA staff will answer questions and discuss problems by telephone, but all telephone conversations should be followed by a summary cable for the record.

OFDA will provide guidance by telephone and cable if equipment is shipped. Customs clearance and all other associated requirements must be arranged in advance of shipment. If arrangements are not made, months or years may go by before equipment clears host country Customs.

4. Questions to Answer Before Requesting Assistance

QUESTIONS TO ANSWER

Before asking OFDA to provide radio equipment and related assistance, Missions should try to obtain answers to the following questions:

a. What entity is operating or will operate the radio system?

b. What level of technical expertise is available in the country for:

- system design?
- system installation?
- system maintenance?
- system operation?

(Sources of technical expertise may be: local communication authority; private companies who use radio communication such as oil and aviation companies, private voluntary organizations, commercial radio companies, military communications personnel, amateur radio operators, radio technician servicing USAID Mission or Embassy radio equipment, other friendly embassies.)

c. What level of expertise in training for radio system operation is available in-country?

d. What equipment is already operating? How well is it working?

e. Are all the local resources being used? What is required to get unused equipment into service?

f. What frequencies have been authorized by the local communication authority?

g. What is the plan for use of frequencies?

h. What are the specific points of communication and the numbers of radios for:

- base station locations?
- mobile operating areas?
- aeronautical operating areas?
- points outside the country (particularly for OFDA operations)?

i. What are the general characteristics of the terrain where stations will be operating (sand, rolling hills, mountains)? Are there any significant high points that overlook large portions of operating areas? Where are they? Can equipment be left there undisturbed?

j. Must roving stations in the field be operated as mobile stations, or can they reasonably operate as portable stations?

k. Is there any objection to drilling holes in vehicles to mount radios and antennas?

l. What manufacturers' equipment can be purchased locally? What models? What quantities?

m. Which manufacturers' equipment can be serviced locally?

n. What is the local electrical supply:

- power line voltage?
- power line frequency?
- reliability?

(If the reliability of the local electrical supply is inadequate for base station operation, use of generators, storage batteries, solar power, and other techniques can be considered.)

o. What kind(s) of fuel can be obtained for generators?

p. Will the local communication authority allow the use of radios that tune over a wide band, or will they accept only channelized radios?

q. If OFDA supplies radios and/or other related equipment, will title to the equipment remain with the U.S. Government or will it be transferred to the local government or other entity?

(OFDA has restrictions on the kinds of organizations that may receive U.S. Government humanitarian assistance commodities. For example, military organizations and in most cases, police organizations may not be granted humanitarian assistance commodities. However, commodities may be loaned to them when they are acting as a civil defense or disaster relief organization. Make certain of each case before discussing commitments.)

r. What other organizations will contribute equipment or funding? What is the point of contact in each for coordinating equipment procurement?

s. When and where must the requested equipment be delivered?

t. To whom in the USAID Mission or U.S. Embassy must the equipment be consigned for Customs clearance and accountability?

5. Characteristics of Several Radio Systems.

a. HF-SSB Radio

SIINGLE SIDE BAND RADIO.

• *Type of service:* voice.

• *Range:* from about 150 to several thousand kilometers depending upon the frequency, time of day, season of the year, level of solar activity, the geomagnetic field, and other factors.

• *Setup time:*

- base stations: 2 to 8 hours
- portable stations: 15 minutes to 1 hour antenna setup time for each use
- mobile stations: 4 hours for initial permanent installation; after that, zero setup time.

• *Components:* transceiver, wire antenna for base and portable stations, tuner and whip antenna for mobile stations.

• *Power source:* 13.8 VDC from a vehicle, storage battery, solar power supply, or power supply run from commercial power or generator.

• *Ease of use:* moderately difficult; knowledge of HF propagation effects and operating procedure required.

• *Usage charges:* none.

b. VHF- and UHF-FM land mobile radio.

FM LAND RADIO.

• *Type of service:* voice.

• *Range:* from about 5 to 100 kilometers depending upon the frequency, terrain, and the use of repeaters.

• *Setup time:*

- base stations: 2 to 8 hours.
- portable stations: 15 minutes to 1 hour antenna setup time for each use.
- mobile stations: 4 hours for initial permanent installation in a vehicle; after that, zero setup time.

• *Components:* transceiver, antenna on a pole for base and portable stations, and a whip antenna for mobile stations.

• *Power source:* 13.8 VDC from a vehicle, storage battery, solar power supply, or power supply run from commercial power or generator.

• *Ease of use:* very easy; knowledge of operating procedures required.

• *Usage charges:* none.

c. VHF-AM ground-to-air radio.

VHF AIRCRAFT

• *Type of service:* voice.

• *Range:* from about 5 to 200 kilometers depending upon the terrain and the height of the aircraft.

• *Setup time:*

- base stations: 1 to 8 hours
- portable stations: 15 minutes to 1 hour antenna setup time for each use
- mobile stations: 4 hours for initial permanent installation; after that, zero setup time

•*Components:* transceiver, antenna on a pole for base and portable stations, and a whip antenna for mobile stations.

•*Power source:* 13.8 VDC from a vehicle, storage battery, solar power supply, or power supply run from commercial power or generator.

•*Ease of use:* very easy; knowledge of operating procedures required.

•*Usage charges:* none.

d. Transportable satellite earth station.

SATELLITE STATION

• *Type of service:* voice, telex, and facsimile to and from land-based telephones and other INMARSAT stations.

• *Range:* most places between about 75 degrees north and south latitude—a clear view of an INMARSAT satellite is required.

- *Setup time:*

  - portable stations: about 30 minutes setup time; about 40 minutes pack up time
  - mobile stations: not capable of mobile operation; the antenna must not move during use.

- *Components:* three containers of about 70 pounds each including all associated components

- *Power source:* 117 VAC, 47 to 63 Hz

- *Ease of use:* very easy; technician/operator will accompany the equipment

- *Usage charges:* U.S. $10 per minute via U.S.A. earth stations for voice calls, U.S. $4 per minute for telex calls; additional fees will probably be applied by non-U.S.A. earth stations. Fees for calls from one portable INMARSAT station to another are double.

6. Glossary of Technical Terms

TECHNICAL GLOSSARY

Technical terms in this section are those you are most likely to find used by radio engineers and technicians and, also, the local communication authority. Explanations are provided instead of precise technical definitions to help you understand the fascinating subject of communicating without wires.

AM (Amplitude modulation): A method of conveying information in which the amplitude (power) of a radio signal is varied. AM is commonly used by VHF aeronautical stations and MF broadcasting stations. AM systems are NOT compatible with SSB and FM systems.

Antenna: Wire or other material that conducts electricity that is used to radiate and receive radio signals. The physical size of an antenna is related to the operating frequency.

Antenna Gain: The result of antenna design that concentrates radiated energy (and received signal pickup) in some directions at the expense of other directions. Antenna gain is usually expressed in decibels (dB) relative to a specified reference antenna.

Antenna Polarization: The direction of the radiated electric field in relation to the surface of the earth; generally vertical in VHF and UHF mobile radio use.

Assigned Frequency: The frequency authorized for use by the local communication authority; in most cases, the carrier frequency.

Assignment: The authorization by the local communication authority for the operation of specific radio facilities with specified characteristics. (Don't leave home without it!)

Attenuation: The loss of power that occurs naturally when a radio signal propagates through transmission lines or air; usually expressed in decibels (dB).

Audio Frequencies: Frequencies encompassing all those that can usually be heard by human ears *(about 50 to 15,000 Hz).*

Bandwidth: A range of frequencies. Most often, bandwidth is used to describe the range of frequencies encompassing most of the power in a transmitted radio signal.

Base Station: A radio station operated from a fixed point.

Carrier Frequency: The frequency of a radio signal that is usually changed in some way to convey information. Often, this may be specified by the communications authority as the assigned frequency.

Hertz (Cycles per Second): The unit used to express frequency.

HF (High Frequency): The band of frequencies from 3 to 30 MHz.

Facsimile (FAX): A system of sending and receiving detailed still images. FAX systems are most commonly used to convey images of documents, pictures, and handwritten items.

FM (Frequency Modulation): A method of conveying information in which the frequency of a radio signal is varied. FM is commonly used by VHF and UHF land mobile stations, VHF and UHF amateur radio stations, and VHF broadcasting stations. FM stations are NOT compatible with AM and SSB systems.

Ground Wave: A radio wave that travels along, and is affected by, the surface of the earth. This is one mode of operation for HF. It is the only mode of operation at VHF and UHF, for practical purposes.

INMARSAT (International Maritime Satellite): A satellite-based radio communication system intended, primarily, to replace HF radio for safety and

other communications for ships on the high seas. Telephone, telex, and data service (for computer data and FAX) can be sent via INMARSAT. INMARSAT is operated by the International Maritime Satellite Consortium, a group of 24 maritime nations, including the U.S.A.

Ionosphere: The upper portion of the earth's atmosphere beginning at about 50 miles above the surface of the earth. Radio signals (usually HF), under the right conditions, are bent in the ionosphere and returned to earth far beyond the horizon.

Kilohertz (KHz): One thousand Hertz.

Land Mobile Radio Service: Radio service between stations on land including base, portable, and mobile stations.

LSB (Lower Sideband): A SSB emission where all significant power is below the carrier frequency.

MF (Medium Frequency): The band of frequencies from 300 KHz to 3 MHz.

Megahertz (MHz): One million Hertz. Also, one thousand Kilohertz.

Mobile Station: A station designed to be operated while in motion.

Modulation: The process of changing a carrier wave to convey information. See AM, SSB, and FM.

Packset: A transceiver that is very similar to the personal portable radio. However, packsets are physically larger to accommodate a larger battery pack and, sometimes, a higher power transmitter.

Personal Portable Radio (Handie-Talkie, Walkie-Talkie, HT, etc.): A transceiver that can be hand-carried. The antenna is directly attached to the radio and an internal battery (rechargeable or replaceable) is used for power. This kind of radio is most commonly used in mobile service.

Portable Station: A station that is movable and operates at unspecified fixed points.

Repeater: A special arrangement of a transmitter and receiver(s) designed to relay transmissions between stations without significant delay. Repeaters are most commonly used to extend the range of small, low-power mobile stations by installing them on tall buildings, tall towers, mountaintops, or even

in airplanes flying over an area at high altitude. NOTE: Repeaters are generally used on frequencies above about 136 MHz.

SSB (Single Sideband): A form of amplitude modulation that carries voices and certain other kinds of information very efficiently. SSB is commonly used at HF for point-to-point and ground-to-air communication. It is also commonly used by radio amateurs. Many aircraft in Africa have HF-SSB equipment installed. SSB equipment is NOT compatible with AM and FM equipment.

Skip Distance: The minimum distance at which radio waves of certain frequencies can be used for communication by way of the ionosphere.

Sky Wave: The main portion of the signal radiated above the horizon. Under the right conditions, the sky wave may be bent by the ionosphere and returned to earth far beyond the horizon. At HF, this is the most common signal used for long distance communication (greater than about 150 Km).

TELEX: A system that provides connections between teleprinters (Teletype*). The TELEX network operates much like the telephone system, except that dialing is done from a keyboard instead of a dial and machines talk to other machines instead of people.

* "Teletype" is a registered trademark of American Telephone & Telegraph Company.

Transceiver: A combination transmitter and receiver. Personal portable radios, for example, are transceivers.

UHF (Ultrahigh Frequency): The band from 300 to 3000 MHz.

USB (Lower Sideband): A SSB emission where all significant power is above the carrier frequency.

VHF (Very High Frequency): The band from 30 to 300 MHz.

D. Dealing with the Media During a Disaster

THE MEDIA

Positive media coverage is always beneficial to the overall public perception of U.S. disaster assistance. The most interesting and eye catching news story is one that deals with cataclysmic human drama--human suffering, human heroism and human involvement in survival. Rarely do such stories materialize during a locust/grasshopper infestation.

This section addresses suggested avenues to be followed to enhance USAID's relationship with the media on disasters generally, and locust/grasshopper disasters specifically. The education of news commentators/reporters on U.S. disaster relief can be extremely valuable because they have substantial influence on the thinking of the local and international population.

1. Who is Responsible?

ABOUT BEING INTERVIEWED

The USIS Representative is usually the designated media contact at U.S. Missions overseas. When a news team or reporter asks an A.I.D. Disaster worker for an interview or background information, the Public Affairs Officer (PAO) should be alerted. The Mission should contact the USIS Representative when scheduling interviews with the press. Often the Representative will want to be present during interviews. USIS may assist the American network reporters and news teams to obtain the appropriate country clearances when traveling in the field.

During a major control campaign, the Mission should designate one or two people at the Mission or Embassy to deal with public relations (PR) matters. If the situation warrants it, the media will devote extensive resources to the operation. The designated PR representatives can help the media do their jobs by gaining access to the field, getting country clearances for them to shoot footage, answering general questions, and setting up interviews. This assistance will also help the U.S. to gain positive media coverage for its disaster control efforts.

OFDA HELP AVAILABLE

If the Mission lacks sufficient manpower to designate a PR representative, or if additional assistance with PR is needed, a PR person can be included in the OFDA assessment team. Such a request should only be made during a major infestation.

2. Obtaining Video Coverage

DOCUMENT WITH VIDEO

If there is a video camera available at USIS, the Embassy or USAID Mission, the Mission should assign someone there to shoot footage of the infestation and control efforts underway in the area. Footage can be sent to the OFDA video library for use in reviewing the overall situation and determining the U.S. response. Video footage should be sent to A.I.D./OFDA, c/o Press Officer.

3. Talking to the Media

PLAN AHEAD

Contacts with the media should begin before a major disaster unfolds. Establishing rapport early can help make the media aware of USAID and the procedures it follows during a locust/grasshopper infestation.

During a crisis, the PR representative should coordinate and monitor the information being released. Staff should make sure the PR representative is aware of the latest developments. When being interviewed by the media, PR representatives should always begin their comments with a positive comment about U.S. efforts. If a conversation with a reporter is to be "off-the-record" or for "background only," the PR representative should make this very clear before the interview begins.

MORE ON BEING INTERVIEWED

What the media wants and needs is the briefest, most appropriate, and correct information available in a timely manner, in order to meet their deadlines. For this reason, it is important to get as many facts together as quickly as possible, be accessible, hold press briefings, and release press statements as often as the situation warrants.

BRIEFINGS

The USIS Representative will help prepare press releases as required and will issue them according to established procedures within the country. However, if no new information is being generated, some members of the press may want to make a deal to receive updates in advance and to hold the material until they receive permission to release it. In these circumstances, PR representatives should ask the USIS Representative or Mission Director for guidance.

PRESS RELEASES

If other donors are involved in the control effort, issues relating to dealing with the media should be discussed jointly.

4. Preparing Press Kits

To facilitate communications with the media, the Mission should prepare and update press kits for each spraying operation, including the latest update on the situation, press releases, maps and background information on the affected area, talking points, and a list of USAID personnel in-country and at A.I.D./W who can be contacted by the media. Press kits allow for easy access to information that the media wants. Since information is in writing, it is less likely to be misinterpreted or misconstrued. A simple fact sheet about the disaster is also useful, especially during a smaller infestation.

PRESS KITS MAKE IT EASIER

When preparing press kit materials, remember four things:

- Package the information in short, concise stories with beginnings, middles and ends.

- Anticipate the kinds of questions reporters will ask and be prepared to respond.

- Eliminate jargon or acronyms from the material and target responses to the general public.

- Always point out the positive factors before elaborating on the negative.

5. Making Public Service Announcements

PUBLIC SERVICE ANNOUNCEMENTS HELP PEOPLE

Prior to a spraying operation, a set of Public Service Announcements (PSA) should be released by the USIS representative to the wire services, local newspapers, radio and television stations. PSAs should explain to the public what they should and should not do during a spraying operation. PSAs should cover such topics as:

- When and where the spraying would occur and for how long.

- Safety precautions to be taken:

  - staying indoors during the spraying
  - safe storage of drinking water, enough for a few days
  - safe storage of food supplies
  - the removal of clothes and other materials from outdoors
  - the use of water outside after the spraying
  - the feeding of animals after the spraying
  - what effects the pesticides could have on humans and animals
  - the washing of clothes after the spraying

General PSAs can be drafted early and details can be incorporated for each spraying operation.

6. Monitoring the Media

MONITOR AND DOCUMENT MEDIA REPORTS

As the crisis develops, someone in the Mission should be assigned to monitor the media and maintain a file of newspaper articles, TV interviews/ stories and press releases on the event and share them with A.I.D./W as soon as possible. Information on the situation in surrounding countries may be obtained by cabling A.I.D./W and requesting the material. To maintain uniformity, U.S. efforts in the field must be coordinated with what is going on in the States, and vice versa.

During a crisis, the media's need to have timely and detailed information must be balanced with the impact the coverage and intervention may have on the disaster response operations and on the victims themselves. By being prepared for the press, working closely with the USIS Representative, and

coordinating with other disaster workers, the Mission can use the media effectively. Through careful planning, the Mission can convey the messages it wants to report, minimize uncomfortable intrusions into human suffering and poverty, and avoid jeopardizing delicate logistics operations.

PLAN AND COORDINATE MEDIA RELEASES

Locust/grasshopper disaster programs do not focus on distressful human suffering but rather on crop destruction and its association with impending famine and hardship. Locust/grasshopper campaigns thus provide an opportunity for the Mission to report on positive steps the U.S. Government is taking to preserve African/Asian crops and avert human misery.

51

Table of Contents

Chapter VI. Surveying and Monitoring

A. Predicting Upsurges VI-2
1. Forecasts VI-2
2. Early Warning Systems VI-2
3. Remote Sensing VI-3

B. Conducting Surveys VI-4

C. Surveying Locusts VI-5
1. Solitarious Phase--Adult Surveys VI-5
2. Gregarious Phase--Hopper Surveys VI-5
3. Gregarious Phase--Flying Swarm Surveys VI-6
4. Gregarious Phase--Settled Swarm Surveys VI-6

D. Surveying Grasshoppers VI-6
1. Egg Surveys VI-7
2. Nymphal (Hopper) Surveys VI-7
3. Adult Surveys VI-8
4. Survey Techniques for Egg Surveys VI-9
5. Survey Techniques for Nymphal Surveys VI-9
6. Survey Techniques for Delimiting Surveys VI-9
7. Survey Techniques for Adult Surveys VI-9

E. Monitoring VI-10

Reference	Notes

Locust/grasshopper campaigns require predictions of when and where upsurges will occur and surveys to locate and assess infestations. Surveys are laborious, expensive and time-consuming, but essential. By correlating survey data with weather and other environmental data, efforts can be focused in locations where pests are most likely to be found. This chapter explains how predictions are made and describes procedures for surveying and monitoring.

A. Predicting Upsurges

1. Forecasts

FORECASTING IS DIFFICULT

Forecasting locust/grasshopper upsurges is an imprecise science. The accuracy of a forecast depends on the accuracy of long-range weather forecasts and the accuracy of surveys that have been made weeks or months beforehand. For example, forecasting Desert Locust upsurges requires mapping on-the-ground reports of swarms, hopper bands, and isolated locusts with significant weather developments (rainfall, temperature, wind speed, and direction). Using these data, a forecaster estimates when, where, and how many new adult populations will appear and be ready to fly. Long-term forecasts depend primarily on seasonal probabilities derived from historical data on migration routes and breeding areas.

THE PRIFAS MODEL

Forecasting of grasshopper upsurges and outbreaks is presently almost entirely dependent on the PRIFAS biomodel of the Senegalese grasshopper, Oedaleus senegalensis. The model depends on both rapid reporting of field observations and historical or forecasted meteorological data. With rapid and adequate inputs, the model can be used to forecast main biological events two weeks in advance. In the medium term (one month), it can give possibilities according to the biological limits of development of the species. In the long term (from the beginning of the dry season to the beginning of the following wet season), it can forecast with reasonable accuracy the worst case scenario of the threat from diapausing eggs.

2. Early Warning Systems

FAMINE EARLY WARNING SYSTEM

Several early warning systems predict and assess potential famine and other emergencies. A.I.D.'s Famine Early Warning System (FEWS) provides information useful in relief planning and operations. The system operated by the Center for Application of Agrometeorology and Hydrology (AGRHYMET) monitors crop and pasture information in the Sahel. Both systems monitor and report pest damage as one of several major risks affecting the food supply and the need for aid.

Early warning systems are designed for the relatively short term. When an outbreak has already been initiated, but is in its first stages, early warning announcements can offer guidance. They rely on surveys that are underway or recently completed for their information.

EARLY WARNING SYSTEMS ARE SHORT TERM

Several early warning systems are capable of predicting and assessing potential famine and other emergencies and providing information useful in relief planning and operations. Both A.I.D.'s Famine Early Warning System (FEWS) and the crop and pasture monitoring project operated in the Sahel by AGRHYMET monitor and report pest damage. They also monitor other major risks affecting the food supply and the need for aid.

Operation Sauteriaux au Sahel (SAS) is an information exchange program with potential for early warning. Information created by the PRIFAS bi-omodel is disseminated to participants through a biweekly newsletter. The newsletter generally arrives after control decisions have been taken, so it is really only useful as a summary of the grasshopper situation and its possible short-term consequences. Similarly, early warning system reports are neither quantitative enough nor early and detailed enough to be useful for field use. Donors use them primarily for medium-term decision making on a national or regional scale.

SAS INFORMATION EXCHANGE PROGRAM

3. Remote Sensing

FAO has been conducting remote sensing research for Desert Locust plague prevention since 1976. Remote sensing involves aerial photographs, multispectral scanner images, thermal images, and radar images. To map Desert Locust habitat in the recession area, FAO uses Landsat imagery, existing topographical and ground survey data and historical locust observations. By superimposing these habitat maps over current vegetation and soil moisture maps, FAO can pinpoint even very small breeding sites.

REMOTE SENSING IMAGERY HELPFUL

In early 1988, a new remote sensing system called ARTEMIS is expected to be operational. ARTEMIS was custom-designed for FAO by the National Aerospace Laboratory of the Netherlands. It is a comprehensive satellite-based system for monitoring precipitation and vegetation conditions on a continental scale.

In 1987, A.I.D. funded a pilot project conducted by the U.S. Geological Survey to develop, test, and evaluate a near real-time vegetation-monitoring procedure. The procedure uses satellite data from the National Oceanic and Atmospheric Administration-Advanced Very High Resolution Radiometer (NOAA-AVHRR) for use in locust and grasshopper control programs in West Africa. Vegetation greenness maps were merged with cartographic data to

produce greenness maps of various Sahelian countries. The maps are useful for planning and conducting field and aerial surveys over areas of potential locust and grasshopper infestations.

USE OF GREENESS MAPS

The use of the greenness maps is based on the principle that initial seasonal rainfall triggers both the growth of herbaceous vegetation and the hatching of locust and grasshopper eggs. By focusing on land areas that are greening up or are presently green, survey teams can significantly narrow down the areas to be covered by both land and aerial survey efforts, avoiding areas that are dry. This information is particularly useful in the Sahel where rainfall distribution is erratic and unevenly distributed.

Specific uses of the greenness maps for survey include:

- Evaluation of greenness extent and intensity of the previous year in order to predict areas where egg pods may be present
- Monitoring initial green-up in the more southern Sudanian zone in order to locate the first generations of the Senegalese grasshopper
- Evaluate rainfall patterns between widely-spaced weather stations
- Plan aerial survey flights on the basis of latest greenness data
- Plan ground surveys on the basis of latest greenness data; send surveyors to green areas and avoid areas that are still dry
- Monitor ephemeral greening of wadis in the Sahelian and Saharan zones, particularly for locusts.

Greenness data must be made available to users as soon as possible. Lag time should not exceed one week, though in practice it has been at least 10 days.

B. Conducting Surveys

STANDARD SURVEY METHODS

Surveys for locusts and grasshoppers require two types of skills: identification and quantification. Precise identification may be difficult because Africa has more than 300 species of locusts and grasshoppers. The quantification of pest numbers per unit of area is fairly simple.

Survey methods should be standardized so that reports of infestations are properly quantified, and can be compared across different regions of a country or across national boundaries. The best way to standardize survey reports is to

train surveyors and teach them to train others, and to use simple, inexpensive, and rapid techniques. For practical field purposes, surveys should be designed to determine as efficiently as possible whether or not treatment is needed under established decision rules.

Farmers have an interest in surveying the grasshopper and locust situation in their own area to protect their own crops. Agricultural extension agents and mobile crop protection service teams can confirm farmers' findings.

The best way to ensure proper identification is to train as many surveyors as possible to recognize a few principal species. For other important species, a network should be set up to which samples can be sent for identification.

C. Surveying Locusts

SURVEY SOLITARIOUS ALSO

In the absence of widespread control efforts, locust plagues tend to maintain plague status for a number of years and then enter a period of prolonged recession. During recessions, populations are principally in the solitarious phase. Locust upsurges that lead to plagues are the result of aggregation of solitarious forms. Therefore, surveys must be aimed at the solitarious as well as the gregarious forms if plagues are to be prevented.

1. Solitarious Phase--Adult Surveys

Adult surveys are conducted in major breeding areas on solitarious populations to check on population numbers, aggregating tendencies, and phase transformation. Adult surveys help identify the need for control measures against future generations. Aerial surveys are not suitable for observing these nonswarming populations.

SOLITARIOUS SURVEY PROCEDURE

Populations of solitarious adults are determined by walking a straight line a predetermined distance and counting the number of locusts that fly up within a width of 5-10 meters each side of the line. The population is recorded in numbers of adults per square kilometer.

2. Gregarious Phase--Hopper Surveys

Hopper surveys are designed to delimit areas in which hopper bands are present. These are normally ground surveys because hopper bands are difficult to detect from the air, particularly in areas of abundant vegetation.

Surveys of gregarious hoppers and adults are visual. Sample areas include both roadsides and areas in which surveyors or local inhabitants report seeing them. For adults, both ground and aerial surveys are utilized. The most

suitable times for adult survey is early morning (when the locusts are roosting and can be detected by their coloration) and mid-afternoon (when they are flying and can be seen as the sun reflects off their wings).

ESTIMATE GREGARIOUS

Populations of gregarious locusts are normally not recorded as a number per given area. Rather, the size of the band by length and width and the swarm size in square kilometers is determined. For cumuliform (thick, towering) swarms the thickness of the swarm (bottom to top) and locust density within the swarm is estimated.

3. Gregarious Phase--Flying Swarm Surveys

Both ground and aerial surveys are used to detect flying swarms. Ground surveys usually rely on reports of sightings from the local populace. Once sighted, swarm movement is tracked to provide guidance to control teams. Survey teams have the responsibility to mark the boundaries of the location at which the swarm settles for the night.

AERIAL SURVEYS

Aerial surveys are conducted along principal weather frontal systems because locusts are known to migrate downwind to areas of low-level wind convergence, typical of frontal systems. High-flying stratiform type swarms are the easiest to detect from aircraft. They appear as a large column of smoke and may be detected from the air from a distance of 80 kilometers (50 miles) on a clear day.

Ground and airborne radar has been tested for the detection of locust swarms in flight. The results have not been shown to improve present detection methods.

4. Gregarious Phase--Settled Swarm Surveys

Surveys of settled swarms are most useful in areas where terrain features inhibit swarm movement. Since bright colorations are typical of many immature and mature adult locust species, settled swarms can often be detected through aerial surveys.

D. Surveying Grasshoppers

Although the Senegalese grasshopper does migrate, most grasshopper species are relatively sedentary, and spread throughout wide areas. Their populations fluctuate over that area according to changes in weather and vegetation, and their movements are not as highly visible as those of locusts. Thus grasshopper outbreaks may not provide a localized, clearly-defined target. Within the infested area, population levels can vary greatly. Delimit-

ing the area of economic importance is far more difficult and time-consuming than for locusts.

1. Egg Surveys

Egg surveys provide two types of information for the program planner: whether grasshoppers did or did not lay eggs at this particular location; and what percentage loss of eggs occurred due to predation, parasitization and desiccation.

EGG SURVEYS REQUIRE EXPERIENCED SURVEYORS

Egg surveys require a high degree of competence in finding egg pods. The surveyor must have an intimate knowledge of the grasshopper species to which the survey is addressed since each species has its own peculiarities when it comes to selecting egg laying sites.

Since experienced egg surveyors know exactly where to look to find egg pods, their results may highly exaggerate the anticipated grasshopper population on an overall basis. Unskilled egg pod surveyors will seldom find a single egg pod even though they may have been guided to a major oviposition site. Egg pod surveyors need a knowledge of soils (types and textures), soil moisture content, and preferred food plants at the time that egg laying can be expected to occur.

EGG POD SURVEYS ARE NOT COST EFFECTIVE

Egg pod surveys are expensive and they require a sizeable manpower outlay if they are to be used as a principal indicator of the following season population. The work is tiring and personnel often balk at being selected to undertake such an assignment. These drawbacks and an analysis of results achieved over many seasons has convinced the USDA that scheduled, intense egg pod surveys do not provide data of sufficient value to warrant their cost.

2. Nymphal (Hopper) Surveys

Nymphal surveys are conducted after hatch occurs. Their function is to detect areas of economic population and delimit those areas for follow-up control action. Nymphal surveys are of little value unless control efforts are contemplated.

NYMPHAL SURVEY TIMING IMPORTANT

Nymphal surveys must be completed quickly, before the window of opportunity for control closes. A knowledge of grasshopper biology, environmental preference, and favored food plants is an asset in nymphal surveys. This knowledge allows the use of topographic, vegetation, and soils maps in the planning phase of the survey, thus limiting the survey to only those areas with potential for economic infestation. As an example, the Senegalese grasshopper prefers open or lightly wooded dry savanna, steppe, and ephem-

eral prairies that develop on sandy soils and have a perennial and/or annual grass cover. The tussock grass Aristida pallida is characteristic of the perennial and Cenchrus biflorus of the annual communities. A closely related species of grasshopper, Oedaleus johnstoni, is at home on the very edge of the desert, feeding on annual grasses that derive their needed moisture from runoff from rainfall in such mountainous regions as the Adrar des Iforas or irrigated oasis agriculture.

TWO TYPES OF NYMPHAL SURVEYS

There are two types of nymphal surveys: roadside surveys and grid surveys. Roadside surveys involve driving slowly along the roads and trails, watching for grasshoppers that hop to the side just ahead of the approaching front wheels, and questioning farmers, shepherds and nomads. Grid surveys are initiated when an economic population is found. In areas of extensive infestation, delimiting surveys should be planned on a 5 kilometer by 5 kilometer grid or less. For relatively small areas (a few thousand hectares) a 1 kilometer by 1 kilometer grid is more appropriate.

In lieu of roadside surveys, grid surveys for detection of economic infestation are often used. Detection grid surveys should be planned on a 10 kilometer by 10 kilometer grid. The average surveyor in a four-wheel drive vehicle can only make 10 to 15 recorded stops per day. With a helicopter for transport this number can be increased by several times. For this reason, helicopters are particularly useful in grid-type detection surveys.

REPEATS NECESSARY

Since not all grasshoppers will hatch at the same time, nymphal surveys may have to be repeated. Also, some grasshoppers such as the Senegalese grasshopper have more than one generation. If early season control is not completely successful, nymphal surveys will have to be repeated following the hatch of the new generation.

3. Adult Surveys

ADULT SURVEYS FORECAST NEXT YEAR

Adult surveys are conducted towards the end of the season when the major grasshopper species have reached maturity. Adult surveys have two prime objectives: they provide an index as to the numbers of grasshoppers that survived to lay eggs for the next season's infestation; and they provide knowledge as to where egg laying has occurred or is likely to occur. Adult surveys provide the basis for forecasting the degree and extent of infestation to be expected the following season.

Adult surveys are best conducted on a grid basis. Surveys should be limited to only those areas where economic populations are likely to occur, based on suitable vegetative cover and soil types and historical records of previous infestation.

Adult surveys should record: the population of grasshoppers present at the time; the dominant species and their percentage of the total population; the occurrence of egg laying; the presence of frass, large quantities of which could be an indicator that higher populations may have been present earlier but have since died or moved to another location; the presence of parasites and predators; and any unfavorable ecological or environmental factors that could impact on the surviving population.

SURVEY INFORMATION

4. Survey Techniques for Egg Surveys

Surveys should be conducted as early as possible after the last egg laying has occurred, when the observers' memories are still fresh and field evidence is apparent.

SURVEY TECHNIQUES

The size and distribution of sampling plots may vary, but at least 10 square meters should be sampled in each habitat. Sampling is then done at intervals of about 10 kilometers at appropriate sites. Two methods for sampling are: to scrape the soil with a trowel or other sharp instrument; and to dig and screen the soil.

5. Survey Techniques for Nymphal Surveys

Survey stops should be made at an interval of about 10 kilometers. Areas not known to support locust/grasshopper populations can be omitted. Counts should be made using a one square meter sampling unit or fraction of that unit. All stops should be recorded on a white background road map as well as on a prepared form. The actual count per square meter should be recorded on both the map and form with actual grid coordinates. Each map should clearly show the date of the survey and the name of the surveyor.

6. Survey Techniques for Delimiting Surveys

Delimiting surveys are basically nymphal surveys, but more intense. When an action level of grasshopper density is found, a delimiting survey should be started immediately. Delimiting surveys should be on a 1- to 5-kilometer grid with each stop as near as possible to the grid intersection.

7. Survey Techniques for Adult Surveys

Adult surveys are not as intensive as nymphal surveys but should provide a wider range of information. A sufficient number of stops should be made to assure adequate coverage of the area to be surveyed (8 to 15 per department or other major governmental unit). The adult survey should provide the following information: concentrations of grasshoppers by area; grasshopper species;

crop damage assessment, and a general description of area including vegetation, soil type, terrain, and soil moisture content.

As with the nymphal survey, stops should be recorded on a standard road map and a prepared form.

E. Monitoring

The term monitoring is used for overseeing the results of control efforts on the target insect and the effects of the treatment on nontarget organisms.

CONTROL EFFECTIVENESS MONITORING NECESSARY

Monitoring the effect of control efforts on the target organism is necessary to determine the degree of control achieved and the effect of the control measures on future populations. If the degree of control is not satisfactory (reducing the population to below the economic injury level), then retreatment might be necessary.

MONITORING THE ENVIRONMENT

Environmental monitoring is necessary both before and after chemical control actions. Before insecticidal applications begin, hazardous areas (areas that might be damaged by chemical control) both within and near the treatment area must be located and mapped. Some areas may have to be eliminated from treatment. Adequate buffers may also be required for hazardous areas inside or near the area to be treated. Planners should follow the recommendations of the Programmatic Environmental Assessment in determining the extent of these buffer zones.

AREAS AT RISK

The following areas should be considered hazardous: areas of human concentrations; areas having human water supplies; water bodies containing fish or frequented by other forms of wildlife; national parks and wildlife refuges; critical wildlife habitats; and endangered species habitats.

The resident populations of birds, small mammals, and nontarget insects should be monitored within the treatment area prior to the application of pesticides. This baseline data will permit an evaluation of any undesirable effects of the treatment. Following treatment, and for at least thirty days thereafter, the area should be checked for adverse effects. A.I.D. Environmental Officers can provide guidance on the scheduling and intensity of monitoring and the indicator organisms to be monitored.

PROPER SAMPLE HANDLING IMPORTANT

If samples of birds, fish, small mammals, plants, or soil are to be taken for pesticide residue analysis, arrangements must be made in advance for the preservation of the samples until they reach the analytical laboratory. The insecticides used for locust/grasshopper control have a rather short residual life. If not properly preserved immediately upon collection, the pesticide

residue will likely dissipate during transportation to the analytical laboratory. Freezing of the sample is the normal procedure, although in some instances chemical extracts may be used. The manager must assure that freezers or dry ice are available, and that the quantity of dry ice is adequate to cover the transportation time to the analytical laboratory with a suitable surplus time in case of unforeseen delays.

Monitoring systems are intended to generate data that may be useful in modifying the program so as to minimize any adverse environmental effects. They serve as an early warning system to the buildup of undesirable residues. They also relieve anxiety as to what unknown undesirable effects may be occurring as a result of the treatment.

Table of Contents

Chapter VII. Selecting and Handling Pesticides

A. Purchasing Pesticides VII-2
1. A.I.D. Regulation 16 ..... VII-2
2. Source of Supply VII-3
3. Registration Status VII-3
4. Appropriate Specifications for Active Ingredient and Formulation VII-3
5. Recommended Use Patterns VII-6

B. Determining Efficacy Against Locusts and Grasshoppers VII-9
1. Lethal Dosage VII-9
2. Rate and Frequency of Application VII-10
3. Cost-Effectiveness VII-10

C. Assessing Toxicity VII-11
1. International Status of Pesticide VII-11
2. Acute Toxicity VII-11
3. Chronic Toxicity VII-13
4. Potential for Human Exposure VII-13
5. Effects on Nontarget Organisms VII-14

D. Storing and Handling Pesticides VII-15
1. Prepositioning VII-15
2. Storage Conditions VII-16
3. Packaging VII-16
4. Labeling VII-17

E. Disposing of Pesticides and Empty Containers VII-17
1. Containers Having Substantial Amounts of Pesticide VII-17
2. Empty Containers VII-18

Reference	Notes

Early in the process of planning for locust/grasshopper control, Missions should address issues relating to the selection and safe handling of pesticides. This chapter outlines requirements for purchasing pesticides, explains how to determine their efficacy and toxicity, and provides information on storing, handling, and disposing of pesticides and their containers.

A. Purchasing Pesticides

1. A.I.D. Regulation 16

REGULATION 16 REQUIREMENTS

Under the emergency conditions of 1986-87, U.S. purchases of pesticides were based on a waiver from the requirements of A.I.D. Regulation 16.

Under nonemergency conditions, full compliance with A.I.D. Regulation 16 is mandatory and an environmental assessment must be completed. (See Appendix C.) Environmental assessments associated with pesticides procurement must address each and every one of the following items required by Regulation 16:

- The U.S. Environmental Protection Agency registration status of the requested pesticide.
- The basis for selection of the requested pesticide.
- The extent to which the proposed pesticide use is part of an integrated pest management program.
- The proposed method or methods of application, including availability of appropriate, handling, mixing, application and safety equipment.
- Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such hazards.
- The effectiveness of the requested pesticide for the proposed use.
- Compatibility of the proposed pesticide with target and nontarget ecosystems.
- The conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils, human habitation, and domestic livestock.
- The availability and effectiveness of other pesticides or nonchemical control methods.

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

- The provision made for training of users and applicators.

- The provisions made for monitoring the use and effectiveness of the pesticide and any impact on the environment.

2. Source of Supply

PESTICIDE PROCUREMENT REQUIREMENTS

When appropriate waivers are obtained for the nonproject emergency procurement of pesticides, any pesticides covered by the Programmatic Environmental Assessment may be purchased.

For purchases made with project funds (project procurement), federal procurement guidelines apply to all pesticides. These source/origin requirements apply to the following pesticides: malathion, carbaryl, bendiocarb, karate, diazinon. Chlorpyrifos may apply—but a determination must be made on a case-by-case basis.

3. Registration Status

PESTICIDE REGISTRATION

When the host country has an established registration system in place, the pesticide chosen for locust/grasshopper control should be registered. Major multinational pesticide producers are usually willing to supply the technical documentation needed for registration. Assistance with registration can be obtained from the International Pesticide Manufacturers Association (GIFAP) in Brussels, Belgium, or the U.S. National Agricultural Chemicals Association (NACA) in Washington, D.C.

4. Appropriate Specifications for Active Ingredient and Formulation

PESTICIDE SPECIFICATIONS

Both the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) develop specifications for the active ingredients in pesticides (see Table VII-1). The U.S. has substantive input to the process of setting specifications.

OFDA is taking steps to ensure that all chemicals used in locust/grasshopper control are covered by FAO specifications. In cases where no FAO or WHO specification is available, manufacturers should be required to provide their own specification and certify that the product being furnished is equal in quality and purity to that manufactured, distributed, and used in the country of origin.

Table VII-1. FAO List of Chemicals Already Used On a Scale to Show Their Effectiveness

Name	Commercial Name	Formulation	Use	Grasshoppers gm.a.i./ha.	Locusts gm.a.i./ha.	U.S. Reg* g/l-0
			Carbamates			
Bendiocarb	Ficam	1% dust	bait		25	
			dust	50-100		
		20% ULV	spray	30-100	75-100	X
Carbaryl	Sevin	10% powder	dust	720		
	Sevin-4-oil	480 gm/l dilute 4:1 with diesel	spray	1,000		X
Propoxur	Undine	1%-5% powder	dust	100		
	Undine 250 UL	250 gm/l ULV	spray	125	100-200	
			Chlorinated Hydrocarbons			
Dieldrin1	Ensodil 20	200 gm/l ULV	spray		10-35	banned in U.S.
Lindane3	300 ULV	300 gm/l ULV	spray	160-200		X
+Lambdacyhalothrin		Karate 40	spray	200 + 8		
			Organophosphates			
Chlorpyrifos	Dursban		dust		250	
	Pennphos	240 gm/l ULV	spray	150-170		X
		240 gm/l micro-encapsulated	spray	150-200		
Diazinon2	Basudin	600-1,000 gm/l	spray	450	500	X
	Knox-out	240 gm/l micro-encapsulated	spray	500-650		
Dichlorvos		40 gm/l ULV	spray	150		
Malathion		96% ULV	spray	560	925	X

Name	Commercial Name	Formulation	Use	Grasshoppers gm.a.i./ha.	Locusts gm.a.i./ha.	U.S. Reg* g/1-0
Fenitrothion5		3-5% powder	dust	250		
	Sumithion Folithion	200-1,000 gm/l ULV and EC	spray	250-350	400-500	
		250 gm/l micro-encapsulated	spray	250		
		Pyrethroids				
Alphacypermethrin4	Fastac	40 gm/l ULV	spray	20	20	
Deltamethrin4	Decis	15-25 gm/l ULV	spray	5-20	10-12	
Lambdacyhalothrin4	Karate	5-40 gm/l ULV	spray	20	20+	
	Growth Regulators					
Treflubenzuron	Nomolt 500F	50 gm/l	spray	50-75		
	Some Pesticides of Interest to A.I.D. But Needing Further Trials Before Large-Scale Use					
		Carbamates				
Carbosulphan	Marshall	spray and dust		200-300	200-300	
		Organophosphates				
Acephate	Orthene	water miscible concentrate	spray	60		

* Registered for use in the U.S. for grasshoppers (g/l); other insects not grasshoppers 0.
1 A.I.D. policy is not to participate where dieldrin is used. (FAO advocates use of existing stocks only).
2 Use of Diazinon should be withheld pending outcome of EPA review.
3 Lindane (Gamma isomer of BHC) should not be used except in exceptional situations and upon approval of A.I.D. Environmental Officers.
4 Pyrethroids are highly toxic to fish so should not be used around water bodies or in principal drainage areas. They are also highly bioaccumulative
5 Fenitrothion is highly toxic to birds.

Several A.I.D. offices are working together to ensure that all future A.I.D. purchases of pesticides are based on adequate formulation specifications. Included are: the Regional Bureaus; the Bureau for Science and Technology, Office of Agriculture (S&T/AGR); and the Directorate for Program and Management Services (M/SER/OP). Common problems caused by poor formulations are unstable emulsions (pesticide separates into separate phase from water layer) and poor suspensions. These problems can cause clogged sprayers, poor adherence to plant surfaces, the formation of crystallized solids in containers, and excessive caking and lumping.

A.I.D. CERTIFIED LABS

The Directorate for Program and Management Services, Office of Procurement, Commodity Support Division (M/SER/OP/COMS) maintains a list of A.I.D.-certified laboratories capable of conducting chemical analyses to ensure that products meet appropriate specifications.

5. Recommended Use Patterns

DECIDING WHICH PESTICIDE TO USE

Several pesticides can give equally satisfactory control against locusts and grasshoppers at particular stages in their development. In deciding among them, several issues merit consideration.

- Efficacy against the insects' stage of development

  -Carbaryl, a stomach poison is most effective against grasshopper and locust nymphs and sedentary grasshopper adults. With little contact action, it is not highly effective for control of swarming adults. It is highly resistant to wash-off, so works well in higher rainfall areas.

  -Malathion and fenitrothion are principally contact insecticides with only short residual action. They work best for locust swarm control or direct contact spraying against locust/grasshopper nymphs. They are not satisfactory for barrier spraying or for use in baits.

- Manufacturing location

  -Malathion is manufactured in the United States by an American company.
  -Carbaryl is manufactured in the United States by a French company.
  -Fenitrothion is Japanese-owned and manufactured in Japan and Europe.
  -Bendiocarb is European-owned but manufactured in the U.S.

106

- Cost of the formulated material including shipping and handling.

  -Fenitrothion is cheaper than malathion since only about 1/2 as much is required per hectare
  -Carbaryl is about twice as expensive as malathion on a per hectare basis because of the higher application rate and amount of active ingredient required. However, as a bait carbaryl is less expensive than both fenitrothion and malathion.
  -Propoxur as a concentrate is relatively inexpensive but, formulated as a 1-2% dust is very expensive on a per hectare basis, particularly if lengthy transportation is added.

- Environmental and human hazard.

  -Carbaryl and malathion are highly toxic to bees.
  -Fenitrothion is toxic to birds.
  -Dieldrin is carcinogenic.

- Ready availability.

  -Dieldrin is no longer manufactured.

- Persistence in the environment and bioaccumulation in nontarget organisms.

  -Chlorpyrifos is moderately persistent in soil.
  -Acephate and malathion have low persistency and bioaccumulation.
  -Synthetic pyrethroids—cypermethrin, lambdacyhalothrin, tralomethrin and deltamethrin are highly bioaccumulative.

- Registration status.

  -Malathion, acephate, chlorpyrifos, carbaryl, diazinon, lindane registered for use on grasshoppers in the U.S.
  -Fenitrothion and bendiocarb registered for use in the U.S.
  -Dieldrin banned for use in the U.S.

- Length of shelf life.

  -Most manufacturers guarantee their products for 18 months to 3 years under adequate storage.

Table VII-2. Recommended Use Patterns for Listed Pesticides

Name	Length of Residue	Use
Bendiocarb	moderate	As dusts or in baits for locust hopper control
Carbaryl	11-21 days	Nymphal and adult grasshopper control and locust hoppers (barrier treatment or complete coverage). Use as ULV spray, dust or in bait.
Propoxur	low	1-2% dust or in bait. Low bioaccumulation.
Dieldrin	30-40 days on vegetation. Very persistent in soil	Banned for use in the U.S. and many African and Asian countries. Not approved for use by A.I.D. A known carcinogen.
Lindane	moderate	For direct application to nymphs and settled swarms, but too volatile for barrier treatments. Not recommended for use by programmatic environmental assessment.
Chlorpyrifos	short on foliage, long in soil	A.I.D. tests in Mali, 1987 proved its effectiveness as ULV spray against Africa grasshoppers.
Diazinon	low on vegetation	As ULV or microencapsulated sprays against nymphs and adult grasshoppers and settled locust swarms.
Diclorovos	low - highly volatile	Used in Morocco against adult locusts for quick knockdown. Not recommended for use by A.I.D.
Fenitrothion	2-3 days under arid	Widely used in Africa and Middle East against both locusts and grasshoppers, nymphs and adults. 3% dust for farmer application. Do not use where there are birds concentrated.
Malathion	2-3 days	Widely used as a ULV spray against grasshoppers and locusts, nymphs and adults. Primarily contact action; effectiveness reduced at temperatures below 70°F.
Acephate	moderate, 3-5 days	Registered for use against grasshoppers in U.S. Untested in Africa. Reportedly does not work well as stomach poison on dry vegetation. Environmentally most acceptable of locust/grasshopper insecticides.
Cypermethrin	moderate	Rapid knockdown but recovery has occurred in some tests. Additional testing needed.
Lambdacyhalothrin	3-6 days	Needs additional testing.
Tralomethrin		Needs additional testing.
Deltamethrin		Needs additional testing.

- Pesticide packaging

  -Is the container size adequate for easy handling under the conditions of its use?
  -Is the container sturdy enough to withstand rough handling?
  -Is the container adequately labeled and in the language of the country of destination?

Table VII-2 presents a summary of recommended use patterns for listed pesticides.

B. Determining Efficacy Against Locusts and Grasshoppers

1. Lethal Dosage

Pesticides act against insects in one or more ways: as stomach poisons, as dermal contact toxins, or as fumigants. Dermal contact poisons can be effective in the absence of green vegetation. Stomach poisons must be applied to foliage because they must be ingested by locusts to be effective.

LETHAL DOSAGE LD50 DEFINED

Pesticides are often described in terms of LD50—the number of milligrams of toxicant per kilogram of body weight required to kill 50 percent of a large population of test animals (lethal dose). A pesticide's LD50 varies among target species and also within the insect's life cycle. Generally, younger stages of the life cycle are more vulnerable.

Table VII-3 gives dermal LD50s for adults of the Desert Locust, as a reference point for comparing the toxicity of these insecticides to acridids as a group. No insecticides with an LD50 higher than about 40 micrograms per gram has found large-scale acceptance.

Table VII-3. Dermal LD50s for Desert Locust Adults.

Insecticide	Dermal LD50 (microg/g)
Dieldrin	3.7-6.9
Lindane (Gamma-BHC, Gamma-HCH)	5.5-14.5
160-200	
Acephate	33
Chlorpyrifos	3-3.2
Diazinon	3.4-6.5
Fenitrothion	3.7-8.4
Malathion	25-38
Bendiocarb	1-2.1
Carbaryl	25->100
Propoxur	1-2.6
Cypermethrin	2.2

For stomach poisons, the effective dose changes according to the amount of vegetation and the speed of action necessary. If rapid, complete knock-down is desired, a relatively high dose must be applied. Except for the most ephemeral chemicals, a lower dose acting over a longer period will achieve the same final mortality.

2. Rate and Frequency of Application

APPLICATION RATE DEVIATION

The rate of application used should be based, where possible, on experimental testing. Usually this testing is accomplished in collaborative testing programs involving the pesticide manufacturer, bilateral and multilateral donors, and affected countries. Any deviation from the "established" rate should be fully justified in the environmental assessment (or waiver) under which the pesticide is procured.

A principal long-term U.S. contact for information on pesticide efficacy testing against grasshoppers is the USDA/ARS Rangeland Insect Laboratory, Montana State University, Bozeman, Montana.

3. Cost-Effectiveness

Cost-effective use of pesticides depends on the overall cost per unit area of treatment. This, in turn, is dependent on: a) the cost per unit area for application; and b) the cost per unit of formulation and absolute amount of formulation needed per unit area.

C. Assessing Toxicity

1. International Status of Pesticides

TOXICITY DETERMINATION

The Food and Agriculture Organization (FAO) and World Health Organization (WHO) hold a Joint Meeting on Pesticide Residues where an international body of experts reviews toxicological data. Based on these reviews, the Meeting establishes or recommends acceptable daily intakes (ADIs) for pesticides. The Meeting also assesses crop, soil, and environmental residues and their time-rate-of-decline under "good agricultural practices." After the review, FAO and WHO prepare a detailed monograph and all these data become a matter of public record. Almost all major pesticide manufacturers participate in this process. Requests for such reviews can be initiated by A.I.D. (as a member of the U.S. Codex Commission on Pesticide Residues Delegation) or by any recipient country member of FAO. Since ADIs are expressed in terms of milligrams of pesticide per day for an average weight male (70 kg), it is possible to calculate whether a safe level would be exceeded based on overall exposure from residue in food and from exposure to the pesticide during application.

2. Acute Toxicity

ALLOWABLE TOXICITY

Although all pesticides are toxic, there are substantial differences in their relative toxicity. The World Health Organization (WHO) rates pesticides on a numerical rating from Hazard Class I to V. Those in the I category are least safe. A.I.D. and the World Bank do not allow small farmers to use pesticide formulations in category I (neither Ia—extremely hazardous nor Ib—highly hazardous).

Table VII-4 shows the toxicological basis of the WHO Hazard Classification System. Table VII-5 lists current pesticides used in locust/grasshopper control by both acute oral LD50 (to rats) and by WHO Hazard Classification.

Whenever practicable, toxicological data for each formulation planned for use should be obtained from the manufacturer. If such data are not obtainable, then the classification may be based on proportionate calculations from the LD50 values of the technical ingredient or ingredients, according to the following formula:

TOXICITY FORMULA

$$\frac{\text{LD50 active ingredient} \times 100}{\text{Percentage of active ingredient in formulation}}$$

Table VII-4. Toxicological Basis for WHO Hazard Classification.

Class	LD50 for the rat (mg/kg body weight)			
	Oral		Dermal	
	Solids*	Liquids*	Solids*	Liquids*
Ia Extremely hazardous	5 or less	20 or less	20 or less	40 or less
Ib Highly hazardous	5-50	20-200	10-100	40-400
II Moderately hazardous	50-500	200-2000	100-1000	400-4000
III Slightly hazardous	Over 500	Over 2000	Over 1000	Over 4000

* The terms "solids" and "liquids" refer to the physical state of the product or formulation being classified.

Table VII-5. Characteristics of Current Pesticides Used in Locust/Grasshopper Control.

Common Name	Chemical Type*	Physical State	Oral LD50 mg/kg	WHO Hazard Classification
acephate	OP	solid	866	III
aldrin**	OC	solid/liquid	60	Ib
bendiocarb	C	solid/liquid	40-156	Ib
BHC**	OC	solid/liquid	270	II
carbaryl	C	solid	850	II
chlorpyrifos	OP	liquid	163	Ib
cypermethrin	PY	solid	4123	HU
diazinon	OP	liquid	400	II
dichlorvos	OP	liquid	100-300	II
dieldrin**	OC	liquid	45-50	Ib
fenitrothion	OP	liquid	800	II
Lambda-cyhalothrin	PY	solid	56	II
lindane**	OC	solid	88	II
malathion	OP	liquid	2800	III
propoxur	C	solid	90-128	II
tralomethrin	PY	solid	3000	HU

* OC = Organochlorine; C = Carbamate; OP = Organophosphate; PY = Synthetic pyrethroid.
** Use not permitted by A.I.D.

If the formulation contains more than one ingredient (including solvents, wetting agents, etc.) of significant toxicity-enhancing properties, then the classification should correspond to the toxicity of the mixed ingredients.

CLORINATED HYDROCARBONS PROHIBITED

Of all the pesticides currently in use or proposed for locust/grasshopper control programs, only dichlorves falls into the highly hazardous category. A.I.D. prohibits the use of chlorinated hydrocarbon pesticides—dieldrin, aldrin, lindane and BHC—because of their potential for adverse chronic effects. They accumulate and remain for considerable periods of time as a deposit in the human body.

3. Chronic Toxicity

CHRONIC TOXICITY INFORMATION

With sufficient exposure, some chemicals produce chronic adverse health effects, including cancer and neurological, mutagenic, and reproductive disorders. Chronic toxicity studies are a routine requirement for food crop use registrations in the U.S. and in all countries of the European Economic Community and Organization for Economic Cooperation and Development (OECD) member countries. Available information indicates that the carbamate, organophosphate, and pyrethroid pesticides proposed for the locust and grasshopper control programs do not pose an unusual risk of chronic adverse effects at the exposure levels expected. All of these chemicals have one or more major food crop registrations in a major developed country.

Crops sprayed with pesticides such a carbaryl and malathion will not contain residue levels of acute toxicological concern, even if collected immediately after spraying. However, common sense suggests that a short time interval between spray and harvest will provide an added safety factor.

4. Potential for Human Exposure

HUMAN EXPSURE

Mixers/Loaders, the personnel involved in mixing and loading (transfer) of pesticides, are exposed to substantial risk of adverse consequences from acute poisoning. Exposure can be through oral or dermal contact, or through inhalation. Dermal contact is usually the biggest problem. The degree of exposure is directly related to the time and frequency of contact and to the concentration of active ingredient.

PROTECTIVE MEASURES

The following types of protective gear are useful in protecting mixer/loader personnel from excessive exposure: goggles, face masks, respirators, boots, gloves, and special protective clothing. At a minimum any personnel engaged in mixing or transferring pesticide concentrates should wear impermeable gloves, a simple face mask, full-length trousers, and a long-sleeved shirt. Beyond this level of protection, good judgment and common sense should come into play.

A copious supply of soap and water should always be provided at the mixing/loading sites so that emergency spills can be readily handled. Similarly, several spares of clean trousers and shirts should always be available so that contaminated clothing can be quickly removed. Most spills, if rapidly treated, will not result in acute poisonings.

FIRST AID DIFFICULT

Outside of hospital settings, medical treatment for pesticide poisonings is difficult. If first aid supplies, such as atropine or PAM, are to be provided, A.I.D. should be sure that local medical personnel are competent in its use. Only a competent physician can determine whether local medical staff are competent.

BLOOD SAMPLE TESTING EFFECTIVE

An effective way to determine whether mixers/loaders are being excessively exposed to organophosphate and carbamate pesticides (malathion, carbaryl, chlorpyrifos, bendiocarb, fenitrothion) is to collect blood samples and monitor for levels of the enzyme cholinesterase. This procedure is simple and local clinical personnel can be trained in the procedures.

PLEASE NOTE: As of presstime for this guidebook, all AID/W funded personnel who handle pesticides will have cholinesterase levels established before departing for locust/grasshopper control assignments in the field.

In general, the provisions for mixers/loaders also apply to applicators.

The general public is at very low risk from most pesticides considered for use in locust control. The amount of combined inhalation and dermal exposure from standing unprotected, directly under spray aircraft would normally be within the acceptable range. Nevertheless, common sense indicates that public safety messages should be distributed by poster, radio, and other mechanisms to reduce unnecessary fears, still rumors, and develop a psychological state of well-being.

5. Effects on Nontarget Organisms

BARRIER ZONES SHOULD BE USED

Determining the consequences of pesticide applications on wildlife is difficult because information is lacking on many chemicals applied throughout Africa for diverse purposes. Chemicals applied for locust/grasshopper control may be overshadowed by broad-scale applications on agricultural lands. Without pretreatment or long-range posttreatment data to assess consequences, certain predictable risks must be accepted. The barrier zone concept, as recommended in the Programmatic Environmental Assessment, should be utilized in all situations. Highly sensitive areas where ecological protection is important should never be sprayed.

In the short term, the use of pesticides in locust/grasshopper control has detrimental effects for nontarget invertebrates (natural predators of locusts/grasshoppers, pollinators, soil organisms, other beneficial insects) and for vertebrates (bird losses, reduced avian reproduction, displacement of insectivorous birds, reduction of local populations of small mammals). The long-term consequences are more difficult to ascertain.

FLOODPLAIN BUFFERS SHOULD BE USED

To avoid the exposure of aquatic areas to pesticides, buffer areas should be established outside the general floodplain of a river. African floodplains incorporate the main channel of the river and a series of flats that are often associated with extensive lake systems that are flooded during the annual flood cycle. Also, semiarid areas tend to form large transient water bodies during the rainy season. Pesticides applied to areas near water bodies may quickly be inundated during parts of the flood season. Pyrethroid insecticides should never be used near sensitive aquatic sites because they are highly toxic to aquatic organisms.

Aquatic animals can easily be exposed to pesticides during spray programs because locust and grasshopper growth is closely associated with rainy seasons. Typically, early (phase 1) interventions are made during the onset of the wet season. Late interventions (or phase 2) occur at the end of the wet season, when floodplains have started to recede and water bodies are shrinking.

When pesticides are applied directly to water bodies (for instance, for the control of grasshoppers in rice paddies), fish, aquatic insects, and invertebrates are severely affected. All aquatic invertebrates and most fish would be killed. There would also be reductions in populations of aquatic invertebrates in streams and rivers downstream from the sites.

D. Storing and Handling Pesticides

1. Prepositioning

PREPOSITIONING DECISION MAKING

In locust/grasshopper control efforts, pesticides need to be accessible on relatively short notice. Chemicals to be used should be prepositioned in an appropriate storage facility that is relatively near the site of operation. Prepositioning entails prior decisions as to what chemicals will be needed and used, the probable quantity required, the formulation compatible with method of application, and some system of accounting for the chemical and replenishing the supply as needed.

Prepositioning can be achieved by having a central facility to maintain adequate supplies of the various chemicals, an appropriate transport and distribution system, and subsidiary facilities near the sites of control efforts. Management is essential to ensure against possible shortages or oversupply.

2. Storage Conditions

When pesticides are being transported or stored, they are usually in a highly concentrated form. Special care must be taken to avoid contamination and maintain inventory control. Storage areas should be constructed and maintained to minimize risks and should be clearly marked with appropriate warning signs.

PESTICIDES HAVE SHORT SHELF LIFE

Pesticides currently used (malathion, carbaryl, fenitrothion, propoxur) have a limited useful life. Their active ingredients tend to lose efficacy over time and under storage conditions. Most manufacturers guarantee their products for two years under tropical storage conditions if their products are stored unopened in their original containers out of direct sunlight. An estimated shelf-life should be established for each product, taking into account regional climatic conditions.

Insecticides stored and used under tropical conditions should be specifically formulated and packaged for these conditions. They may need additional stabilizers and higher boiling solvents for liquids, to prevent changes that reduce their effectiveness for locust/grasshopper control. Each pesticide shipment should contain an analysis of formulation properties, active ingredients, and an analysis of suspensibility using standardized accelerated storage tests. Storage conditions to avoid include buildings with little or no ventilation and outdoor locations where daytime temperatures are very high. Never permit storage containers to be exposed directly to sunlight for extended periods of time.

INSPECTIONS ARE NECESSARY

Inspection procedures should be established at storage sites to assure that packages and containers are adequate and that damaged goods are re-packaged or disposed of properly. When leaks are observed, package repairs or product transfers need to be made and spills should be promptly decontaminated and cleaned up.

3. Packaging

Pesticides must be packaged appropriately for storage, climatic, and shipment conditions. Vendors should be asked to furnish their own specifications. A.I.D./W can review these specifications and approve or disapprove case-by-case on the basis of past experience with packaging.

116

Size of packaging should be specified early in the planning process, based on the type and number of end users and the kinds of application equipment. The exposure of the pesticide handlers at major distribution sites should be minimized. Under no circumstances should repackaging operations be undertaken unless specifically authorized!

DON'T REPACKAGE !

The packages must be sturdy and suitable for hot arid and hot tropical conditions. For large quantities of liquids, 55-gallon drums have been the preferred package, but experience in the 1986-87 campaign indicated that these drums were too heavy for convenient manual loading/unloading. They caused numerous physical injuries, and were frequently damaged when they were dropped onto hard surfaces. A.I.D./W is now strongly promoting the use of smaller drums (for example, 30-gallon containers). All major pesticide manufacturers are capable of packaging their product in such containers!

SMALLER CONTAINERS ARE BETTER

Pesticide packaging guidelines developed collaboratively by A.I.D. and FAO are now available as an FAO document in a number of languages. (See Appendix D.) That document should be utilized to the extent possible in developing specifications.

4. Labeling

Specifications for the purchase of pesticides should require that all containers shipped into the country have proper labeling. At a minimum, the label should have: the product name, the common or chemical name, the percentage of active and inert ingredients, net contents, and the name and address of manufacturer.

LABELING SPECIFICATIONS

General guidance on labeling can be found in an FAO document referenced in the FAO Code of Conduct (Appendix E). All pesticide containers from which pesticides are removed for introduction into application equipment should individually be labeled in the appropriate language. In cases where directions for use do not include locusts or grasshoppers, A.I.D. should provide for the design and printing of collateral labeling which can be affixed to individual containers.

E. Disposing of Pesticides and Empty Containers

1. Containers Having Substantial Amounts of Pesticide

Missions should plan for the disposal of any excess containers full of pesticides. After a locust/grasshopper control effort, A.I.D. should never leave behind a long-term toxic waste problem. Careful planning and adequate disposal budgeting are essential.

PLAN FOR DISPOSAL

A cardinal rule of pesticide disposal is to use the excess pesticide for any approved use. Alternate local uses for unused supplies should be identified early in the planning process and tentative arrangements made for diversion, if necessary.

EXCESS STOCK DISPOSAL

When excess stock far exceeds local absorptive capacity, the best solution is to return the pesticide to the prime offshore manufacturer or send it to a nearby developing country with a legitimate need. Pesticides should not be discarded without seeking competent advice. OFDA is prepared to offer advice in this regard.

2. Empty Containers

USE PROPER CONTAINER DISPOSAL

After a locust/grasshopper control effort, empty pesticide containers should be perforated, crushed, and buried. A.I.D. has adopted this policy to prevent the reuse of drums for unauthorized purposes such as grain or water storage. At least one hole should be made in the top and bottom and several around the sides. The tops of drums should never be removed since this will cause personnel to have excessive exposure to the residual pesticide within the drum.

Drums are best disposed of by piling on the soil surface and covering with a light layer of soil. Deep pits should never be dug since a major objective is to have the maximum separation between any residual pesticide and shallow ground water.

TREAT EMPTY CONTAINERS

If soils are low in clay content (very sandy), additional precautions are required. Either sprinkle kerosene or fuel oil (not gasoline) over drums and ignite, or sprinkle one kilo of hydrated lime [$Ca(OH)2$] under and around each drum at the disposal site. If the drums are burned, care should be taken that there is a steady wind away from livestock and inhabited areas. If drums are sprinkled with lime, the alkaline environment will cause hydrolysis of most pesticides to less toxic by-products.

Soils have the maximum ability to degrade pesticides in the upper 6 to 12 inches of soil horizon. The small residual amounts of pesticides within the containers will easily biodegrade by the combined forces of hydrolysis and soil microbial decomposition.

Appendix F provides further information on the disposal of pesticides and pesticide containers.

Table of Contents

Chapter VIII. Selecting Equipment for Aerial and Ground Applications

A. What Kind of Equipment is Needed? VIII-2

B. Aerial Applications VIII-3
1. Selecting Aircraft VIII-3
2. Monitoring the Application VIII-6
3. Applying Ultra-Low-Volume (ULV) Sprays VIII-7
4. Applying Bait VIII-9
5. Marking Areas for Treatment VIII-10
6. Support Requirements for an Aerial Control Operation VIII-11
7. Airstrip Specifications for Aerial Spraying Operations . VIII-12
8. Aerial Spraying Checklist VIII-13

C. Ground Applications VIII-18

D. Ground Transportation VIII-23

Reference	Notes

A. What Kind of Equipment is Needed?

On locust/grasshopper control efforts, pesticides can be applied by airplanes and helicopters, ground sprayers and dusters, and by hand. Aerial equipment is generally used for applications on large tracts of agricultural and nonagricultural land, areas inaccessible to ground equipment, and areas in which there is an urgent need for immediate control.

Ground equipment is used for smaller agricultural areas adjacent to water bodies where drift could create hazards, and other small habitats such as city parks. Ground equipment can also be used to treat marching locust bands or to apply barrier sprays. Hand applications are used for small agricultural areas, backyard gardens, and for applying bait in front of marching hopper bands.

EQUIPMENT SELECTION FACTORS

In selecting equipment for locust/grasshopper control, planners should consider several factors:

- Accessibility--Terrain features may preclude the use of motorized ground equipment

- Remoteness--Airstrips may be too widely spaced for effective use of single-engine aircraft

- Environmental concerns--Human habitation or the presence of birds, fish, and other wildlife may preclude aerial treatment because of possible drift

- Size of treatment area--Different kinds of equipment are needed for treatment areas of different sizes

The following list shows how the size of the treatment area provides a guide to what equipment is appropriate:

1-10 hectares	Dust bags, hand-operated dusters and sprayers
10-15 hectares	Compression sprayers, mist blowers
15-500 hectares	Vehicle-mounted ultra-low-volume (ULV) and exhaust-nozzle sprayers
500-2,000 hectares	Helicopters
2,000 hectares +	Fixed-wing single-engine aircraft
5,000 hectares +	Large single-engine or small multi-engine aircraft
50,000 hectares +	Large multi-engine aircraft

When there is a wide variation in the size of infested areas that require treatment, efficiency and cost-effectiveness can be achieved with a mix of equipment.

MATCH EQUIPMENT TO PESTICIDE

In selecting equipment to apply pesticides, the type and size of equipment must be carefully matched with the specific formulations to be used. For example, if droplets of pesticide are too fine, they may drift beyond the target area; if droplets are too coarse, they will not cover enough area per unit area of surface.

Special attention must also be given to the state of repair of equipment and the timely acquisition of spare and repair parts. Unserviceable, outmoded, leaking, or poorly designed equipment should be physically destroyed as new equipment is purchased to replace it.

Prior to awarding an aerial contract, A.I.D. should have a qualified aerial application specialist check the condition of the aircraft and auxiliary equipment to assure that it meets contract specifications.

As a safety measure in the event of accident, all aircraft used in locust/grasshopper control programs should have an E.L.T. beacon as a required installation. If a plane goes down, particularly in the summer, it is necessary to find it quickly. Direction finders can be used to locate the missing aircraft.

B. Aerial Applications

Aerial application of pesticides is a highly technical science, involving the use of toxic chemicals mixed in precise proportions and applied within strict limitations. These requirements minimize the risks of adverse effects to the applicators, the public, and nontarget organisms.

1. Selecting Aircraft

SELECT THE RIGHT AIRCRAFT FOR THE JOB

For locust/grasshopper control, a combination of types of aircraft is usually desirable. For control sites close to the operational base, small locally available aircraft may be able to handle pesticide applications. For control sites far from the operational base, large aircraft with substantial load capacity may be needed to carry sufficient fuel and ferry the long distances. For smaller areas, helicopters may be appropriate. Compared to other aircraft, helicopters are more expensive to operate on an hourly basis, but they can operate in treatment areas that do not have airstrips. Helicopters can also be used for small cultivated areas and areas requiring short turn capability and precise placement of pesticides.

Table VIII-1. Average Load Capabilities for Several Types of Single-engine Aircraft.

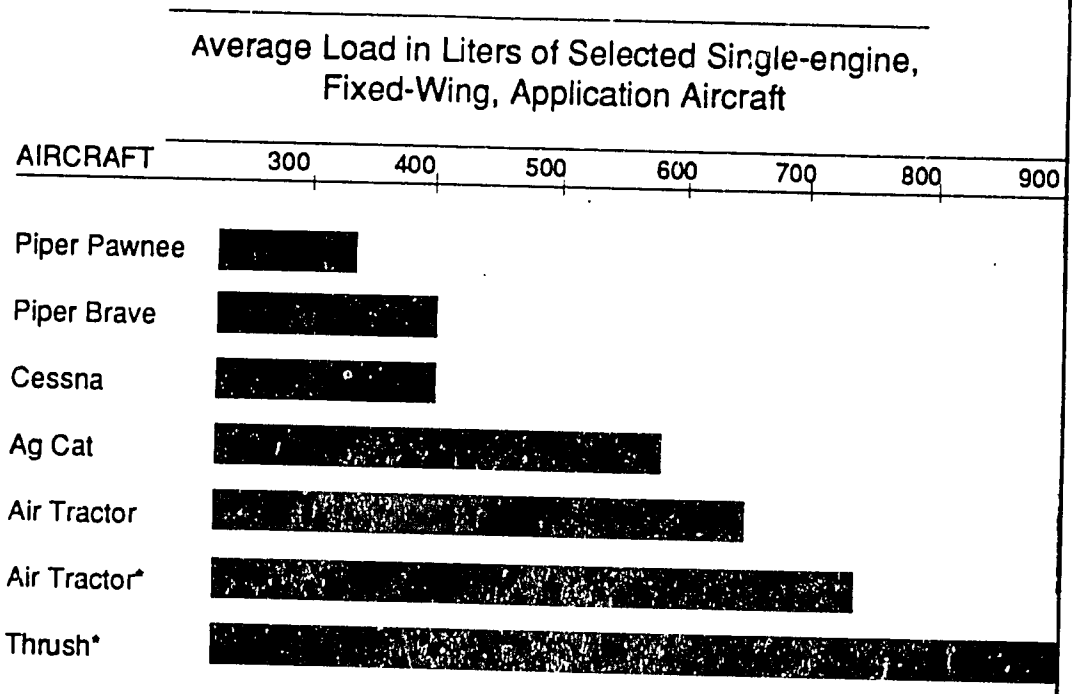


Table VIII-1 summarizes the aircraft load capabilities for several types of single-engine aircraft. Large four-engine, fixed-wing aircraft such as the DC-7 can carry as much as 11,300 liters of insecticide.

In selecting types of aircraft for locust/grasshopper control, Missions should consider the following factors (Dyer, 1987):

- Speed of aircraft
- Effective swath width
- Useful payload
- Fuel capacity and ferry distance capability
- Maneuverability at average loaded weights
- Performance at above 5,000 feet elevation
- Type of fuel available
- Size of area(s) to be treated

- Performance over rugged terrain at all altitudes

- Overall production capability to finish the job during the window of opportunity

- Runway length and width requirements of the type of aircraft, including taxiway and ramp strength

Wherever possible, large treatment areas should be broken up into several small treatment areas, with untreated barriers surrounding.

LARGE AIRCRAFT USE

Large multi-engine aircraft have performed well in the application of pesticides to large tracts of land and in the application of barrier strips for the control of marching locust bands. For safety reasons, multi-engine aircraft must be used when treating congested areas. Large aircraft have not proven successful in the treatment of locust swarms, either settled or in flight.

SMALL AIRCRAFT USE

Single-engine aircraft, fixed- or rotary-wing, are appropriate choices for applying pesticides to flat desert, rolling to rugged mountainous terrain, or small wadi. They may also be used to treat locations within or adjacent to sensitive areas to minimize the problem of drift. Single-engine aircraft must not be used to treat congested areas unless they can be flown at an altitude that will enable them to make a safe landing outside the congested area, without danger to persons or property. Except in unusual cases such as a locust swarm settled in town, the treatment of congested areas should be avoided.

HELICOPTERS

Helicopters are useful to apply pesticides in or near sensitive areas where drift may occur. Helicopters can maintain slow speed, very low altitude, and excellent visibility for precise cutoff of the application.

Large helicopters include Bell 204, 205A and 212 twin engines, the Sikorsky S58T, and the Alouette III or Lama. With on-site loading, these helicopters in (ultra-low-volume) ULV applications compete favorably and economically with large airplanes.

Medium-sized light turbine helicopters such as the Bell 206, Hughes 500, or Aerospatiale A-Star are most commonly used. They have a 1000 pound or 100 to 120 gallon capacity. Smaller reciprocating engine models such as the Bell 47, Hiller 12E, Hughes 300, and Alouette II have 600 to 800 pound or 50 to 80 gallon capacity.

Table VIII-2 presents the computations used in figuring the cost of operations of three turbine thrush airplanes in Senegal in 1986. The cost was $2.47 per hectare (based on 1986 production and cost).

Table VIII-2. Cost Estimates for 3 Turbine Thrush Fixed-wing Aircraft.

Direct Cost:

Spraying at the rate of 40.5 acres (16.4 ha.)/min., and allowance of 50% of the total flight time for ferry and turns, a Turbine Thrush will spray 491 ha. per hr. (16.4 ha./min. = 491 ha.) at an operation cost of $972 per hr., the direct cost will be $1.98 per ha. ($972/491 ha./hr. = $1.98).

Spraying 240,000 ha. at 491 ha./hr. requires 488 hrs. (240,000/491 = 488).

Direct Cost of Operation:	
(488 hrs. x $972/hr. = $474,336)	$474,336
Fuel Cost:	
Jet A fuel @ $1.27/gal. ($.34/L)	
Consumption at 40 gal./hr. (151 L/hr.)	
Fuel Costs ($1.27/gal. x 40 gal./hr. x 488 hrs. = $24,790)	$ 24,790
Support Costs:	
Based upon 1986 Canadian Operation of $.39/ha.	
($.39/ha. x 240,000 ha. = $93,600)	$ 93,600
TOTAL COSTS	$592,726
Costs per hectare:	
($592,726/240,000 ha. = $2.47)	$ 2.47
Insecticide cost per hectare:	
Doc 3643A	$ 2.13

SOURCE: Jack Henderson.

Any large-scale locust/grasshopper control program will require several different types of aircraft. All turbine, fixed-wing aircraft must be equipped with long-range fuel capability carried in the wings. Official visual flight rules should be maintained in agricultural operations. An incident, or accident, could cause loss of insurance and make future coverage problematic.

2. Monitoring the Application

The determination of the effective swath is usually done by flying over a line of specially treated dye cards at the flight altitude assigned for application. The dye cards have a known droplet-size spread factor so that the actual size of the spray droplets emitted by the aircraft can be accurately determined.

The effective swath is calculated by the numbers of droplets per centimeter square on the cards. For ultra-low-volume (ULV) application, the effective swath is generally considered the distance at which cards obtain at least 5 droplets per centimeter square.

EFFECTIVE SWATH

If these specially treated cards are not available, the effective swath can be determined by adding a dye to water in the aircraft spray tank and having the aircraft fly over a line of sheets of paper.

Most spray nozzle companies provide charts that give the flow rate with water at a specified pressure for each nozzle orifice size. By knowing the desired application rate (spray volume per minute) and dividing it by the nozzle flow rate (nozzle capacity), the number of nozzles required can be approximately determined. Since nozzle flow rates are based on water, and the flow rate of most insecticides will differ from that of water, the flow rate of each insecticide and insecticide formulation to be used should be obtained from the manufacturer (see p. VIII-9 for a list of simple formulas).

NOZZLE FLOW RATES

- Sophisticated systems have been developed to assist in determining the deposit distribution. One was developed by Oklahoma State University, another by Texas A&M University, and a "String System" by Kansas State University. The string system can be easily used by anyone in the field who secures the string kit and follows the directions. After the aircraft with the supplied dye passes over the string, the string is rolled up and returned to WRK, Inc., Manhattan, Kansas for the reading and charting of the deposit. One kit checks single-pass swath quantity; another kit is for sequential passes and indicates total field coverage with several overlapping runs.

3. Applying Ultra-Low-Volume (ULV) Sprays

Ultra-low-volume (ULV) sprays are especially useful in Africa where long flights are required from airstrips to areas of infestation. They provide an increase in aircraft efficiency through the increase in the area coverage that can be carried out in a single flight, and they eliminate the need to transport dilution material and mix formulations in the field. Thus, ULV sprays reduce problems of evaporation and decrease the cost of spray materials. Table VIII-3 presents a theoretical comparison of dust bags and ULV application of carbaryl.

ULV INCREASES AERIAL EFFICIENCY

ULV sprays with a volume median diameter in the range of 60 to 150 microns (1 micron = 0.001 mm) can be used for contact and residual treatments against pests and diseases. They will penetrate foliage well and be

Table VIII-3. Theoretical Comparison of Dust Bags and ULV Application of Carbaryl (FAO, 1987).

Dust Bags

A. Walking speed 60 m/min.
B. Swath width 2 m
C. Work rate
60 m/min. x 2 m swath = 120 m2/min.
120 m2/min. x 60 min. = .72 ha./hr.
D. Cost of Chemical
1% Propoxur @ $1200/MT
10 kg./ha. - $12.00/ha.
E. Cost of Transport
(Based on estimate of $40/MT)
$40 - 100 ha. = $.40/ha.
F. Labor Cost/ha.
$.72 ha./hr. x $1.00/hr. = $1.40/ha.
G. Efficiency rate (est.)
50% - $1.40/ha. = $2.80/ha.
H. Total Cost/ha.
Insecticide $12.00/ha.
Transport .40
Labor 2.80
$15.20/ha.
I. Cost Per Unit of Efficiency
70% - $15.20/ha. = $21.71/ha.

ULV Carbaryl

A. Walking speed 60 m/min.
B. Swath width 30 m
C. Work rate
60 m/min. x 30 m swath = 1800 m2/min.
1800 m2/min. x 60 = 10.8 ha./hr.
D. Cost of Chemical
Sevin 4-Oil @ $3.50/L
1.18 L/ha. = $4.13/ha. +
(.3 L of diesel = $.21) = $4.33/ha
E. Cost of Transport
(Based on estimate of $40/MT)
$40 - 743 ha./MT = $.05/ha.
F. Labor Cost/ha.
10.8 ha./hr. x $1.00/hr. = $.09/ha.
G. Efficiency rate (est.)
90% - $.09/ha. = $.10/ha.
H. Total Cost/ha.
Insecticide $4.33/ha.
Transport .05
Labor .10
$4.48/ha.
I. Cost Per Unit of Efficiency
85% - $4.48/ha. = $5.27/ha.

Cost Comparisons (Senegal, 1986)

Type	Pesticide $/ha.	Application $/ha.	Transport $/ha.	Total $/ha.	Expected Control	Ha./hr.
FARMERS						
Dust	14-18		4	18-22	40%	.5
Bait	4		4	8	84%	.5
CPS						
Dust	14-18	4	4	22-26	50%	8
Bait	4	4	4	12	88%	8
ULV						
malathion	2	4	0	6	90%	12
carbaryl*	4.50	4	0	8.50	90%	12
fenitrothion	3	4	0	7	90%	12
AERIAL						
malathion	2	3	0	5	90%	470
carbaryl*	4.5	3.5	0	8	90%	450
fenitrothion	2	3	0	5	90%	470

*Longer residual may justify additional cost.

effective on flying insects. Preference should be given to nonvolatile materials and to flying at lower altitudes so that the droplets do not remain airborne long, creating excessive drift. Sometimes drift or "extended swath" can be used to advantage in broad areas and in areas where flight paths are difficult.

Since most types of application equipment available to farmers are not capable of applying ULV formulations, care must be taken not to overorder. The problems of disposal of unused insecticides may be even greater than the problems associated with the control effort.

ULV SELECTION FACTORS

With ULV applications, the following factors should be considered:

- Height of flight—Finely atomized insecticide droplets can drift long distances in even a slight wind. A good guide to use is the wing span of the aircraft to half again as much.

- Aircraft Calibration—All aircraft coming on the job should be calibrated in advance of treatment. As a starting point for calibration, most nozzle manufacturers will provide flow charts for their nozzles (see formulas and descriptions of equipment given below).

- Droplet size—Large droplets waste insecticide, while very small droplets may provide only sublethal doses and are subject to excessive drift. Droplets in the size range of about 100 microns to 120 microns are favored.

- Drift spraying—Utilization of a light crosswind to displace the swath downwind and increase its width. Drift spraying for locust/grasshopper control has been used in Africa for many years. Its advantages are that it exposes more surface area of the target pest and the plants on which it feeds to the insecticide and that it increases the area that can be treated within a given period of time.

The disadvantage of drift spraying is that even slight changes in the wind speed or direction can appreciably increase or decrease the insecticide deposit within a described area. Drift spraying also increases the chances of undesirable insecticide residues drifting into areas not scheduled for treatment such as sensitive areas and critical wildlife habitats. When used judiciously, drift spraying has proven highly effective and appreciably reduces overall control costs.

- Weather—Light early morning crosswinds, cool air and ground temperatures are normally excellent spraying conditions. When temperature differential between ground and air temperatures become close

175

together (within a few degrees) the spray will not reach the target. It will rise and be lost in the atmosphere.

AIRCRAFT FORMULAS

The following formulas are used for calibrating aircraft:

$$\text{ACRES/MINUTE} = \frac{2 \times \text{swath width (ft.)} \times \text{speed (mph)}}{1{,}000}$$

SPRAY VOLUME = acres/minute x spray volume/acre (fluid ounces)

ADJUSTED CAPACITY/NOZZLE = nozzle capacity x flow rate (ounces/minute)

$$\text{NUMBER OF NOZZLES} = \frac{\text{total spray volume/min. (in fl. oz.)}}{\text{adjusted capacity/nozzle (in fl. oz.)}}$$

Several types of aerial application equipment are currently in use.

Rotary atomizers include:

- Micronair AU 3000—at 30-50 psi it can deliver up to 10.5 gal./min.
- Micronair AU 5000—at 20-40 psi it can deliver up to 6 gal./min.
- Beecomist 350—at 30-40 psi it can deliver volumes up to 5 gal./min.

Micronair sprayers operate electrically with a series of rotating screens and a variable pitch fan. Beecomist is an electrically operated atomizer with a rotating perforated metal sleeve with holes of 0.002 in. diameter.

Flat-fan and disc-core cone nozzles are attached to a boom of 3/4 to 1 in. diameter with either an electric or wind-driven pump. Flat-fan cone nozzles are commonly used for locust/grasshopper control.

4. Applying Bait

Both single- and multi-engine aircraft were utilized extensively in the late 1940s to early 1950s for the application of wheat bran bait for grasshopper control in the western United States. Its use was discontinued with the introduction of ultra-low-volume (ULV) spray applications of the persistent and relatively inexpensive organochlorine insecticides.

Recently, the use of baits has gained momentum because of their low environmental hazard level, even though the problems of bait application continue to exist. Chief among them are:

BAIT APPLICATION PROBLEMS

- Bulkiness and associated problems of transportation, mixing with the insecticide, and storage
- Extensive ground time of the aircraft during loading operations
- Reduced operational capacity of aircraft (hectares treated per flight hour)
- Lack of effectiveness with some grasshopper species that will not eat bait
- Inability to stand up well under heavy rainfall

Compared to most liquid ULV sprays, baits have the advantage of requiring only about one-sixth the amount of toxicant per hectare.

An aerial application specialist should be consulted in advance, if plans call for the use of baits applied by aircraft. Bait application requires special loading equipment for aircraft such as hoppers with attached elevators to lift the bait to the aircraft hopper. A large labor force is also required.

AERIAL APPLICATION EQUIPMENT

Small aircraft equipped with conventional venturi dust application equipment can normally be utilized to apply bait if the spreader is equipped with baffles to evenly spread the bait. Baffles may require adjustment or realignment. Hopper gates may also require modification to prevent the bait from bridging over. Large multi-engine aircraft may require far more sophisticated application equipment.

In spite of these drawbacks, the use of baits should be considered in locust/grasshopper programs, particularly if large quantities of suitable bait materials are available locally. Wheat bran, rice bran, rice hulls, and peanut hulls are likely candidates, but should be tested in advance as to feeding preference by the principal grasshopper species involved.

5. Marking Areas for Treatment

MARKING AREAS FOR PILOTS

For each spray block, corners should be easily recognizable by the pilots. Various means can be utilized:

- Use of natural features such as rock formations, buildings, clearings
- Helium balloons (kytoons), hand-held or well-anchored, fly from 7.5-15 meters above the surface, trees, or other obstructions to the pilot's line of sight

- Smoke from wood fires (green) or old tires
- Cloth as flags in trees or on poles or spread on the ground
- Mirrors to reflect sunlight (these require training in use)
- Strobe lights (best used to guide the pilot to the spray block)

AIRCRAFT GUIDANCE SYSTEMS

In locust/grasshopper control programs, flaggers can seldom be used to mark swaths. Nevertheless, guidance systems are required. The Loran C network does not cover much of Africa. The Omega Navigation System is too bulky for small aircraft but works well in multi-engine aircraft. For small aircraft, a Horizontal Situation Indicator can be tied into a gyro compass to indicate 180° back-and-forth passes once the first spray run is established.

AERIAL APPLICATION REQUIRES SUPPORT

6. Support Requirements for an Aerial Control Operation

Communications

Radio communication is essential: between the operations site and the aircraft; the operations site and the spray block; the spray block and the aircraft; the operations site and the command center.

Safety Equipment

- Masks and goggles (or full-face respirators)
- Neoprene gloves
- Safety-toed boots
- Rainsuits or waterproof coveralls for everyone in direct contact with the pesticide (disposable preferred)
- Fire extinguishers
- First aid kits
- Clean water and soap
- Hard hats with chin straps for operational personnel

Operational--Airstrip

- Lights for predawn operation
- Manual or electric barrel pump
- Truck with hydraulic lift tailgate
- Tool kit and bung wrench
- Maps - 1:200,000 for pilot navigation
  - 1:50,000 for marking spray block boundaries, sensitive areas, etc., for pilots and surveyors
  - 1:15,000 for treatment record at operations site
- Vehicles--At least one for pilots and one for operations personnel
- Meteorological Equipment--Thermometer and anemometer
- Housekeeping Equipment for operations site cleanup
- Personnel--Operations Officer, Logistician, Records keeper, loading and refueling labor

Operational--Treatment site

- Treatment area marking equipment--Balloons, flags, mirrors, strobe lights, flare guns
- Anemometers
- Radios
- Spray deposit cards or plates
- Fire extinguishers and first aid kits
- Informational equipment for local residents

7. Airstrip Specifications for Aerial Spraying Operations

Specifications (for small fixed-wing aircraft such as Agtruck, Ag-Cat):

FIELD AIRSTRIP SELECTION GUIDELINES

- Orient the airstrip so that the pilots are not taking off and landing with the sun in their eyes; avoid east-west orientation. If there is a prevailing wind in the area, orient the airstrip so that pilots can take off into the wind.

- The running surface should be at least 12 meters wide, smooth, well-drained, and free of potholes and large stones.

- A 10 meter strip of shoulder should be brushed out along each site of the running surface to ensure wing clearance. The grade of the clearance strips should be lower than the running surface. Small hills should be bulldozed and brush-trimmed.

- The running surface may be slightly crowned to allow water runoff, but it should not be sloped across its width.

- Grass, packed sand, or fine gravel are acceptable surface materials.

- The running surface must be a straight 600 meter length. A 5 percent slope is acceptable.

- Visibility along the entire length is essential.

- The loading/mixing site can be at either end of a flat airstrip, but only at the high end of a sloping airstrip. It should be at least 25 meters in diameter with a further 10 meter wing clearance around the perimeter. If two or more planes are using the same facilities, the turnaround should be 40 meters in diameter, also with a 10 meter wing clearance. The turnaround can be constructed as a widening of the road surface.

- The loading equipment should be located alongside the turnaround, preferably on the left-hand side so that the plane will be in taxi position before loading. All hookups are located along the left-hand side of the fuselage.

- A nearby clearing may be built up to the running surface level to park and tie down aircraft. This area should not be used to store pesticides and materials.

8. Aerial Spraying Checklist
(Not all items will be required for each operation)

A CHECK-LIST FOR PLANNING

Planning

- Tender Preparation

  - Total number of hectares to be sprayed
  - Number and size of spray blocks
  - Applied volume per hectare
  - Map 1:50,000 showing all spray blocks and airstrips
  - Map (topographic 1:50,000) showing spray blocks and airstrips
  - Map (large-scale) if necessary showing spray blocks and airstrips
  - Aircraft capacity in hectares per hour
  - Starting date--application period
  - Estimated average spraying time per day
  - Aircraft calibrated

- Notification of Public

- Field Preparation

  - Chemicals
    . Materials delivered to site
    . Field storage prepared
    . Pesticide inventory

  - Project Maps
    . 1:50,000 to record treatments
    . 1:50,000 topographic
    . Spray block boundaries shown

  - Airstrip
    . Meets specifications
    . Surface graded smooth, stones removed and holes filled

  - Water for Wetting Runway
    . Dribble bar if water truck is being used
    . "Y" valve in water supply
    . Appropriate nozzle for spraying/wetting runway surface
    . Adequate hose to cover 200 m of runway and turnabout area

- Washing Facilities
  . Clean water and Soap
  . Dishpan or bucket

- Loading Equipment
  . Gas loading pump
  . Gas for pump
  . Backup loading pump
  . Inlet hose
  . Outlet hose, chemical resistant material
  . Soft paper towels for cleaning aircraft windshield
  . Aerial spraying record
  . 50-mesh screen for strainer

- Safety Equipment
  . Neoprene boots and gloves
  . Protective coveralls
  . Hard hats with chin straps
  . Respirators
  . Safety goggles
  . First aid kit

- For Ground Flaggers
  . Disposable coveralls
  . Hard hats with chin straps
  . Goggles
  . Respirators
  . Neoprene boots

- Ground Equipment
  . Communications with aircraft
  . Strobe lights
  . Psychrometer and Wind gauge
  . Signs to post sprayed areas

Daily Spray Operations

Night Before

DAILY ACTIVITIES

• All key personnel should meet to plan for the next spray period. The following should be discussed:

- General comments on progress to date
- Plan of action for next spray
- Weather forecast for area

- Coordination with environmental impact monitoring and spray deposit crews, if appropriate
- Arrange for weather monitoring to supply early morning information on weather conditions at spray block

• The weather monitor should be at the spray block early and should relay weather conditions to the Project Supervisor.

• Check quantities of pesticide.

• Review the area to be sprayed with the pilots.

- Provide marked photos and maps
- Review the spray block boundaries and all ground reference points
- Point out all designated areas within and adjacent to the spray block that are to be protected with an unsprayed buffer strip, including special requests (e.g., private property, beekeepers, poultry farmers, etc.)
- Make sure that the pilot fully understands these points before liftoff

Preflight

• Obtain weather conditions from block-based weather monitors.

• Dispatch load crews and pilots to the airport. Be prepared to lift off at first light: loading crews and pilots should be at the airport 1/2 to 1 hour before sunrise.

• Check communications with spray block and with aircraft on the ground.

• Ensure that warning signs and flagmen are placed on roads to keep public out of the spray area and loading area.

• Commence loading operations.

During Spray

• Weather monitor should keep supervisor informed of progress in the spray block.

• Weather monitor should take weather readings every 15 minutes immediately prior to and during spray period.

- Supervisor should ensure that aerial spraying load record is being maintained.

- Where possible, aerial and ground observers should monitor aerial application for:

  - Swath width and overlap
  - Positive shut-off at end of spray run and when crossing "no spray areas"
  - Drifting of spray cloud outside of boundaries and/or spray cloud not setting
  - Correct flying height

- Report and record all malfunctioning or overdue aircraft immediately to supervisor.

- Prohibit public access to or through spray blocks during spraying.

After Spraying

- Clean up loading site.

- Rinse out empty drums and puncture at least 4 times on the side.

- Secure aircraft.

- Supervisor and pilots should review and certify daily aerial spraying.

- Weather records and aerial spraying load records should be completed and forwarded to supervisor.

- Update large-scale maps to show daily spraying progress or changes.

- All key personnel should meet to plan the next spray period.

- Post all sprayed areas.

Program Completion (After the spray program has been completed)

- Loading site should be cleaned up: spills handled according to approved procedures.

- All pumps and hoses should be flushed and stored (Note "Rinsings" should be added to last spray load DO NOT STORE).

- Empty containers should be removed from airstrip and disposed of in approved manner.

- All pesticide should be stored in an inaccessible or locked storage area.

- Ensure that all spray areas are posted.

- The project supervisor should meet with the pilots to review total hectares treated; pilots and supervisor should sign aerial spraying records to indicate they are in agreement on area treated.

C. Ground Applications

Ground equipment can be used to apply insecticides in two ways. Manually operated or conventional sprayers project the chemical onto the leaves by pressure. Mechanically operated equipment moves the small drops of chemical or dust particles on to the plant in a jet of air. Both methods are used at close range, so that the applicator can aim the chemical at the target. Winds of moderate speed do not affect the result.

GROUND EQUIPMENT BEST FOR AMALL AREAS

Table VIII-4 lists various types of hydraulic and nonhydraulic spraying and dusting equipment and their advantages and disadvantages. Most ground equipment applies insecticide too slowly to be effective in widespread locust/grasshopper outbreaks.

With the manually operated, high-volume hydraulic equipment, droplets must be of considerable size because it is the initial momentum that carries them through the air. With insufficient velocity or inadequate size, pesticide may not be carried the required distance to the target.

With blower applicators, an air stream carries the droplets, and small droplet size is an advantage. The number of droplets deposited per unit volume of liquid is greater with most types of blower applicators. So, despite the much lower volume of liquid applied per unit area, the number of droplets deposited is greater.

DRIFT SPRAYING FOR DESERT LOCUSTS

Drift spraying from the ground offers a means of treating rather large areas quickly with moderate accuracy. The Sayer Exhaust Nozzle Sprayer is widely used in Africa and the Middle East for drift spraying for control of Desert Locusts, especially in the establishment of barrier strips. An essential feature of a ground machine for drift spraying is the ability to carry the liquid to a sufficient height so that the wind can carry the drops a long way before they reach the ground. This is accomplished by fixing the nozzles *(cont. page 22)*

Table VIII-4. Types of Spraying and Dusting Equipment and Their Advantages/Disadvantages.

Advantages	*Disadvantages*
DUST BAGS (Sack Dusters)	
- Inexpensive, no significant cash outlay required, sacks can be made locally - Simple, no moving parts so no maintenance costs - Requires little training for applicator	- Wind speed of 1-2 meters per sec. required for adequate dust dispersal - Pesticide coverage is seldom uniform so ineffective control often results - Should not be used to treat plants that are taller than waist high - High applicator exposure to the insecticide, dermal and inhalation
BELLOWS DUSTERS	
- Inexpensive - Simple, hand-operated, few moving parts - Can be constructed locally - Requires little operator training	- Single-action, dispenses dust only on closing stroke - Suitable for spot treatment or individual plant treatment only, not suitable for complete coverage treatments - Tiring to operator as it requires both hands for operation
CRANK DUSTERS	
- Simple and inexpensive - Crank-driven blowers to dispense dust - Most models have internal agitators to assure an even flow - Flow rate can be regulated - Some models can also apply bait	- Tiring, requires continual cranking - Small hopper requires continual refill - Narrow swath suitable principally for row crops--wind is necessary for fuller coverage
TRUCK-MOUNTED POWER DUSTERS	
- Quantity applied can be closely regulated - Force of discharge can be easily regulated by the speed of the fan	- Limited by the terrain as to where it can be used - Large quantities of the dust applied drifts from the target area causing excessive environmental contamination

Advantages	Disadvantages
TROMBONE SPRAYER Single-action—Discharges spray on backward stroke Double-action—Discharges spray on forward and backward stroke	
- Inexpensive - Simple, few operating parts - Lightweight (plastic tank-type) backpack, 10-20 liters capacity - Requires only minimal training for applicator	- Pumping must be continuous and rapid so very tiring to applicator - Both hands are needed to operate - High-volume application only - Adequate for spot spraying only
LEVER-OPERATED SPRAYER	
- Inexpensive, though more expensive than Trombone-type -Simple, few operating parts - Lightweight (plastic tank-type) backpack, 10-20 liters capacity - Less tiring than Trombone-type; on some models lever may be moved from one side of tank to other so both arms can be used to pump - Requires only minimal training for applicator	- Pumping must be continuous and rapid - Both hands are needed to operate - High-volume application only - Adequate for spot spraying only
MOTORIZED BACKPACK MIST BLOWERS	
- Swath width 10-15 meters without wind assist - Flow rate 0.5-3 liters per min. (7.5-45 liters per ha. at wind speed of 4 km. per hr.) - Small droplets, 50-100 microns - Airstream from fan provides better crop penetration than manual sprayers	- Requires use of emulsifiable concentrate, or wettable powder insecticide formulations in water - Many movable parts means increased maintenance - Fuel (gasoline) not available in all locations

Advantages	Disadvantages
COMPRESSION SPRAYER Backpack—two carrying straps Underarm—single carrying strap	
- Does not require continuous pumping so is less tiring to the applicator - Requires only one hand to operate - Lightweight plastic tank models are available - More uniform spray application than with Trombone or lever-operated types	- To pressurize tank one must discontinue spraying - Tank can only be filled about 3/4-full to allow space for compressed air - Spray output decreases as pressure in the tank drops - Pressure must be released prior to opening tank to avoid accidental spray discharge
SPINNING DISC SPRAYER Battery-operated	
- ULV applicator—flow rate 4 ml to 60 ml per min. - Swath width 10 meters at wind speeds of 1-2 meters per sec. - Smaller and more uniform droplets, less than 100 microns in size - Lightweight—less tiring to the operator than compression sprayer - Will operate about 14 hours with 16 D-cell batteries	- Restrictors must be changed to change the flow rate. - Many movable parts increase maintenance needs - Batteries need frequent replacement and are not readily available - Use of ULV insecticide increases the hazard to the applicator - More intensive training required for applicator than for the compression, lever and Trombone types
ULV MOTORIZED BACKPACK SPRAYER	
- Lower flow rate than mist blowers, 30-100 ml per min. - Swath width generally greater than mist blowers - ULV more effective than dilute formulations for locust/grasshopper control	- Exposes the applicator to concentrated insecticides - Even slight application errors can be more critical than with higher-volume sprayers

Advantages	Disadvantages
EXHAUST NOZZLE SPRAYERS	
- Simple, few movable parts, vehicle-mounted - Operates on vehicle exhaust gases - Low flow rate—ULV application - Swath width 50-100 meters at wind speeds of one meter per sec. - Low initial purchase price, easily mounted on vehicle	- Application rate subject to large variation as it is dependent upon vehicle forward speed and wind speed which seldom remain constant - Causes excessive wear on vehicle engine due to restriction of exhaust gases - Heat of exhaust gases may cause degradation of some insecticides
AIRBLAST MACHINES	
- Airblast provides the energy for breaking the liquid into droplets and distributing them - Concentration of toxicant used and volume of liquid per hectare may be varied - Some models can also apply dusts and baits	- Air velocity decreases rapidly with distance - Air is a poor carrier of liquid droplets - Large droplets tend to fall short of the target while the smallest droplets fail to impinge and end up as undesirable drift

at the top of a mast (vehicle-mounted spinner disc sprayers), or blowing the droplets upwards with air or gas (Sayer Exhaust Sprayer).

With the air blow (jet) system in a crosswind the liquid spray does not break up abruptly at a fixed height, so the droplets fall to the ground from a wide range of heights. In a mild crosswind the liquid reaches higher, but the droplets fall out more steeply, so they travel downwind about the same distance as they would had they been projected to a smaller height in a higher wind speed.

In a practical demonstration of the efficiency of drift spraying using ground equipment, Huddleston et al., 1986, applied .59 L/ha. of ULV malathion to grasshopper-infested rangeland in New Mexico. Utilizing a motorized backpack mist blower with a swath of 30.48 meters and a wind speed in excess of 2.24 m/sec., in excess of 91 percent control was achieved. The swath width achieved is equivalent to that achieved by most of the smaller single-engine aircraft operating under no-wind or only slight-wind conditions. Table VIII-5 compares the operational capabilities of three types of ground equipment using drift spraying.

Baits are often applied from the ground using crank-type dusters or hand seeders. Only dry baits can be applied with this equipment. Wet bait tends to cake and plug the equipment.

Table VIII-5. A Comparison of Operational Capabilities of Three Types of Ground Equipment Using Drift Spraying.

	Hand-Operated	Motorized Knapsack Blower ULV	Hand-Carried Spinning Disc
Tank capacity (liters)	15	10	1
Swath width (meters)	1	30	10
Hectares/hr. (treated)	.36	10.8	3.6
Operational efficiency* (ha./day)	1.44	70.0	26.0

* Includes time for refill; walking speed = 1 meter per second (m/s).

In many places baits are applied by hand, either walking or from the back of a truck. When spreading baits by hand, choose a period with winds of about 4 to 8 mph, throw the bait upwards and let the wind disperse it.

BAIT APPLICATION COMPARISON

The application of bait by hand, though inexpensive, usually results in very excessive use of the bait materials. Hand application may utilize in excess of 100 kilograms per hectare, whereas aerial application utilizes only about 18 to 25 kilograms per hectare.

D. Ground Transportation

DON'T BUY BIG TRUCKS

Most African crop protection services are financially incapable of supporting a large fleet of heavy-duty trucks essential for any major locust/grasshopper control program. Therefore, A.I.D. should not invest substantially in heavy-duty trucks. Rather, the use by crop protection services of locally available commercial transportation should be encouraged.

SMALL VEHICLES ESSENTIAL

Crop protection services are often critically short of four-wheel-drive passenger-carrying vehicles necessary for survey, monitoring, research, and support of ground and aerial control activities. Lack of such vehicles appre-

ciably increases the possibilities of missed economic infestations during surveys, perhaps requiring expensive helicopter use to fill the gap. Lack of vehicles also increases the hazard of inefficient or ineffective control, and contamination of sensitive areas. Vehicles owned by host country crop protection services are often ill-equipped for operation in remote semidesert and desert areas, subjecting personnel to unnecessary risks.

VEHICLE EQUIPMENT NEEDS

In remote area surveys, vehicles should always operate in pairs. If one vehicle breaks down, a second vehicle is available to make it back to an inhabited area. Vehicles operating in remote areas should be equipped with at least the following:

- Tool kit containing a complete set of socket and end wrenches, pliers, wire and wire cutters, screwdrivers, friction tape, fuses, hammer
- Jack, lug wrench, and spare tire
- Shovel
- Sand channels
- Tow chain
- Extra fuel in 5-gallon jerry cans. Vehicles should be equipped with outside racks for fuel. Fuel should never be carried within the vehicle.
- Extra water, 5 or more gallons
- Compass
- Maps
- Bedding, cooking utensils, and food
- Radio for communication

Four-wheel-drive pickup trucks operate well in remote environments. They can carry one or two passengers in the cab and control equipment and pesticides in the bed. Much more expensive 4x4 trucks may be capable of carrying a heavier load, but little if anything more.

VEHICLE ALTERNATIVES

Trail bikes or mobilettes are advantageous to extension agents surveying in inhabited cropland areas, but have no place in remote semidesert or desert survey. Alternatively, bicycles may be a suitable means of transportation in inhabited cropland areas, where travel distances are minimal.

OTHER VEHICLE NEEDS

For control operations, vans are useful for transporting personnel to and from the operations site.

Tank trucks permit the loading of insecticide directly from the tank to the aircraft, decreasing the hazards of spills and personnel exposure to the pesticide. Such spills occur frequently when loading from barrels.

If loading from barrels, a truck with a hydraulic tail gate should be required equipment for the loading and unloading of drums of insecticide and fuel. Alternatively, the size of the drums should be restricted for ease in handling.

Some pesticide manufacturers are now packaging their chemicals in closed system returnable containers to eliminate the exposure problem. Such systems should be utilized whenever possible.

APPENDIX A

A. I. D. /OFDA Guidelines and Sample Disaster Determination

- A.I.D. Guidelines for Disaster Determination
  Handbook 8, Chapter 3
- Telexes
- Sample Disaster Determination

Reference	Notes

A.I.D. Guidelines for Disaster Determination

HANDBOOK 8 - CHAPTER 3

RESPONSIBILITIES OF MISSIONS

3A. Purpose

To review the actions expected of Missions or diplomatic posts when a disaster is imminent or has occurred; to present guidelines for decisions confronted by Chiefs of Mission (CM) and Mission Disaster Relief Officers (MDRO); to indicate additional sources of information for Mission planning and organization for disaster preparedness and relief.

3B. Defining the Disaster Concept

Disasters have considerable potential for disrupting, retarding or altering the course of economic development. In practice, disasters are often stereotyped in the classic abrupt and violent model of the earthquake or hurricane. It is important to include as possible disasters other phenomena that are less easily differentiated from development problems: droughts, food shortages, and epidemics are often slow-onset disasters with composite roots in processes of environmental degradation such as overgrazing, deforestation and poor farming practices. In addition, primary disasters such as earthquakes or hurricanes may trigger secondary disasters: floods, landslides, fires or civil disturbances. (See 3F below.)

3C. Disaster Preparedness

Disaster planning and preparedness, by identifying the hazards present in a given country or region, the vulnerability of population and infrastructure, and the resources available for relief and rehabilitation, allows the disaster manager flexibility in anticipating the range of possible disasters and dealing with their effects. Disaster preparedness is the ideal point at which to enter the disaster cycle.

Integrating disaster preparedness with development programs requires a broad-based strategy that moves from the technological analysis of the hazards and possibilities for preventing or lessening the impact of disasters to the organizational specifics of training disaster relief personnel and setting up disaster management teams. OFDA can provide (from its own staff or through established relationship with technical, scientific and disaster training and management organizations) a wide range of supporting activities, literature, and training at the request of the CM or MDRO. Examples include hazard management surveys, hazard monitoring, disaster preparedness workshops, and sponsorships of training of emergency management officials. Such activities can promote host country awareness of hazards and reinforce both host Government and Mission capabilities for disaster management and response.

Mission disaster preparedness centers on the CM's designation of a Mission Disaster Relief Officer (MDRO) and the development of a Mission Disaster Relief Plan (MDRP).

3D. Mission Disaster Relief Officer

The MDRO should be a senior officer of the Embassy or of one of its agencies, should be a U.S. citizen, should report directly to the Ambassador, and should be a member of the Emergency Action Committee. The MDRO has responsibility for assuring that a Mission Disaster Relief Plan is prepared and maintained and that key Mission personnel are aware of the actions the Plan entails.

3E. Mission Disaster Relief Plan

1. The MDRP should indicate the hazards and areas of vulnerability facing the host country. It should provide a framework for Mission actions in

a. defining which events can be classed as disasters;

b. assessing disaster damages and relief requirements;

c. organizing Mission response to disasters;

d. supporting host country government response; and

e. coordinating the USG relief and rehabilitation efforts with OFDA and other donor organizations.

A sample Table of Contents is provided in Appendix D.

2. The MDRP should contain baseline data on essential disaster relief resources for health and sanitation, transportation, communications, shelter, food and water supplies and disaster equipment. It should provide current contact lists for all disaster managers likely to be involved in a country or regional relief effort. It should contain the organization and structure of the Mission disaster relief team, defining roles and tasks Embassy/Mission staff will take on during disaster assistance efforts.

3. Plan formats, disaster assistance procedures, and guidelines are addressed in OFDA's Model Disaster Preparedness and Relief Plan. Recently prepared Mission plans and Mission disaster relief planning guidance papers are available on request from OFDA. (See Appendix D.)

4. Plans should be centrally located, revised annually or as often as needed, and integrated with the Emergency Action Manual.

3F. The Disaster Determination

1. When a hazard reaches proportions that threaten the stability of a host country's economy and social organization, a disaster determination by the Chief of Mission may be appropriate. (Note: in countries where no U.S. diplomatic Mission is present or in the event of a multicountry disaster, a

149

disaster determination may be made by the Deputy Assistant Secretary of State for the appropriate geographic bureau.) A disaster determination is a prerequisite for U.S. Government relief aid, but is not required for diversion of Food for Peace commodities. The CM makes such a determination after verifying that:

a. a disaster (as defined below) exists;

b. the disaster is of such magnitude that it is beyond the ability of the host government to respond adequately;

c. disaster assistance is desired by the host government;

d. it is in the interests of the U.S. Government to provide assistance.

2. As noted in 2FAM 060-061.1, foreign disasters comprise both acts of nature and acts of man which disrupt social and economic life. A foreign disaster is defined as one which occurs outside the United States, its territories, or possessions and may be:

a. A violent act of nature, such as flood, hurricane, fire, earthquake, volcanic eruption, landslide;

b. An act of man, such as civil strife, border conflict, riot, displacement of large numbers of people, explosion, fire;

c. An accident of serious proportions;

d. A slowly developing catastrophe caused by nature or man's neglect, or both, such as drought, famine, epidemic; or

e. A potential calamity, including ecological threats, menacing lives and property and requiring prevention or monitoring measures.

3. When a disaster determination has been made, the Office of U.S. Foreign Disaster Assistance (A.I.D./OFDA) is to be notified by cable or telephone immediately with written confirmation following as soon as possible. OFDA duty officers can be reached at all times at (202) 632-8924, or through the State Department Operations Center at (202) 632-1512.

4. OFDA should also be alerted to potential or developing disasters in host or neighboring countries as soon as the situation suggests that USG assistance may be required. This facilitates and enhances OFDA's response and enables the Mission and OFDA to explore possible alternate forms/channels of assistance.

3G. Disaster Assistance Authority (DAA)

The Disaster Assistance Authority allows the CM to obligate up to $25,000 in cash, supplies or services from the international disaster assistance account without prior A.I.D. approval, and to apply USG resources within the country (e.g., P.L. 480 food, USG equipment or personnel, once a disaster determination has been made and OFDA has been notified.

1. Sample uses of the DAA include:

a. cash donations to organizations active in the relief effort;

b. local purchase of supplies and equipment;

c. funding of transportation of supplies donated by disaster relief organizations;

d. requests for supplies, equipment and services from in-country or nearby U.S. military sources;

e. reimbursement of other USG agencies for disaster relief services and;

f. acquisition of disaster supplies from OFDA stockpiles.

2. Locally available supplies especially from the private sector, are nearly always preferred as they can be speedily obtained and their purchase supports the local economy. Inventories of suitable equipment and material should be made in advance by host country governments and Mission disaster relief staff.

3. Self-Help. Whenever feasible, stricken countries should be urged to meet needs from their own resources in both preparedness and relief activities. A self-help component may be integrated into Mission-supported assistance.

4. PL-480 Title II stocks may be diverted from in-country development projects, thereby permitting rapid distribution from existing facilities.

5. Requests for relief supplies from the OFDA stockpiles or U.S. sources, or for military supplies and services, and services of other USG agency specialists from the United States must be made through OFDA.

6. Transportation. Surface transportation both to and within the host country should be used whenever possible. U.S. military equipment, especially aircraft, should be used only if other options (commercial or voluntary agency) are unavailable or cannot meet needs within the required time frame. Airlift of material is extremely costly.

7. U.S. Military Equipment. Only in exceptional cases of extreme need are offers of U.S. military aircraft or field hospitals justifiable. Offers of these services require OFDA and DOD approval.

8. Unsolicited Assistance. Unsolicited offers of equipment, supplies, and services are the rule rather than the exception in disaster relief situations. Missions should screen all such offers to ensure that they are appropriate for victims' needs and culture, and that they will not require costly transportation and distribution. Inappropriate clothing and food and out-of-date drugs are common unsolicited items.

9. The CM may not use his DAA to declare a disaster outside of the host country.

3H. Assessment

1. Assessment enables the disaster manager to compare the effects of the disaster (in terms of deaths and injuries and damage to houses and buildings, roads, crops, property, etc.) with predisaster data to determine needs for relief supplies and support. Assessment is enhanced by good baseline data. Accurate assessments enable the disaster manager to provide appropriate relief necessities and avoid duplication. An initial survey when a determination is under consideration is helpful in establishing that the extent of damage exceeds the host country's ability to cope. Sample assessments formats for the five critical sectors are included as Appendix E.

2. Assessment teams may be composed of Mission staff, host government personnel, or international organization representatives. The multidonor mission, comprising representatives from several donor governments and international organizations, has often been used for disasters involving several countries. Mission staff may function as part of a multidonor Mission or as civilian members of a Military Disaster Assistance Survey Team (DAST).

3. The DAST (which may be a military team, mixed military and civilian, or a civilian team organized according to the military model) is a self-sufficient rapid deployment group of specialists in such areas as health, logistics, communications, operations, engineering and civil affairs. The DAST's mission is to determine the extent of the disaster stricken area, provide detailed accounts of damages, deaths and injuries, and provide status reports on transportation, communications, water, food, shelter, fuel, infrastructure and local government organizations, especially local government relief efforts and needs. Military DASTs are under the U.S. Military chain of command, but come under the policy control of the U.S. Ambassador in-country and may report to the Ambassador for some operational purposes. U.S. Civilian DAST members report to the Ambassador or Chief of Mission. Military DAST deployment must be requested through OFDA, as must all U.S. Military disaster assistance. Funding for all U.S. Military disaster assistance is provided by OFDA and is usually allocated in advance of Military assistance deployment.

4. Assessment information should focus on identifying the resources left intact or in functioning order after the disaster and the needs created by the disaster. The difference between baseline data collected prior to the disaster and remaining resources serves as a check that the needs identified are realistic, again reinforcing the value of preparedness. The emphasis in needs identification must be on precision;

speed has proven to be less important than reliable information. Relief actions may have long-lasting effects on various economic sectors or political developments in the stricken country: the transitions between relief, rehabilitation and reconstruction should be taken into consideration. Sample assessment formats for the five critical sectors are included as Appendix E.

3I. Coordination

1. Assessment data should be transmitted to other donors and compared with any other assessment data available. Coordination is the key to translation of accurate assessments into an effective relief program. Within the U.S. Government, response coordination between the Mission/Embassy, OFDA, and other A.I.D./W entities and U.S. Military groups is essential.

2. In most disasters, international and volag assistance must also be coordinated with the U.S. effort. United Nations Development Program Resident Representatives have been designated coordinators of the United Nations disaster assistance programs and have often played the same role for coordination of international relief efforts.

3. It is important that the Mission identify international, other bilateral, and voluntary agency donors in-country and maintain contact with them as part of its preparedness program.

4. Annual or semiannual meetings of donors in-country can provide a strong framework for a coordinated assistance program; donor meetings during a relief operation are essential.

3J. Reporting

1. Immediate notification of a disaster determination by the CM, regular situation reports, follow-through actions, and a final summary disaster report on each disaster relief operation must be sent to OFDA promptly. Sample formats for these communications are presented in Appendix F.

2. The Mission is responsible for monitoring distribution and use of disaster materials to ensure that they reach disaster victims.

PAGE 01 KHARTO 08519 01 OF 02 251330Z
ACTION AID-00

INFO LOG-00 AF-00 CIAE-00 EB-08 DODE-00 IO-17
FDRE-00
/025 W

----------242461 251332Z /38

O 251331Z JUN 86
FM AMEMBASSY KHARTOUM
TO SECSTATE WASHDC IMMEDIATE 1747
INFO AMEMBASSY NAIROBI PRIORITY
INFO AMEMBASSY ADDIS ABABA PRIORITY
INFO AMEMBASSY KAMPALA PRIORITY
INFO AMEMBASSY NDJAMENA PRIORITY

UNCLAS SECTION 01 OF 02 KHARTOUM 08519

AIDAC

E.O. 12356:N/A
SUBJECT: SUDAN - AMBASSADOR'S DETERMINATION THAT INCIPIENT LOCUST OUTBREAK CONSTITUTES A DISASTER

REF: (A) NAIROBI 20179, (B) STATE 176431, (C) NAIROBI 21273, (D) KHARTOUM 7857, (E) STATE 184857, (F) ROME 14499, (G) NAIROBI 22393, (H) ROME 14627.

1. SUMMARY:

(A) MISSION DISCUSSIONS AND MEETINGS WITH GOS, EEC, FAO AND VISITING LOCUST CONTROL EXPERT CONFIRM THAT THE SUDAN FACES SEVERE DESERT LOCUST, AFRICAN MIGRATORY LOCUST AND GRASSHOPPER INFESTATION WHICH THREATEN SEVERE DAMAGE TO FOOD CROPS DURING CURRENT SEASON IF ADEQUATE MEASURES OF CONTROL ARE NOT TAKEN. THE MAGNITUDE OF THIS PROBLEM IS FAR BEYOND THE ABILITY OF GOS. BECAUSE OF THE URGENCY AND THE U.S. GOVERNMENT'S INTEREST IN AVERTING YET ANOTHER FOOD EMERGENCY IN SUDAN, I, AS U.S. AMBASSADOR, HEREBY DETERMINE THAT

THIS INCIPIENT LOCUST OUTBREAK CONSTITUTES AN EMERGENCY AND CALLS FOR URGENT U.S. ASSISTANCE. MISSION IS REQUESTING THAT US DOLLARS IN OFDA FUNDS BE MADE AVAILABLE FOR LOCUST AND GRASSHOPPER CONTROL DURING THE 1986 GROWING SEASON. SEPTEL PROVIDES (A) LATEST DEVELOPMENT IN DONOR EFFORTS TO DEFINE AND DEPLOY A WELL COORDINATED AND MANAGED PROGRAM OF ACTION AND (B) RECOMMENDATIONS CONCERNING U.S. CONTRIBUTION TO IT. END SUMMARY.

2. SUDAN WAS HEAVILY INFESTED BY LOCUSTS DURING THE 1985/86 SEASON. THIS INFESTATION CONTINUED FROM SEPTEMBER 1985 TO MID-APRIL 1986. IT RESULTED IN SEVERE DAMAGE TO THE MAJOR FOOD CROPS (SORGHUM AND MILLET) WITH LOSSES ESTIMATED TO BE 30-40 PERCENT OF THE TOTAL CROP OF PREVIOUS SEASON. THE GOOD AND WIDESPREAD RAINFALL OF LAST SEASON HAS CREATED VERY FAVORABLE HABITATS FOR THE BREEDING AND MULTIPLICATION OF VARIOUS PESTS, PARTICULARLY THE AFRICAN MIGRATORY LOCUST. MOREOVER, THE RAINFALL ALONG THE RED SEA COAST FROM DECEMBER 1985 UNTIL MARCH 1986 WAS ALSO GOOD AND CREATED VERY FAVORABLE CONDITIONS FOR LOCUST BREEDING.

3. THE FORECAST FOR THE 1986/87 SEASON, STARTING JULY 1986, IS THAT AN EVEN WORSE BUILD UP OF THE AFRICAN MIGRATORY AND DESERT LOCUSTS AS WELL AS GRASSHOPPERS IS VERY MUCH TO BE EXPECTED FOR THE FOLLOWING REASONS:

A. THE GOOD AND WIDESPREAD RAINS RECEIVED IN THE CENTRAL, EASTERN AND RED SEA COASTAL AREAS OF SUDAN ENHANCED THE BREEDING OF LOCUSTS LAST SEASON. SUCH FAVORABLE CONDITIONS ARE EXPECTED TO PREVAIL THIS COMING SEASON. SUCCESSFUL LOCUST BREEDING SHOULD CONTINUE THIS SEASON.

B. DURING THE PAST FEW MONTHS HEAVY LOCUST INFESTATIONS HAVE BEEN FOUND ALONG THE RED SEA COAST OF SUDAN, TIHAMA OF SAUDI ARABIA, PARTS OF SOUTHERN SUDAN, NORTHERN PARTS OF KENYA AND UGANDA. LIMITED CONTROL MEASURES WERE UNDERTAKEN ALONG SUDAN'S RED SEA COAST. HOWEVER, IT IS EXPECTED THAT CONSIDERABLE ESCAPE FROM THESE CONTROL OPERATIONS OCCURRED. WITH THE CHANGE OF WIND DIRECTION FROM NORTHERLY TO SOUTHERLY DUE TO THE MOVEMENT OF THE INTER-TROPICAL CONVERGENCE ZONE (ITCZ) ACROSS CENTRAL PART OF COUNTRY, MIGRATION OF THE LOCUST SWARMS THAT MISSED CONTROL MEASURES IN SUDAN AND NEIGHBORING COUNTRIES WILL TAKE PLACE. THE ITCZ IS NORMALLY ASSOCIATED WITH RAINY CONDITIONS WHICH OFFER FAVORABLE ECOLOGICAL CONDITIONS FOR LOCUSTS.

C. CURRENT SURVEY OPERATIONS CARRIED OUT BY THE GOS PLANT PROTECTION DEPARTMENT (PPD) CONFIRM THE PRESENCE OF MIGRATORY LOCUSTS IN SUBSTANTIAL NUMBERS COVERING VAST AREAS IN EASTERN, WHITE NILE AND BLUE NILE REGIONS. IN FEAR OF THIS MANY FARMERS IN THE RAINFED AREAS ARE RELUCTANT TO START PREPARATION AND PLANTING OF CROPS FOR THE CURRENT SEASON. CONSEQUENTLY A REDUCTION OF 30 PERCENT IN THE AREA PLANTED LAST YEAR IS TO BE EXPECTED.

4. MISSION HAS RECEIVED AN OFFICIAL APPEAL FROM THE GOS MINISTER OF AGRICULTURE FOR ASSISTANCE IN THE CONTROL OF LOCUSTS DURING THE 1986/87 SEASON. THE MISSION HAS DISCUSSED THE SITUATION WITH CONCERNED ORGANIZATIONS INCLUDING THE SUDAN PLANT PROTECTION

PAGE 01 KHARTO 08519 02 OF 02 251331Z
ACTION AID-00

INFO LOG-00 COPY-01 AF-00 CIAE-00 EB-08 DODE-00 IO-17
FDRE-00 /026 W
----------242552 251341Z /44-38

O 251331Z JUN 86
FM AMEMBASSY KHARTOUM
TO SECSTATE WASHDC IMMEDIATE 1748
INFO AMEMBASSY NAIROBI PRIORITY
INFO AMEMBASSY ADDIS ABABA PRIORITY
INFO AMEMBASSY KAMPALA PRIORITY
INFO AMEMBASSY NDJAMENA PRIORITY

UNCLAS SECTION 02 OF 02 KHARTOUM 08519

AIDAC

E.O. 12356:N/A
SUBJECT: SUDAN - AMBASSADOR'S DETERMINATION THAT DEPARTMENT, GERMAN AID EXPERTS AND AN EEC FINANCED LOCUST EXPERT, MR. CLIFF ASHALL, WHO JUST COMPLETED A CONSULTANCY IN ROME AND SUDAN CONCERNING THE CURRENT LOCUST PROBLEM. ALL TECHNICAL BODIES AND EXPERTS CONSULTED BY USAID AGREE THAT SUDAN COULD BE FACING A THREAT TO THIS SEASON'S GRAIN CROP THAT WOULD CAUSE UP TO 50 PERCENT CROP DESTRUCTION IN WORST AFFECTED AREAS. ASHALL BELIEVES THAT,IF UNCHECKED, WORSE DESTRUCTION COULD OCCUR NEXT YEAR AS SWARMS BUILD TO TRUE "PLAGUE" DIMENSIONS.

5. IT IS EVIDENT THAT THE SIZE OF THE LOCUST PROBLEM IS FAR BEYOND THE CAPABILITIES OF THE NATIONAL PLANT PROTECTION DEPARTMENT AND THE IN-COUNTRY STRUCTURE OF THE DESERT CONTROL ORGANIZATION.

6. SUDAN, WITH ITS FRAGILE ECONOMY,HAS JUST COME OUT OF A DROUGHT DISASTER. GIVEN ITS MAGNITUDE, THE LOCUST

PROBLEM IS FAR BEYOND THE FINANCIAL AND LOGISTICAL ABILITY OF THE GOVERNMENT OF SUDAN TO MOUNT ADEQUATE RESPONSE. RAPID ASSISTANCE FROM THE US GOVERNMENT HAS BEEN REQUESTED BY THE HOST COUNTRY. U.S. DISASTER ASSISTANCE IN AVERTING A NEW FOOD EMERGENCY DUE TO LOCUST DAMAGE IS IN THE U.S. INTEREST. IN VIEW OF THE ABOVE CONSIDERATIONS, I, AS U.S. AMBASSADOR, HEREBY DETERMINE THAT THE INCIPIENT LOCUST OUTBREAK CONSTITUTES A DISASTER AND CALLS FOR URGENT U.S. ASSISTANCE. THE MISSION REQUESTS THAT UP TO DOLS ONE MILLION IN U.S. FOREIGN DISASTER ASSISTANCE BE ALLOCATED TO SUPPORT CONTROL ACTIVITIES IN COOPERATION WITH OTHER DONORS. SEPTEL REPORTS ON RESULTS OF DONOR EFFORTS TO DATE TO DEVELOP AN ACTION PROGRAM IN COOPERATION WITH GOS PLANT PROTECTION DEPARTMENT AND RECOMMENDS AN APPROACH TO PROVIDING U.S. ASSISTANCE.
HORAN

DZ

Reference	Notes

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, DC 20523

ASSISTANT
ADMINISTRATOR

MAR 25, 1987

ACTION MEMORANDUM FOR THE ADMINISTRATOR

FROM : OFDA, Julia V. Taft
AA/AFR, Alexander R. Love (Acting)

SUBJECT : A.I.D. Regulation 16 Emergency Determination for Sudan Locust/Grasshopper Control

PURPOSE: Pursuant to Section 216.3(b)(2)(i) of A.I.D. Regulation 16, you are requested to make a determination that emergency conditions exist in the case of a threatened locust and grasshopper plague in Sudan, so that the pesticide evaluation procedures set forth in Section 216.3(b)(1) to Regulation 16 do not apply.

DISCUSSION: Section 216.3(b)(2)(i) of A.I.D. Regulation 16 permits A.I.D. to provide assistance for the use or procurement of pesticides without following pesticide evaluation procedures if the A.I.D. Administrator determines that the following conditions are met: (a) a pest outbreak has occurred or is imminent; (b) significant health or economic problems will occur if the proposed pesticides are not used promptly; and (c) insufficient time is available to evaluate the proposed pesticides in accordance with A.I.D. Regulation 16 procedures. All three conditions are met in the case of Sudan.

Sudan continues to face a heavy infestation of desert locusts in the Red Sea coastal area. The 1987 campaign against locust infestation far exceeds in seriousness any previous infestation on the Red Sea Coast since the 1978-1979 plague. It is believed that locust swarms arriving on the Red Sea coast have traveled North from Eritrea and East from the Ed Dueim area of Sudan's central region. Based on the current situation as reported by the Plant Protection Department (PPD) of the Ministry of Agriculture, and reports from Saudi Arabia concerning the presence of numerous swarms, the PPD anticipates that locusts potentially will be a more severe problem in 1987 than in 1986. Furthermore, Sudan is braced for the possible invasion from the East of mature swarms of locusts from Saudi Arabia which are expected as early as July. The PPD has also indicated that there most likely will be re-infestation of desert locust in the central regions of Sudan beginning as early as May 1987. The potential magnitude of the 1987 locust outbreak is far greater than in 1986, and exceeds the ability of the Government of Sudan (GOS) to implement an adequate response. On February 15, 1987, the U.S. Ambassador to Sudan determined that the incipient locust outbreak constituted an emergency and declared a national disaster (Attachment "A").

The Sudan experienced a severe outbreak of grasshoppers and locust during the 1986 crop season in all of the northern regions of the country. The exceptional outbreak began in 1985 with an upsurge of African Migratory locusts in the central regions of Sudan. The 1986 outbreak was anticipated by the GOS due to FAO forecasts concerning the convergence of an upsurge of all major locust and grasshopper species in Africa. In response to an urgent GOS plea to international donors for assistance in combatting an imminent locust infestation, a steering committee consisting of FAO, international donors and GOS representatives was formed to coordinate the response. Subsequently, over $4 million was pledged to provide the GOS with required pesticides, vehicles, and spray equipment. The expeditious arrival and distribution of equipment and pesticides to plant protection field stations resulted in a relatively successful summer program. The program apparently was a success, because Sudan enjoyed a second year of good harvests. However, despite the extensive control measures in the central regions of the Sudan, there were numerous locust swarm escapes which migrated to the winter breeding areas on the Red Sea coast. The PPD has reported that these swarms have settled in areas with rich, green annual vegetation, millet and sorghum plantations.

A 1987 Sudan Locust Control Operational Plan has been developed for both the summer and winter campaigns and consists of the following:

1. Administrative Directorate. The 1987 Program will be directed by a task force and steering committee in the same manner as the 1986 Program. The host country representatives will remain the same as for the 1986 Program. An international staff will be contracted through FAO and financed from the general multi-donor fund to manage the 1987 Program. The staff will report directly to the Steering Committee. The positions will be programmed in the overall country plan for two years. The team leader will be responsible for overall coordination and planning for the Locust Control Program.

2. Locust control chemicals and equipment will be pre-positioned before the roads are destroyed by summer rains. Past experience with emergency relief activities in the Sudan has proven this to be a critical aspect of the strategy.

3. The environmental and health effects of pesticide storage, handling and application will be addressed as one of the highest priorities. Protective clothing will be provided to the pesticide handlers. A country-wide program will be implemented to destroy rotting drums and to decontaminate soils in and around warehouses. Training courses will be designed to improve the skill of field personnel over the short and long term.

4. Local currency will be provided for port charges, spray equipment repair, improvements to port facilities and their management, training programs, destruction and decontamination of approximately 200 metric tons of rotting pesticide drums and soils.

5. The funds which will be provided by the international donors for the 1987 Locust Control Program will be pooled to procure certain items which require compatibility with existing inventories in Sudan.

161

6. The operations cadres consist of ground and aerial teams for monitoring and control.

A total of $1.1 million in U.S. assistance has been requested, which is consistent with last year's commitment. To date A.I.D. has provided $298,000 for the general fund and A.I.D./W has advised that an additional $750,000 could be made available for the purchase of pesticides, protective clothing and tents. The EEC and Netherlands have already pledged $610,000 and other donor contributions are expected shortly.

The logistical constraints involved in implementing an emergency program in the Sudan are well known and do not need to be repeated here. Past experience has taught emergency workers that the prepositioning of commodities (whether food or chemicals) before the roads are destroyed by summer rains is critical. According to the PPD, the most urgently needed chemicals at this time are ULV formula Malathion and Propoxur for bait. By April 1987, ULV supplies in Sudan will be extremely low, if not exhausted. All bait and half of the ULV formula pesticides should be in Sudan by May 1987. Thus, the U.S.G. funds for the purchase of Propoxur must be authorized immediately.

The following pesticide(s) have been proposed by the Steering Committee for use in Sudan: Malathion, Fenitrothion, Propoxur, and Bendiocarb. BHC will not be used in the Sudan locust control program this year, because serious objections were raised about its use by the United States and, subsequently, agreed to by FAO. Comments on the use and safety of each proposed pesticide are provided by AFR/TR and S&T/AGR.

Propoxur has been proven to be effective in grasshopper control and to be non-toxic to other non-target organisms. In addition, it is resistant to sunlight, persistent on soils, and can be procured inexpensively in Europe. It was used effectively without incident in several African countries (Chad, Mali, and Burkina Faso) last year.

Fenitrothion is acceptable, based upon its long history of use without reported safety incident, as well as its reported effectiveness against locusts and grasshoppers. Effective at low dosage (15-30 fluid ounces per hectare), it is reasonably safe, inexpensive, and works well in spray systems. Fenitrothion was used in last year's grasshopper/locust campaigns in almost every country, including Chad, Ethiopia, Burkina Faso, Niger and Botswana. Fenitrothion is an organophosphorus insecticide that is very similar to Malathion. While it was originally developed by an American Company (American Cyanamid), it was not registered by this company. Subsequently, it was put into production by a Japanese Company (Sumitomo). Fenitrothion is only registered by the U.S. EPA for 15 uses, and cannot be used in the United States for grasshopper control, or in pastures, rangeland, or other similar sites where large populations of grasshoppers are likely to occur. However, it has been used extensively in Canada for the control of forest insects and for the control of many insects on a wide range of crops in other countries. It has been used extensively for locust and grasshopper control in Africa, and in other areas of the world.

162

Malathion is a non-persistent organophosphorus insecticide that has been used for large-scale grasshopper control programs in the U.S. for over 20 years. It provides effective, safe, rapid, and economical control. Malathion was effective in locust control in Ethiopia and Northern Somalia in 1968-1969, and in 1977-1978. In 1986, it was effective in grasshopper/locust aerial spray campaigns in Mali, Senegal, and The Gambia. It has been used extensively for adult mosquito control in highly populated areas of the U.S. and in many other countries for the control of the Mediterranean fruitfly, other fruitflies, and many other insects. It is registered by the U.S. EPA for use on many food crops against several hundred species of insects. The Food and Drug Administration has established residue tolerances for this product on many food crops.

Bendiocarb, a cholinesterase-inhibiting carbamate pesticide, is safe and used as a dust or bait formulation in grasshopper/locust control programs. It was recently tested in Sudan and proved to be effective and safe.

Due to the time limitations imposed by the urgency of the 1987 grasshopper/locust control program in Sudan, there has been insufficient time to prepare an environmental assessment for the country.

Given the life cycle of grasshoppers and locusts, which is dependent upon favorable weather conditions, there was no guarantee that the insects would appear in the coming year, and that control operations using pesticides would be warranted. Recent egg pod surveys, which were conducted in several countries, monitoring of winter breeding grounds, and projected positive weather conditions, however, confirm the existence and imminent threat of the insects this year. Thus, pesticides should be prepositioned immediately to allow full scale ground control operations to begin shortly after early season planting (April-May) and to allow for the preparation of aerial spray campaigns (June-August) later in the season.

A.I.D.'s pesticide procedures require environmental review of specific pesticides against specific pests, at specific sites. There is not sufficient time to conduct the environmental review generally required prior to procurement of pesticides, if they are to be prepositioned in time to meet the present threat. Moreover, the volatile nature of grasshoppers/locusts makes it impossible to predict at the present time where the pesticides will be applied.

Although it is necessary to procure and preposition pesticides without environmental review to meet this emergency in a timely manner, the Agency has designed a responsible, effective program for environmental review of affected areas. As part of several 1987 initiatives designed to ensure the environmental safety of pesticides that A.I.D. procures for the grasshopper/locust control programs, a programmatic environmental assessment is scheduled to begin in Africa early this summer. An Action Memorandum outlining this activity and others, such as pesticide testing and research, was approved by the A.I.D. Administrator on February 26, 1987 (Attachment "B").

A.I.D./W will notify the USAID Mission when the Regulation 16 waiver is approved and indicate the specific pesticides for which approval has been obtained. Instructions will be given to the Mission to develop

162

arrangements adequate to ensure that A.I.D. funds cannot be used for procurement or use, including spraying operations, of any other pesticide.

RECOMMENDATION: That you exercise the authority vested in you by Section 216.3(b)(2)(i) of A.I.D. Regulation 16 and determine that emergency conditions exist in Sudan based upon the imminent outbreak of grasshoppers, and the serious economic problems consequent to an uncontrolled outbreak, and that, further, time available before the necessary use of the pesticides described above is insufficient to allow detailed evaluation of their proposed use in accordance with Section 216.3(b)(1) of A.I.D. Regulation 16.

Approved: _____

Disapproved: _____

Date: _____

Clearances

GC, HFry: Draft
AFR/TR, BBoyd: Draft
OFDA, TKnight: Draft
AFR/OEO, FCFischer: Draft
S&T/AGR, CCollier: Draft
AFR/EA, JTurk: Draft
AFR/EA, SMintz: Draft
A/AID, NCohen: Draft
GC/CP, STisa: Draft

Drafter: AFR/OEO: DKreslins: 3/23/87:x78827:1544b

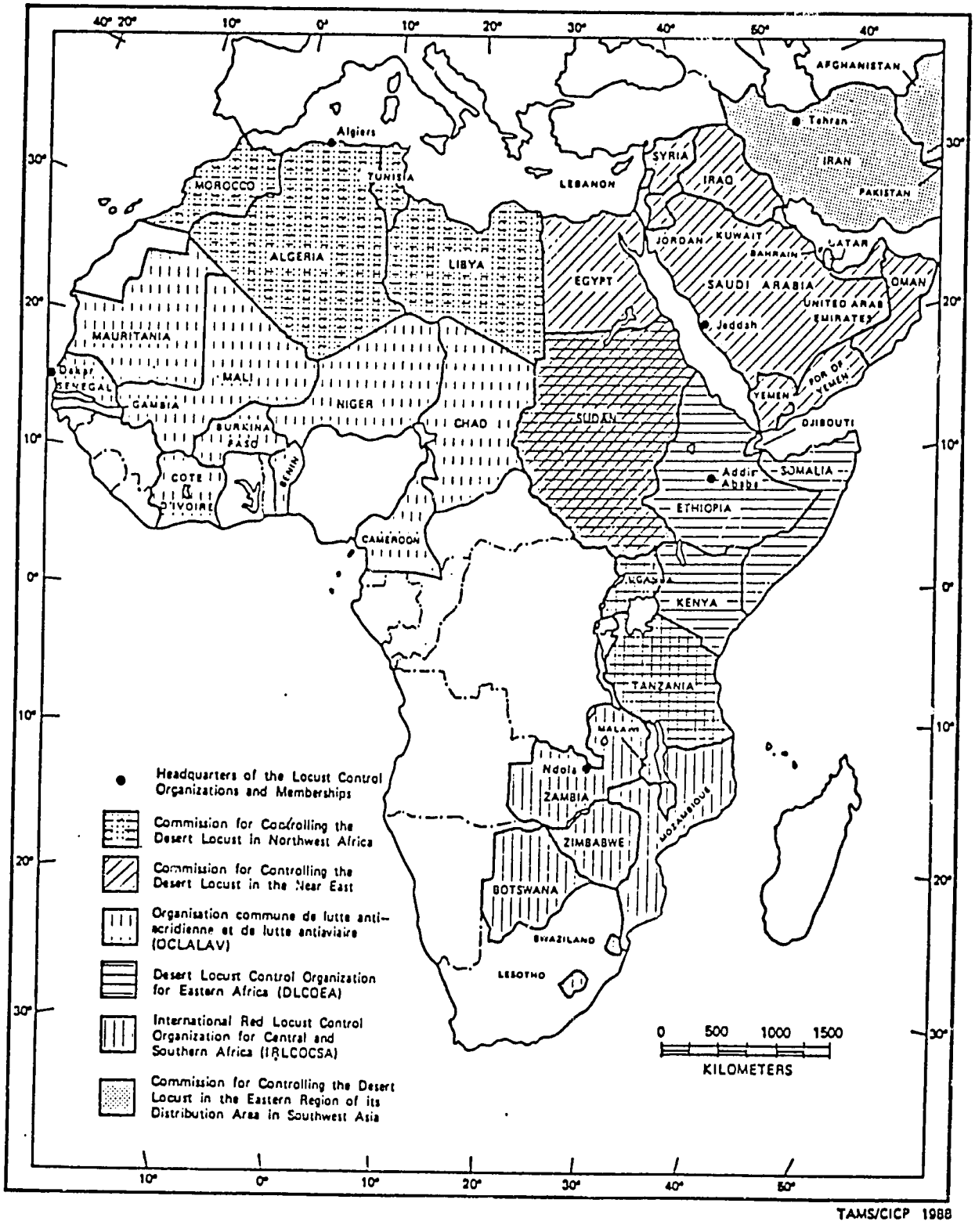
164

Reference	Notes

APPENDIX B

Locust Control Organizations

Reference	Notes



LOCUST CONTROL ORGANIZATIONS

Reference	Notes

APPENDIX C

U. S. Regulations on Pesticides and Environmental Procedures

- 22 CFR Part 216--Environmental Procedures
- Part 166--Exemption of Federal and State Agencies for use of Pesticides under Emergency Conditions

Reference	Notes

INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
Agency for International Development

22 CFR Part 216

Environmental Procedures

§216.1 Introduction.

(a) *Purpose.* In accordance with Sections 118(b) and 821 of the Foreign Assistance Act of 1981, as amended, (the FAA) the following general procedures shall be used by A.I.D. to ensure that environmental factors and values are integrated into the A.I.D. decision making process. These procedures also assign responsibility within the Agency for assessing the environmental effects of A.I.D.'s actions. These procedures are consistent with Executive Order 12114, issued January 4, 1979, entitled Environmental Effects Abroad of Major Federal Actions, and the purposes of the National Environmental Policy Act of 1970, as amended (42 U.S.C. 4371 et seq.) (NEPA). They are intended to implement the requirements of NEPA as they effect the A.I.D. program.

(b) *Environmental Policy.* In the conduct of its mandate to help upgrade the quality of life of the poor in developing countries, A.I.D. conducts a broad range of activities. These activities address such basic problems as hunger, malnutrition, overpopulation, disease, disaster, deterioration of the environment and the natural resource base, illiteracy as well as the lack of adequate housing and transportation. Pursuant to the F.A.A. A.I.D. provides development assistance in the form of technical advisory services, research, training, construction and commodity support. In addition, A.I.D. conducts programs under the Agricultural Trade Development and Assistance Act of 1964 (Pub. L. 480) that are designed to combat hunger, malnutrition and to facilitate economic development. Assistance programs are carried out under the foreign policy guidance of the Secretary of State and in cooperation with the governments of sovereign states. Within this framework, it is A.I.D. policy to:

(1) Ensure that the environmental consequences of A.I.D.-financed activities are identified and considered by A.I.D. and the host country prior to a final decision to proceed and that appropriate environmental safeguards are adopted;

(2) Assist developing countries to strengthen their capabilities to appreciate and effectively evaluate the potential environmental effects of proposed development strategies and projects, and to select, implement and manage effective environmental programs;

(3) Identify impacts resulting from A.I.D.'s actions upon the environment; including those aspects of the biosphere which are the common and cultural heritage of all mankind; and

(4) Define environmental limiting factors that constrain development and identify and carry out activities that assist in restoring the renewable resource base on which sustained development depends.

(c) *Definitions*--(1) *CEQ Regulations.* Regulations promulgated by the President's Council on Environmental Quality (CEQ) (Federal Register, Volume 43, Number 230, November 29, 1978) under the authority of NEPA and Executive Order 11514, entitled Protection and Enhancement of Environmental Quality (March 5, 1970) as amended by Executive Order 11991 (May 24, 1977).

(2) *Initial Environmental Examination.* An Initial Environmental Examination is the first review of the reasonably foreseeable effects of a proposed action on the environment. Its function is to provide a brief statement of the factual basis for a Threshold Decision as to whether an Environmental Assessment or an Environmental Impact Statement will be required.

(3) *Threshold Decision.* A formal Agency decision which determines, based on an Initial Environmental Examination, whether a proposed Agency action is a major action significantly affecting the environment.

(4) *Environmental Assessment.* 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.

(5) *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 as described in §216.7 of these procedures. It is a specific document having a definite format and content, as provided in NEPA and the CEQ Regulations. The required form and content of an Environmental Impact Statement is further described in §216.7 infra.

(6) *Project Identification Document (PID).* An internal A.I.D. document which initially identifies and describes a proposed project.

(7) *Program Assistance Initial Proposal (PAIP).* An internal A.I.D. document used to initiate and identify proposed non-project assistance, including commodity import programs. It is analogous to the PID.

(8) *Project Paper (PP).* An internal A.I.D. document which provides a definitive description and appraisal of the project and particularly the plan or implementation.

(9) *Program Assistance Approval Document (PAAD).* An internal A.I.D. document approving non-project assistance. It is analogous to the PP.

(10) *Environment.* The term environment, as used in these procedures with respect to effects occurring outside the United States, means the natural and physical environment. With respect to effects occurring within the United States see §216.7(b).

(11) *Significant Effect.* With respect to effects on the environment outside the United States, a proposed action has a significant effect on the environment if it does significant harm to the environment.

(12) *Minor Donor.* For purposes of these procedures, A.I.D. is a minor donor to a multidonor project when A.I.D. does not control the planning or design of the multidonor project and either (i) A.I.D.'s total contribution to the project is both less than $1,000,000 and less than 25 percent of the estimated project cost, or (ii) A.I.D.'s total contribution is more than $1,000,000 but less than 25 percent of the estimated project cost and the environmental procedures of the donor in control of the planning of design of the project are followed, but only if the A.I.D. Environmental Coordinator determines that such procedures are adequate.

§216.2 Applicability of procedures.

(a) *Scope.* Except as provided in §216.2(b), these procedures apply to all new projects, programs or activities authorized or approved by A.I.D. and to substantive amendments or extensions of ongoing projects, programs, or activities.

(b) *Exemptions.* (1) Projects, programs or activities involving the following are exempt from these procedures:

(i) International disaster assistance;

(ii) Other emergency circumstances; and

(iii) Circumstances involving exceptional foreign policy sensitivities.

(2) A formal written determination, including a statement of the justification therefor, is required for each project, program or activity for which an exemption is made under paragraphs (b)(1)(ii) and (iii) of this section, but is not required for projects, programs or activities under paragraph (b)(1)(i) of this section. The determination shall be made either by the Assistant Administrator having responsibility for the program, project or activity, or by the Administrator, where authority to approve financing has been reserved by the Administrator. The determination shall be made after consultation with CEQ regarding the environmental consequences of the proposed program, project or activity.

(c) *Categorical Exclusions.* (1) The following criteria have been applied in determining the classes of actions included in §216.2(c)(2) for which an Initial Environmental Examination, Environmental Assessment and Environmental Impact Statement generally are not required:

(i) The action does not have an effect on the natural or physical environment;

(ii) A.I.D. does not have knowledge of or control over, and the objective of A.I.D. in furnishing assistance does not require, either prior to approval of financing or prior to implementation of specific activities, knowledge of or control over, the details of the specific activities that have an effect on the physical and natural environment for which financing is provided by A.I.D.;

(iii) Research activities which may have an affect on the physical and natural environment but will not have a significant effect as a result of limited scope, carefully controlled nature and effective monitoring.

(2) The following classes of actions are not subject to the procedures set forth in §216.3, except to the extent provided herein:

(i) Education, technical assistance, or training programs except to the extent such programs include activities directly affecting the environment (such as construction of facilities, etc.);

(ii) Controlled experimentation exclusively for the purpose of research and field evaluation which are confined to small areas and carefully monitored;

(iii) Analyses, studies, academic or research workshops and meetings;

(iv) Projects in which A.I.D. is a minor donor to a multidonor project and there is no potential significant effects upon the environment of the United States, areas outside any nation's jurisdiction or endangered or threatened species or their critical habitat;

(v) Document and information transfers;

(vi) Contributions to international, regional or national organizations by the United States which are not for the purpose of carrying out a specifically identifiable project or projects;

(vii) Institution building grants to research and educational institutions in the United States such as those provided for under Section 122(d) and Title XII of Chapter 2 of Part I of the FAA (22 USCA §§2151 p. (b)2220a. (1979));

(viii) Programs involving nutrition, health care or population and family planning services except to the extent designed to include

activities directly affecting the environment (such as construction of facilities, water supply systems, waste water treatment, etc.);

(ix) Assistance provided under a Commodity Import Program when, prior to approval, A.I.D. does not have knowledge of the specific commodities to be financed and when the objective in furnishing such assistance requires neither knowledge, at the time the assistance is authorized, nor control, during implementation, of the commodities or their use in the host country;

(x) Support for intermediate credit institutions when the objective is to assist in the capitalization of the institution or part thereof and when such support does not involve reservation of the right to review and approve individual loans made by the institution;

(xi) Programs of maternal or child feeding conducted under Title II of Pub. L. 480;

(xii) Food for development programs conducted by food recipient countries under Title III of Pub. L. 480, when achieving A.I.D.'s objectives in such programs does not require knowledge of or control over the details of the specific activities conducted by the foreign country under such programs;

(xiii) Matching, general support and institutional support grants provided to private voluntary organizations (PVOs) to assist in financing programs where A.I.D.'s objective in providing such financing does not require knowledge of or control over the details of the specific activities conducted by the PVO;

(xiv) Studies, projects or programs intended to develop the capability of recipient countries to engage in development planning, except to the extent designed to result in activities directly affecting the environment (such as construction of facilities, etc.); and

(xv) Activities which involve the application of design criteria or standards developed and approved by A.I.D.

(3) The originator of a project, program or activity shall determine the extent to which it is within the classes of actions described in paragraph (c)(2) of this section. This determination shall be made in writing and be submitted with the PID, PAID or comparable document. This determination, which must include a brief statement supporting application of the exclusion shall be reviewed by the Bureau Environmental Officer in the same manner as a Threshold Decision under §216.3(a)(2) of these procedures. Notwithstanding paragraph (c)(2) of this section, the procedures set forth in §216.3 shall apply to any project, program or activity included in the classes of actions listed in paragraph (c)(2) of this section, or any aspect or component thereof, if at any time in the design, review or approval of the activity it is determined that the project, program or activity, or aspect or component thereof, is subject to the control of A.I.D. and may have a significant effect on the environment.

(d) *Classes of Actions Normally Having a Significant Effects on the Environment.* (1) The following classes of actions have been determined generally to have a significant effect on the environment and an Environmental Assessment or Environmental Impact Statement, as appropriate, will be required:

(i) Programs of river basin development;

(ii) Irrigation or water management projects, including dams and impoundments;

(iii) Agricultural land leveling;

(iv) Drainage projects;

(v) Large scale agricultural mechanization;

(vi) New lands development;
(vii) Resettlement projects;
(viii) Penetration road building or road improvement projects;
(ix) Powerplants;
(x) Industrial plants;
(xi) Potable water and sewerage projects other than those that are small-scale.

(2) An Initial Environmental Examination normally will not be necessary for activities within the classes described in §216.2(d), except when the originator of the project believes that the project will not have a significant effect on the environment. In such cases, the activity may be subjected to the procedures set forth in §216.3.

(e) *Pesticides.* The exemptions of §216.2(b)(1) and the categorical exclusions of §216.2(c)(2) are not applicable to assistance for the procurement or use of pesticides.

§216.3 Procedures.

(a) *General Procedures*--(1) *Preparation of the Initial Environmental Examination.* Except as otherwise provided, an Initial Environmental Examination is not required for activities identified in §216.2(b)(1), (c)(2), and (d). For all other A.I.D. activities described in §216.2(a) an Initial Environmental Examination will be prepared by the originator of an action. Except as indicated in this section, it should be prepared with the PID or PAIP. For projects including the procurement or use of pesticides, the procedures set forth in §216.3(b) will be followed, in addition to the procedures in this paragraph. Activities which cannot be identified in sufficient detail to permit the completion of an Initial Environmental Examination with the PID or PAIP, shall be described by including with the PID or PAIP: (i) an explanation indicating why the Initial Environmental Examination cannot be completed; (ii) an estimate of the amount of time required to complete the Initial Environmental Examination; and (iii) a recommendation that a Threshold Decision be deferred until the Initial Environmental Examination is completed. The responsible Assistant Administrator will act on the request for deferral concurrently with action on the PID or PAIP and will designate a time for completion of the Initial Environmental Examination. In all instances, except as provided in §216.3(a)(7), this completion date will be in sufficient time to allow for the completion of an Environmental Assessment or Environmental Impact Statement, if required, before a final decision is made to provide A.I.D. funding for the action.

(2) *Threshold Decision.* (i) The Initial Environmental Examination will include a Threshold Decision made by the officer in the originating office who signs the PID or PAIP. If the Initial Environmental Examination is completed prior to or at the same time as the PID or PAIP, the Threshold Decision will be reviewed by the Bureau Environmental Officer concurrently with approval of the PID or PAIP. The Bureau Environmental Officer will either concur in the Threshold Decision or request reconsideration by the officer who made the Threshold Decision, stating the reasons for the request. Differences of opinion between these officers shall be submitted for resolution to the Assistant Administrator at the same time that the PID is submitted for approval.

(ii) An Initial Environmental Examination, completed subsequent to approval of the PID or PAIP, will be forwarded immediately together with the Threshold Determination to the Bureau Environmental Officer for action as described above.

(iii) A Positive Threshold Decision shall result from a finding that the proposed action will have a significant effect on the environment. An Environmental Impact Statement shall be prepared if required pursuant to §216.7. If an impact statement is not required, an Environmental Assessment will be prepared in accordance with §216.6. The cognizant Bureau or Office will record a Negative Determination if the proposed action will not have a significant effect on the environment.

(3) *Negative Declaration.* The Assistant Administrator, or the Administrator in actions for which the approval of the Administrator is required for the authorization of financing, may make a Negative Declaration in writing, that the Agency will not develop an Environmental Assessment or an Environmental Impact Statement regarding an action found to have a significant effect on the environment when (i) a substantial number of Environmental Impact Statements relating to similar activities have been prepared in the past, if relevant to the proposed action, (ii) the Agency has previously prepared a programmatic Statement or Assessment covering the activity in question which has been considered in the development of such activity, or (iii) the Agency has developed designed criteria for such an action which, if applied in the design of the action, will avoid a significant effect on the environment.

(4) *Scope of Environmental Assessment or Impact Statement*--(i) *Procedure and Content.* After a Positive Threshold Decision has been made, or a determination is made under the pesticide procedures set forth in §216.3(b) that an Environmental Assessment or Environmental Impact Statement is required, the originator of the action shall commence the process of identifying the significant issues relating to the proposed action and of determining the scope of the issues to be addressed in the Environmental Assessment or Environmental Impact Statement. The originator of an action within the classes of actions described in §216.2(d) shall commence this scoping process as soon as practicable. Persons having expertise relevant to the environmental aspects of the proposed action shall also participate in this scoping process. (Participants may include but are not limited to representatives of host governments, public and private institutions, the A.I.D. Mission staff and contractors.) This process shall result in a written statement which shall include the following matters:

(*a*) A determination of the scope and significance of issues to be analyzed in the Environmental Assessment or Impact Statement, including direct and indirect effects of the project on the environment.

(*b*) Identification and elimination from detailed study of the issues that are not significant or have been covered by earlier environmental review, or approved design considerations, narrowing the discussion of these issues to a brief presentation of why they will not have a significant effect on the environment.

(*c*) A description of (1) the timing of the preparation of environmental analyses, including phasing if appropriate, (2) variations required in the format of the Environmental Assessment, and (3) the tentative planning and decision making schedule; and

(*d*) A description of how the analysis will be conducted and the disciplines that will participate in the analysis.

177

(ii) These written statements shall be reviewed and approved by the Bureau Environmental Officer.

(iii) *Circulation of Scoping Statement.* To assist in the preparation of an Environmental Assessment, the Bureau Environmental Office may circulate copies of the written statement, together with a request for written comments, within thirty days, to selected federal agencies if that Officer believes comments by such federal agencies will be useful in the preparation of an Environmental Assessment. Comments received from reviewing federal agencies will be considered in the preparation of the Environmental Assessment and in the formulation of the design and implementation of the project, and will, together with the scoping statement, be included in the project file.

(iv) *Change in Threshold Decision.* If it becomes evident that the action will not have a significant effect on the environment (i.e., will not cause significant harm to the environment), the Positive Threshold Decision may be withdrawn with the concurrence of the Bureau Environmental Officer. In the case of an action included in §216.2(d)(2), the request for withdrawal shall be made to the Bureau Environmental Officer.

(5) *Preparation of Environmental Assessments and Environmental Impact Statement.* If the PID or PAIP is approved, and the Threshold Decision is positive, or the action is included in §216.2(d), the originator of the action will be responsible for the preparation of an Environmental Assessment or Environmental Impact Statement as required. Draft Environmental Impact Statements will be circulated for review and comment as part of the review of Project Papers and as outlined further in §216.7 of those procedures. Except as provided in §216.3(a)(7), final approval of the PP and PAAD and the method of implementation will include consideration of the Environmental Assessment of final Environmental Impact Statement.

(6) *Processing and Review Within A.I.D.* (1) Initial Environmental Examinations, Environmental Assessments and final Environmental Impact Statements will be processed pursuant to standard A.I.D. procedures for project approval documents. Except as provided in §216.3(a)(7), Environmental Assessments and final Environmental Impact Statements will be reviewed as an integral part of the Project Paper or equivalent document. In addition to these procedures, Environmental Assessments will be reviewed and cleared by the Bureau Environmental Officer. They may also be reviewed by the Agency's Environmental Coordinator who will monitor the Environmental Assessment process.

(ii) When project approval authority is delegated to field posts, Environmental Assessments shall be reviewed and cleared by the Bureau Environmental Officer prior to the approval of such actions.

(iii) Draft and final Environmental Impact Statements will be reviewed and cleared by the Environmental Coordinator and the Office of the General Counsel.

(7) *Environmental Review After Authorization of Financing* (i) Environmental review may be performed after authorization of a project, program or activity only with respect to subprojects or significant aspects of the project, program or activity that are unidentified at the time of authorization. Environmental review shall be completed prior to authorization for all subprojects and aspects of a project, program or activity that are identified.

(ii) Environmental review should occur at the earliest time in design or implementation at which a meaningful review can be undertaken, but in no event later than when previously unidentified subprojects or aspects of

179

projects, programs or activities are identified and planned. To the extent possible, adequate information to undertake deferred environmental review should be obtained before funds are obligated for unidentified subprojects or aspects of projects, programs or activities. (Funds may be obligated for the other aspects for which environmental review has been completed.) To avoid an irreversible commitment of resources prior to the conclusion of environmental review, the obligation of funds can be made incrementally as subprojects or aspects of projects, programs or activities are identified; or if necessary while planning continues, including environmental review, the agreement or other document obligating funds may contain appropriate covenants or conditions precedent to disbursement for unidentified subprojects or aspects of projects, programs or activities.

(iii) When environmental review must be deferred beyond the time some of the funds are to be disbursed (e.g., long lead times for the delivery of goods or services), the project agreement or other document obligating funds shall contain a covenant or covenants requiring environmental review, including an Environmental Assessment or Environmental Impact Statement, when appropriate, to be completed and taken into account prior to implementation of those subprojects or aspects of the project, program or activity for which environmental review is deferred. Such covenants shall ensure that implementation plans will be modified in accordance with environmental review if the parties decide that modifications are necessary.

(iv) When environmental review will not be completed for an entire project, program or activity prior to authorization, the Initial Environmental Examination and Threshold Decision required under §216.3(a)(1) and (2) shall identify those aspects of the project, program or activity for which environmental review will be completed prior to the time financing is authorized. It shall also include those subprojects or aspects for which environmental review will be deferred, stating the reasons for deferral and the time when environmental review will be completed. Further, it shall state how an irreversible commitment of funds will be avoided until environmental review is completed. The A.I.D. officer responsible for making environmental decisions for such projects, programs or activities shall also be identified (the same officer who has decision making authority for the other aspects of implementation). This deferral shall be reviewed and approved by the officer making the Threshold Decision and the officer who authorizes the project, program or activity. Such approval may be made only after consultation with the Office of General-Counsel for the purpose of establishing the manner in which conditions precedent to disbursement or covenants in project and other agreements will avoid an irreversible commitment of resources before environmental review is completed.

(8) *Monitoring.* To the extent feasible and relevant, projects and programs for which Environmental Impact Statements or Environmental Assessments have been prepared should be designed to include measurement of any changes in environmental quality, positive or negative, during their implementation. This will require recording of baseline data at the start. To the extent that available data permit, originating offices of A.I.D. will formulate systems in collaboration with the recipient nations, to monitor such impacts during the life of A.I.D.'s involvement. Monitoring implementation of projects, programs and activities shall take into account environmental impacts to the same extent as other aspects of such projects, programs and activities. If during implementation of any project, program

or activity, whether or not an Environmental Assessment or Environmental Impact Statement was originally required, it appears to the Mission Director, or officer responsible for the project, program or activity, that it is having or will have a significant effect on the environment that was not previously studied in an Environmental Assessment or Environmental Impact Statement, the procedures contained in this part shall be followed including, as appropriate, a Threshold Decision, Scoping and an Environmental Assessment or Environmental Impact Statement.

(9) *Revisions.* If, after a Threshold Decision is made resulting in Negative Determination, a project is revised or new information becomes available which indicates that a proposed action might be "major" and its effects "significant", the Negative Determination will be reviewed and revised by the cognizant Bureau and an Environmental Assessment or Environmental Impact Statement will be prepared, if appropriate. Environmental Assessments and Environmental Impact Statements will be amended and processed appropriately if there are major changes in the project or program, or if significant new information becomes available which relates to the impact of the project, program or activity on the environment that was not considered at the time the Environmental Assessment or Environmental Impact Statement was approved. When ongoing programs are revised to incorporate a change in scope or nature, a determination will be made as to whether such change may have an environmental impact not previously assessed. If so, the procedures outlined in this part will be followed.

(10) *Other Approval Documents.* These procedures refer to certain A.I.D. documents such as PIDs, PAIPs, PPs and PAADs as the A.I.D. internal instruments for approval of projects, programs or activities. From time to time, certain special procedures, such as those in §216.4, may not require the use of the aforementioned documents. In these situations, these environmental procedures shall apply to those special approval procedures, unless otherwise exempt, at approval times and levels comparable to projects, programs and activities in which the aforementioned documents are used.

(b) *Pesticide Procedures*--(1) *Project Assistance.* Except as provided in §216.3(b)(2), all proposed projects involving assistance for the procurement or use, or both, of pesticides shall be subject to the procedures prescribed in §216.3(b)(1)(i) through (v) below. These procedures shall also apply, to the extent permitted by agreements entered into by A.I.D. before the effective date of these pesticide procedures, to such projects that have been authorized but for which pesticides have not been procured as of the effective date of these pesticide procedures.

(i) When a project includes assistance for procurement or use or both, of pesticides registered for the same or similar uses by USEPA without restriction, the Initial Environmental Examination for the project shall include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticide use to determine whether the use may result in significant environmental impact. Factors to be considered in such an evaluation shall include, but not be limited to the following:

(*a*) The USEPA registration status of the requested pesticide;

(*b*) The basis for selection of the requested pesticide;

(*c*) The extent to which the proposed pesticide use is part of an integrated pest management program;

180

(*d*) The proposed method or methods of 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 use and measures available to minimize such hazards;

(*f*) The effectiveness of the requested pesticide for the proposed use;

(*g*) Compatibility of the proposed pesticide 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;

(*k*) The provisions made for training of users and applicators; and

(*l*) The provisions made for monitoring the use and effectiveness of the pesticide.

In those cases where the evaluation of the proposed pesticide use in the Initial Environmental Examination indicates that the use will significantly affect the human environment, the Threshold Decision will include a recommendation for the preparation of an Environmental Assessment or Environmental Impact Statement, as appropriate. In the event a decision is made to approve the planned pesticide use, the Project Paper shall include to the extent practicable, provisions designed to mitigate potential adverse effects of the pesticide. When the pesticide evaluation section of the Initial Environmental Examination does not indicate a potentially unreasonable risk arising from the pesticide use, an Environmental Assessment or Environmental Impact Statement shall nevertheless be prepared if the environmental effects of the project otherwise require further assessment.

(ii) When a project includes assistance for the procurement or use, or both, of any pesticide registered for the same or similar uses in the United States but the proposed use is restricted by the USEPA on the basis of user hazard, the procedures set forth in §216.3(b)(1)(i) above will be followed. In addition, the Initial Environmental Examination will include an evaluation of the user hazards associated with the proposed USEPA restricted uses to ensure that the implementation plan which is contained in the Project Paper incorporates provisions for making the recipient government aware of these risks and providing, if necessary, such technical assistance as may be required to mitigate these risks. If the proposed pesticide use is also restricted on a basis other than user hazard, the procedures in §216.3(b)(1)(iii) shall be followed in lieu of the procedures in this section.

(iii) If the project includes assistance for the procurement or use, or both of:

(*a*) Any pesticide other than one registered for the same or similar uses by USEPA without restriction or for restricted use on the basis of user hazard; or

(*b*) Any pesticide for which a notice of rebuttable presumption against reregistration, notice of intent to cancel, or notice of intent to suspend has been issued by USEPA.

The Threshold Decision will provide for the preparation of an Environmental Assessment or Environmental Impact Statement, as appropriate (§216.6(a)). The EA or EIS shall include, but not be limited to, an analysis of the factors identified in §216.3(b)(1)(i) above.

(iv) Notwithstanding the provisions of §§216.3(b)(1)(i) through (iii) above, if the project includes assistance for the procurement or use, or both, of a pesticide against which USEPA has initiated a regulatory action for cause, or for which it has issued a notice of rebuttable presumption against reregistration, the nature of the action or notice, including the relevant technical and scientific factors will be discussed with the requesting government and considered in the IEE and, if prepared, in the EA or EIS. If USEPA initiates any of the regulatory actions above against a pesticide subsequent to its evaluation in an IEE, EA or EIS, the nature of the action will be discussed with the recipient government and considered in an amended IEE or amended EA or EIS, as appropriate.

(v) If the project includes assistance for the procurement or use, or both of pesticides but the specific pesticides to be procured or used cannot be identified at the time the IEE is prepared, the procedures outlined in §§216.3(b)(i) through (iv) will be followed when the specific pesticides are identified and before procurement or use is authorized. Where identification of the pesticides to be procured or used does not occur until after Project Paper approval, neither the procurement nor the use of the pesticides shall be undertaken unless approved, in writing, by the Assistant Administrator (or in the case of projects authorized at the Mission level, the Mission Director) who approved the Project Paper.

(2) *Exceptions to Pesticide Procedures.* The procedures set forth in §216.3(b)(1) above shall not apply to the following projects including assistance for the procurement or use, or both, of pesticides.

(i) Projects under emergency conditions.
Emergency conditions shall be deemed to exist when it is determined by the Administrator, A.I.D., in writing that:

(*a*) A pest outbreak has occurred or is imminent; and

(*b*) Significant health problems (either human or animal) or significant economic problems will occur without the prompt use of the proposed pesticide; and

(*c*) Insufficient time is available before the pesticide must be used to evaluate the proposed use in accordance with the provisions of this regulation.

(ii) Projects where A.I.D. is a minor donor, as defined in §216.1(c)(12) above, to a multidonor project.

(iii) Projects including assistance for procurement or use, or both, of pesticides for research or limited field evaluation purposes by or under the supervision of project personnel. In such instances, however, A.I.D. will ensure that the manufacturers of the pesticides provide toxicological and environmental data necessary to safeguard the health or research personnel and the quality of the local environment in which the pesticides will be used. Furthermore, treated crops will not be used for human or animal consumption unless appropriate tolerances have been established by EPA or recommended by FAO/WHO, and the rates and frequency of application, together with the prescribed preharvest intervals, do not result in residues exceeding such tolerances. This prohibition does not apply to the feeding of such crops to animals for research purposes.

(3) *Non-Project Assistance.* In a very few limited number of circumstances A.I.D. may provide non-project assistance for the procurement

and use of pesticides. Assistance in such cases shall be provided if the A.I.D. Administrator determines in writing that (1) emergency conditions, as defined in §216.3(b)(2)(i) above exists; or (ii) that compelling circumstances exist such that failure to provide the proposed assistance would seriously impede the attainment of U.S. foreign policy objectives or the objectives of the foreign assistance program. In the latter case, a decision to provide the assistance will be based to the maximum extent practicable upon a consideration of the factors set forth in §216.3(b)(1)(i) and, to the extent available, the history of efficacy and safety covering the past use of the pesticide in the recipient country.

§216.4 Private applicants.

Programs, projects or activities for which financing from A.I.D. is sought by private applications, such as PVOs and educational and research institutions, are subject to these procedures. Except as provided in §§216.2(b), (c) or (d), preliminary proposals for financing submitted by private applicants shall be accompanied by an Initial Environmental Examination or adequate information to permit preparation of an Initial Environmental Examination. The Threshold Decision shall be made by the Mission Director for the country to which the proposal relates, if the preliminary proposal is submitted to the A.I.D. Mission, or shall be made by the officer in A.I.D. who approves the preliminary proposal. In either case, the concurrence of the Bureau Environmental Officer is required in the same manner as in §216.3(a)(2), except for PVO projects approved in A.I.D. Missions with total life of project costs less than $500,000. Thereafter, the same procedures set forth in §216.3 including as appropriate scoping and Environmental Assessments or Environmental Impact Statements, shall be applicable to programs, projects or activities submitted by private applicants. The final proposal submitted for financing shall be treated, for purposes of these procedures, as a Project Paper. The Bureau Environmental Officer shall advise private applicants of studies or other information foreseeably required for action by A.I.D.

§216.5 Endangered species.

It is A.I.D. policy to conduct its assistance programs in a manner that is sensitive to the protection of endangered or threatened species and their critical habitats. The Initial Environmental Examination for each project, program or activity having an effect on the environment shall specifically determine whether the project, program or activity will have an effect on an endangered or threatened species, or critical habitat. If the proposed project, program or activity will have the effect of jeopardizing an endangered or threatened species or of adversely modifying its critical habitat, the Threshold Decision shall be a Positive Determination and an Environmental Assessment or Environmental Impact Statement completed as appropriate, which shall discuss alternatives or modifications to avoid or mitigate such impact on the species or its habitat.

§216.6 Environmental assessments.

(a) *General Purpose.* The purpose of the Environmental Assessment is to provide Agency and host country decision makers with a full discussion of significant environmental effects of a proposed action. It includes alternatives which would avoid or minimize adverse effects or enhance the quality of the environment so that the expected benefits of development objectives can be weighed against any adverse impact upon the human environment or any irreversible or irretrievable commitment of resources.

(b) *Collaboration with Affected Nation on Preparation.* Collaboration in obtaining data, conducting analyses and considering alternatives will help build an awareness of development associated environmental problems in less developed countries as well as assist in building an indigenous institutional capability to deal nationally with such problems. Missions, Bureaus and Offices will collaborate with affected countries to the maximum extent possible, in the development of any Environmental Assessments and consideration of environmental consequences as set forth therein.

(c) *Content and Form.* The Environmental Assessment shall be based upon the scoping statement and shall address the following elements, as appropriate:

(1) *Summary.* The summary shall stress the major conclusions, areas of controversy, if any, and the issues to be resolved.

(2) *Purpose.* The Environmental Assessment shall briefly specify the underlying purpose and need to which the Agency is responding in proposing the alternatives including the proposed action.

(3) *Alternatives Including the Proposed Action.* This section should present the environmental impacts of the proposal and its alternatives in comparative form, thereby sharpening the issues and providing a clear basis for choice among options by the decision maker. This section should explore and evaluate reasonable alternatives and briefly discuss the reasons for eliminating those alternatives which were not included in the detailed study; devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits; include the alternative of no action; identify the Agency's preferred alternative or alternatives. If one or more exists; include appropriate mitigation measures not already included in the proposed action or alternatives.

(4) *Affected Environment.* The Environmental Assessment shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in the Environmental Assessment shall be commensurate with the significance of the impact with less important material summarized consolidated or simply referenced.

(5) *Environmental Consequences.* This section forms the analytic basis for the comparisons under paragraph (c)(3) of this section. It will include the environmental impacts of the alternatives including the proposed action; any adverse effects that cannot be avoided should the proposed action be implemented; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented. It should not duplicate discussions in paragraph (c)(3) of this section. This section of the Environmental Assessment should include discussions of

direct effects and their significance; indirect effects and their significance; possible conflicts between the proposed action and land use plans, policies and controls for the areas concerned; energy requirements and conservation potential of various alternatives and mitigation measures; natural or depletable resource requirements and conservation potential of various requirements and mitigation measures; urban quality; historic and cultural resources and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures; and means to mitigate adverse environmental impacts.

(6) *List of Preparers.* The Environmental Assessment shall list the names and qualifications (expertise, experience, professional discipline) of the persons primarily responsible for preparing the Environmental Assessment or significant background papers.

(7) *Appendix.* An Appendix may be prepared.

(d) *Program Assessment.* Program Assessments may be appropriate in order to assess the environmental effects of a number of individual actions and their cumulative environmental impact in a given country or geographic area, or the environmental impacts that are generic or common to the class of agency actions, or other activities which are not country-specific. In these cases, a single, programmatic assessment will be prepared in A.I.D./Washington and circulated to appropriate overseas Missions, host governments, and to interested parties within the United States. To the extent practicable, the form and content of the programmatic Environmental Assessment will be the same as for project Assessments. Subsequent Environmental Assessments on major individual actions will only be necessary where such follow-on or subsequent activities may have significant environmental impacts on specific countries where such impacts have not been adequately evaluated in the programmatic Environmental Assessment. Other programmatic evaluations of classes of actions may be conducted in an effort to establish additional categorical exclusions or design standards or criteria for such classes that will eliminate or minimize adverse effects of such actions, enhance the environmental effect of such action or reduce the amount of paperwork or time involved in these procedures. Programmatic evaluations conducted for the purpose of establishing additional categorical exclusions under §216.2(c) or design considerations that will eliminate significant effects for classes of actions shall be made available for public comment before the categorical exclusions or design standards or criteria are adopted by A.I.D. Notice of the availability of such document shall be published in the Federal Register. Additional categorical exclusions shall be adopted by A.I.D. upon the approval of the Administrator, and design consideration in accordance with usual agency procedures.

(e) *Consultation and Review.* (1) When Environmental Assessments are prepared on activities carried out within or focused on specific developing countries, consultation will be held between A.I.D. staff and the host government both in the early stages of preparation and on the results and significance of the completed Assessment before the project is authorized.

(2) Missions will encourage the host government to make the Environmental Assessment available to the general public of the recipient country. If Environmental Assessments are prepared on activities which are not country-specific, the Assessment will be circulated by the Environmental Coordinator to A.I.D.'s Overseas Missions and interested governments for information, guidance and comment and will be made available in the U.S. to interested parties.

185

(f) *Effect in Other Countries.* In a situation where an analysis indicates that potential effects may extend beyond the national boundaries of a recipient country and adjacent foreign nations may be affected, A.I.D. will urge the recipient country to consult with such countries in advance of project approval and to negotiate mutually acceptable accommodations.

(g) *Classified Material.* Environmental Assessments will not normally include classified or administratively controlled material. However, there may be situations where environmental aspects cannot be adequately discussed without the inclusion of such material. The handling and disclosure of classified or administratively controlled material shall be governed by 22 CFR Part 9. Those portions of an Environmental Assessment which are not classified or administratively controlled will be made available to persons outside the Agency as provided for in 22 CFR Part 212.

§216.7 Environmental impact statements.

(a) *Applicability.* An Environmental Impact Statement shall be prepared when agency actions significantly affect:

(1) The global environment or areas outside the jurisdiction of any nation (e.g., the oceans);

(2) The environment of the United States; or

(3) Other aspects of the environment at the discretion of the Administrator.

(b) *Effects on the United States: Content and Form.* An Environmental Impact Statement relating to paragraph (a)(2) of this section shall comply with the CEQ Regulations. With respect to effects on the United States, the terms environment and significant effect wherever used in these procedures have the same meaning as in the CEQ Regulations rather than as defined in §216.1(c)(12) and (13) of these procedures.

(c) *Other Effects: Content and Form.* An Environmental Impact Statement relating to paragraphs (a)(1) and (a)(3) of this section will generally follow the CEQ Regulations, but will take into account the special considerations and concerns of A.I.D. Circulation of such Environmental Impact Statements in draft form will precede approval of a Project Paper or equivalent and comments from such circulation will be considered before final project authorization as outlined in §216.3 of these procedures. The draft Environmental Impact Statement will also be circulated by the Missions to affected foreign governments for information and comment. Draft Environmental Impact Statements generally will be made available for comment to Federal agencies with jurisdiction by law or special expertise with respect to any environmental impact involved, and to public and private organizations and individuals for not less than forty-five (45) days. Notice of availability of the draft Environmental Impact Statements will be published in the Federal Register. Cognizant Bureaus and Offices will submit these drafts for circulation through the Environmental Coordinator who will have the responsibility for coordinating all such communications with persons outside A.I.D. Any comments received by the Environmental Coordinator will be forwarded to the originating Bureau or Office for consideration in final policy decisions and the preparation of a final Environmental Impact Statement. All such comments will be attached to the final Statement, and those relevant comments not adequately discussed in the draft Environmental Impact Statement will be appropriately

dealt with in the final Environmental Impact Statement. Copies of the final Environmental Impact Statement, with comments attached, will be sent by the Environmental Coordinator to CEQ and to all other Federal, state, and local agencies and private organizations that made substantive comments on the draft, including affected foreign governments. Where emergency circumstances or considerations of foreign policy make it necessary to take an action without observing the provisions of §1506.10 of the CEQ Regulations, or when there are overriding considerations of expense to the United States or foreign governments, the originating Office will advise the Environmental Coordinator who will consult with Department of State and CEQ concerning appropriate modification of review procedures.

§216.8 Public hearings.

(a) In most instances A.I.D. will be able to gain the benefit of public participation in the impact statement process through circulation of draft statements and notice of public availability in CEQ publications. However, in some cases the Administrator may wish to hold public hearings on draft Environmental Impact Statements. In deciding whether or not a public hearing is appropriate, Bureaus in conjunction with the Environmental Coordinator should consider:

(1) The magnitude of the proposal in terms of economic costs, the geographic area involved, and the uniqueness or size of commitment of the resources involved;

(2) The degree of interest in the proposal as evidenced by requests from the public and from Federal, state and local authorities, and private organizations and individuals, that a hearing be held;

(3) The complexity of the issue and likelihood that information will be presented at the hearing which will be of assistance to the Agency; and

(4) The extent to which public involvement already has been achieved through other means, such as earlier public hearings, meetings with citizen representatives, and/or written comments on the proposed action.

(b) If public hearings are held, draft Environmental Impact Statements to be discussed should be made available to the public at least fifteen (15) days prior to the time of the public hearings, and a notice will be placed in the Federal Register giving the subject, time and place of the proposed hearings.

§216.9 Bilateral and multilateral studies and concise reviews of environmental issues.

Notwithstanding anything to the contrary in these procedures, the Administrator may approve the use of either of the following documents as a substitute for an Environmental Assessment (but not a substitute for an Environmental Impact Statement) required under these procedures:

(a) Bilateral and multilateral environmental studies, relevant or related to the proposed action, prepared by the United States and one or more foreign countries or by an international body or organization in which the United States is a member or participant; or

(b) Concise reviews of the environmental issues involved including summary environmental analyses or other appropriate documents.

§216.10 Records and reports.

Each Agency Bureau will maintain a current list of activities for which Environmental Assessments and Environmental Impact Statements are being prepared and for which Negative Determinations and Declarations have been made. Copies of final Initial Environmental Examinations, scoping statements, Assessments and Impact Statements will be available to interested Federal agencies upon request. The cognizant Bureau will maintain a permanent file (which may be part of its normal project files) of Environmental Impact Statements. Environmental Assessments, final Initial Environmental Examinations, scoping statements, Determinations and Declarations which will be available to the public under the Freedom of Information Act. Interested persons can obtain information or status reports regarding Environmental Assessments and Environmental Impact Statements through the A.I.D. Environmental Coordinator.

(22 U.S.C. 2381; 42 U.S.C. 4332)
Dated October 9, 1980.
Joseph C. Wheeler.
Acting Administrator.

Reference	Notes

PART 166--EXEMPTION OF FEDERAL AND STATE AGENCIES FOR USE OF PESTICIDES UNDER EMERGENCY CONDITIONS

Subpart A--General Provisions

Sec.
166.1 Purpose and organization.
166.2 Types of exemptions.
166.3 Definitions.
166.7 User notification.

Subpart B--Specific, Quarantine, and Public Health Exemptions

166.20 Application for a specific, quarantine, or public health exemption.
166.22 Consultation with the Secretary of Agriculture and Governors of the States.
166.24 Public notice of receipt of application, and opportunity for public comment.
166.25 Agency review.
166.28 Duration of exemption.
166.30 Notice of Agency decision.
166.32 Reporting and recordkeeping requirements for specific, quarantine, and public health exemptions.
166.34 EPA review of information obtained in connection with emergency exemptions.
166.35 Revocation or modification of exemptions.

Subpart C--Crisis Exemptions

166.40 Authorization.
166.41 Limitations.
166.43 Notice to EPA and registrants or basic manufacturers.
166.45 Duration of crisis exemption.
166.47 Notification of FDA, USDA, and State health officials.
166.49 Public notice of crisis exemptions.
166.50 Reporting and recordkeeping requirements for crisis exemptions.
166.53 EPA review of crisis exemption and revocation of authority.

AUTHORITY: 7 U.S.C. 136p and 136w.

SOURCE: 51 FR 1902, Jan. 15, 1986, unless otherwise noted.

Subpart A--General Provisions

§166.1 Purpose and organization.

(a) *Purpose and scope.* Section 18 of the Act authorizes the Administrator to exempt State and Federal agencies from any provision of the Act, if he determines that emergency conditions exist which require an exemption. The regulations in this Part establish procedures whereby the Administrator may exempt a Federal or State agency from the provisions of the Act which regulate the manner in which a pesticide is made available for use or is used.

(b) *Organization.* (1) The provisions in Subpart A of this part describe the four types of emergency exemptions authorized by the Agency and define terms used in this Part.

(2) Subpart B of this part establishes procedures and criteria for specific, quarantine, and public health exemptions.

(3) Subpart C of this part establishes procedures and criteria for crisis exemptions.

§166.2 Types of exemptions.

There are four types of emergency exemptions which may be authorized: specific, quarantine, public health, and crisis exemptions.

(a) Specific exemption. A specific exemption may be authorized in an emergency condition to avert:

(1) A significant economic loss; or

(2) A significant risk to:

(i) Endangered species,

(ii) Threatened species,

(iii) Beneficial organisms, or

(iv) The environment.

(b) *Quarantine exemption.* A quarantine exemption may be authorized in an emergency condition to control the introduction or spread of any pest new to or not theretofore known to be widely prevalent or distributed within and throughout the United States and its territories.

(c) *Public health exemptions.* A public health exemption may be authorized in an emergency condition to control a pest that will cause a significant risk to human health.

(d) *Crisis exemption.* A crisis exemption may be utilized in an emergency condition when the time from discovery of the emergency to the time when the pesticide use is needed is insufficient to allow for the authorization of a specific, quarantine, or public health exemption.

§166.3 Definitions.

Terms used in this part shall have the meanings established by the Federal Insecticide, Fungicide, and Rodenticide Act. In addition, as used in this part, the following terms shall also apply:

(a) The term "the Act" means the Federal, Insecticide, Fungicide, and Rodenticide Action, as amended, 7 U.S.C. 136 *et seq.*

(b) The terms "the Agency" and "EPA" mean the U.S. Environmental Protection Agency.

APPENDIX D

GUIDELINES FOR THE PACKAGING AND STORAGE OF PESTICIDES

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome - March 1985

Reference	Notes

CONTENTS

	PAGE
1. GENERAL REQUIREMENTS	D-1
2. PESTICIDE CONTAINER STANDARDS	D-2
2.1 Inside Containers	D-2
2.2 Overpacks	D-3
2.3 Bulk Containers	D-3
3. SELECTION OF APPROPRIATE PESTICIDE CONTAINERS	D-3
3.1 Solid Products - Powders, Dusts and Granules	D-3
3.2 Liquid Products	D-5
3.3 Pressure Packages	D-7
3.4 Overpacks	D-7
3.5 Closures	D-7
3.6 Measuring Devices	D-8
4. SPECIFICATIONS OF PESTICIDE CONTAINERS	D-8
5. TESTING OF PESTICIDE CONTAINERS	D-8
6. PESTICIDE CONTAINER STORAGE STANDARDS	D-9
6.1 Rules for Storing and Display of Pesticide Containers	D-9
6.2 Security and Safety in Pesticide Storage Areas	D-9

Reference	Notes

GUIDELINES FOR THE PACKAGING AND STORAGE OF PESTICIDES

1. GENERAL REQUIREMENTS

1.1 Pesticide containers and related outer packaging should comply with all national standards and regulations which apply to packaging, and where required, with international transportation and safety regulations.

1.2 The shelf life for container and product should be established as at least two years. In the event that the life of the product is shorter, the expiration date should be clearly imprinted in a prominent place.

1.3 Pesticides should only be packaged in clean and dry containers designed to provide protection against product deterioration, compaction, weight change or other spoilage. Containers must withstand all anticipated levels of handling, storage, stacking, loading and unloading conditions and should not become adversely affected by changes in atmospheric conditions, pressure, temperature and humidity. Standards of performance should be established through accepted test procedures.

1.4 The inner surface of containers or closures may be coated or lined with substance or materials which have been tested to resist corrosion. When such coating, linings or materials are used they should not contain substances which could react with the contents, form other compounds, or weaken the overall structure.

1.5 Outer surfaces of pesticide containers must be constructed of, or be coated with, materials which resist corrosion or other deterioration and which will accept either printed label copy, or the attachment of a printed label. Labelling should be positioned so as to be readily identified and should remain legible and attached throughout the anticipated shelf life.

1.6 Inks used for printing, labelling, codes or expiration dates, should be color-fast and resistant to weathering. Tests established for one container or label may be applied to other products using similar containers and formulations.

1.7 Containers of a specific design which have ben qualified through tests performed for one specific product, must be retested if they are to be used with another product, or with a new formulation of the existing product.

1.8 Inspection procedures should be established at container filling sites which assure that the quality of pesticide containers is maintained.

1.9 All liquid containers should have an ullage of at least 5%.

1.10 Reused or reconditioned packaging should meet the same standard as the original packaging.

196

2. PESTICIDE CONTAINER STANDARDS

General

All pesticide containers shall protect both the active ingredient and the qualities of the formulation for a period of two years to an acceptable level. The external surfaces of the container shall not have been, nor shall become contaminated with the content. Each container type and formulation should be tested before distribution by the test procedure required. The results of these tests shall be recorded. At the time of initial manufacture and distribution, representative samples shall be further tested under worst case ambient conditions, to provide confirmatory results. In the event that the shelf life is less than two years, each package must be clearly marked with an expiry date.

All containers and formulations used in testing shall be manufactured from materials similar to those used at the time of product distribution. In the event that the size or shape of the container or the thickness of the walls or the coatings is changed for distribution, then the test procedure will be repeated.

Closures shall be tested together with containers. Changes of closure type, coatings or liners, shall require repeated testing.

Where required, impact or drop tests will be performed to the required test procedures and the results recorded.

2.1 Inside Containers

Inside containers are defined as those which require an overpack to provide protection during shipment, handling and storage. Inside containers may be removed from overpacks for sale or display.

2.1.1 Bags containing not more than 10 kg

Bags shall be constructed of one or more plies of paper film or aluminum foil. Bags will be tested by approved procedures for compatibility and resistance to impact.

2.1.2 Bottles containing not more than 1 kg or 1 L

Bottles shall be fitted with closures, which in the case of liquids, will not exceed 63 mm. Polyethylene or other plastic bottles shall only be constructed from resins having a known high level of resistance to environmental stress cracking. Bottles will be tested by approved procedures for compatibility and resistance to impact. Similar conditions shall apply for plastic containers not exceeding 1 kg or 1 L capacity.

2.1.3 Metal containers containing not more than 10 kg or 20 L

Metal containers shall be constructed from steel, which may be coated with tin or other materials, to provide compatibility with the content and external protection. In addition metal containers

for liquids shall use a gasketing compound at seams which are not joined by welding. Metal containers shall be fitted with closures, which in the case of liquids will not exceed 63 mm. Metal containers will be tested by approved procedures for compatibility and resistance to impact.

2.2 Overpacks

Overpacks are defined as containers, such as boxes or cartons, which provide essential levels of protection to one or more inside containers. Overpacks shall be sufficiently rigid to prevent compaction or other damage to contents. Where required internal packing materials should be used to assist in protecting the contents.

2.2.1 The quality of board used for overpacks shall not be measured as less than 190 g/m^2 when tested by the approved procedure.

2.2.2 Overpacks shall be drop tested while containing inside containers filled with water or other suitable inert material by the approved Procedure.

2.3 Bulk Containers

Bulk containers are defined as rigid wall packages which may be metal, polyethylene or fibre drums or heavy duty corrugated paper boxes.

2.3.1 Drums containing not more than 250 kg or 200 L

Drums shall be constructed from steel, which shall be coated internally with a rust preventative or corrosion resistant medium and externally so as to be rust resistant. In addition, all seams not joined by welding shall use a gasketing compound. Polyethylene drums shall be manufactured from resins with a known high level of resistance to environmental stress cracking. Fibre drums and corrugated boxes, manufactured from paper, shall be internally lined with sealed polyethylene bags, having a thickness of not less than 0.05 mm. The size of closures for liquid containers shall not exceed 63 mm. Bulk containers shall be tested by approved Procedure for compatibility and impact resistance.

3. SELECTION OF APPROPRIATE PESTICIDE CONTAINERS

3.1 Solid Products - Powders, Dusts or Granules

3.1.1 Small packages, usually up to 3.0 kg capacity, can generally be selected from ready made packaging, such as bags, pouches, canisters, cans, glass or plastic jars.

3.1.1.1 Bags or pouches should be manufactured so as to be leakproof through bottom and sides. The top will be open for filling, and must subsequently be sealed so as to become leakproof, usually through a combination of heat and pressure, using a standard heat sealing device. Bags and pouches are often manufactured with more than one ply of

material. The inner ply will usually be polyethylene film, which is useful for sealing, provides an excellent moisture barrier and is resistant to attack by most chemicals. The thickness of this film should not be less than 0.02 mm. Thicker films, up to 0.05 mm are often needed to achieve leakproof seals after filling.

3.1.1.2 Canisters and cans should be manufactured with leakproof bottoms and tops for filling. Canisters use layers of paper to form the body, which can be embedded with polyethylene or other materials, such as aluminum foil, to develop necessary barrier qualities. Canisters can be made with round or rectangular section. Cans are normally manufactured from tinplate, thin steel sheet coated with tin on both sides, and can also be round or rectangular. Tinplate normally provides good environmental and chemical protection, making it a useful packaging medium. Occasionally, corrosion occurs, which is preventable through use of an inner coating. These coatings can only be satisfactorily applied to round cans. When required, outer coatings of paint or varnish can be applied.

There is variety of closures for canisters and cans, the most useful in the case of solids, being the replaceable plug. When controlled application is needed, sifter tops in tinplate and plastic are available. Screw-on closures are also available.

3.1.1.3 Glass or plastic jars are one piece containers comprising bottom and body, manufactured for top filling, and are often available in standard sizes. Glass is seldom corroded by pesticide formulations but is seldom used for packaging solids. Plastic jars made from polyethylene are particularly useful, due to their moisture barrier and shatterproof characteristics. Other plastics may be used for jar manufacture at some cost to overall packaging qualities.

Closures for glass and plastic jars should be of the screw-on type, unless an alternate closure is shown to have sufficient retentive capability.

3.1.2 Large packages, typically sized between 10 and 30 kg, can be selected from sacks, fibre, plastic or steel drums or corrugated boxes.

3.1.2.1 Sacks should be manufactured so as to be leakproof and may be filled through an open top or through a valved opening. The valved sack is to be generally preferred in many operations, since any dust generated in filling, is easier to control and there is no requirement for closing, other than, with some designs, having to fold and tuck the valve. Sacks may be manufactured entirely from polyethylene film or from layers of paper and film, or other barriers. Sacks which are open at the top for filling will be

199

subsequently closed either by sewing or heat sealing. Sewn tops are not leakproof for dusts and powders and do not provide moisture resistant seals unless special over-taping methods are employed.

Valved sacks manufactured from multiple layers of paper will usually have minor leak points at the top and bottom, due to the manufacturer's difficulty in controlling the requisite folds and their adhesion. However, when made from polyethylene, valved sacks can be expected to be fully leakproof.

When filled with powders and leakproof closed, sacks will always contain some entrapped air. Since this takes time to dissipate, there is often difficulty in stacking filled sacks on pallets. It is therefore desirable to have a means of venting the container, usually accomplished through perforations through the inner plys of multiple ply sacks, or through one-way venting systems with polyethylene sacks. Air can be removed through vents by squeezing the sack in a horizontal position with the product evenly distributed. This can be done by use of a weight, or by two appropriately spaced roller conveyors, set one above the other.

3.1.2.2 Fibre, plastic or steel drums will usually be standard sizes. Linings are often used in the form of polyethylene bags either for moisture protection or to reduce drum contamination and ease cleaning for reuse. The drums will have full size removable heads, which should have been capable of being locked on after filling, so as to maintain integrity through rough handling.

Fibre drums are manufactured from layers of paper and can have polyethylene or other barriers such as aluminum foil embedded. Plastic drums are manufactured from polyethylene, providing an excellent moisture barrier. Steel drums will provide maximum protection and can be protected against corrosion either by use of coatings or polyethylene bags.

The use of any of these large rigid containers provides excellent protection against compaction.

Drums can all be closed, using a variety of heads. Since gasketing is frequently used, it is important to check compatibility.

3.2 Liquid Products

3.2.1 Small containers, sized up to 5 liters, can generally be selected from available stock packaging. Types used are cans, or bottles with necks, made from glass or plastic.

3.2.1.1 Cans should be manufactured with leakproof ends which use gasketing compounds at the interface with the body. Side seams should be welded or soldered. Cans, which are manufactured from tinplate, usually provide excellent protection to liquid formulations. In the event that additional internal protection against corrosion is required, coatings can be applied to round cans.

Care should be taken to ensure that minimal volumes of water are present in cans or formulations at the time of packaging to avoid the development of rust and pinholes. Defective compound and side seaming and the presence of water are major causes of can failure.

Glass or plastic bottles with necks are useful for liquids, since they enable pouring without spill.

Glass bottles are excellent for chemical packaging, due to characteristic inertness, but are more liable to break or shatter during a typical life cycle. Some plastic bottles, usually made form polyethylene, are useful for containing formulations without solvents. However, new developments in this field have overcome the problem with deterioration by solvents. Special care must also be taken in the design of outer containers for small plastic bottles, to protect them from becoming crushed when stacked during storage. Under these conditions cracks readily develop and leaking occurs.

3.2.1.2 Closures for small liquid containers should be of the screw-on type and for ease of pouring should be sized in relation to the viscosity of the formulation, thicker products requiring large openings, the two most useful sizes being 38 and 63 mm. The closure liner should be compatible with the product and should also afford a good seal at the interface with the top of the neck.

3.2.2 Large liquid containers, typically sized between 10 and 200 liters are usually of standard varieties, such as jerry cans and drums manufactured from steel or plastic. Liquids should always be packaged in containers with closed heads. In the case of drums the head should be seamed or welded onto the body. Individual openings for dispensing from large liquid containers should not exceed 63 mm but two openings should be placed in the head to improve pourability. In some instances, provisions may be made for a suitable pouring device.

3.2.2.1 Steel containers provide very high levels of strength, with consequent resistance to damage during handling, transportation, storage and stacking. They can be coated internally with a variety of materials which provide resistance to corrosion. Internal coatings should be used and selected with great care to avoid incompatibility. In addition, consideration should always be given to the risk of

coating failure, due to incorrect manufacturing procedures, becoming the cause for major defects. Seaming compounds are used to seal the interface between drum ends and body. Rubber, elastomer or plastic gaskets are used to seal the closures. As with small containers, care should be taken to avoid presence of water when filling.

3.2.2.2 Large plastic containers, usually constructed from polyethylene, are either self-supporting or require an overpack, in the form of a steel drum or a corrugated box. These containers provide excellent protection against moisture, particularly due to the weight or thickness of the walls. This thickness often provides an adequate barrier for the packaging of solvent based formulations, particularly when vapor pressure is low.

3.3 Pressure Packages

3.3.1 Containers which must retain the contents under pressure at ambient temperatures, should be packaged in containers designed to be pressure resistant. The gauge of the metal used for the body and heads, the means of sealing and the construction of the valve are particularly important.

The design, selection and testing of pressure containers is complex and should only be undertaken by trained persons, using carefully calibrated instruments. The shelf life of pressure containers is often less than two years and packers are well advised to limit production in coordination with consumption.

3.4 Overpacks

3.4.1 Overpacks are used to accumulate one or more containers together and often provide extra protection for the side containers, such as protection from handling, stacking and shipping damage.

3.4.2 Overpacks can be constructed from film bags, shrink wrappings, paper or corrugated boxes, depending upon the level of protection required. The most commonly used overpack for pesticides is the box, particularly since it provides low cost, economic protection.

3.4.3 When extremely severe transportation conditions are anticipated, it is advisable to congregate a number of boxes within a wooden crate.

3.5 Closures

3.5.1 Selection of the correct closure is extremely important to successful packaging in rigid containers, especially when they contain liquids. As previously noted, the closure size for liquid containers should be determined from the rate of pour required and the viscosity of the formulation. Closure sizes for liquid

containers should not exceed 63 mm, and it is useful to limit smaller sizes to 38 mm, for the purpose of standardization.

3.5.2 Closures for rigid containers containing powders or granules may be larger than 63 mm, often close to, or similar in size to the diameter of the jar or drum. Tamperproof features built into the closure, which indicate whether a container has been opened are particularly useful. Other tamperproof methods are available, such as shrink-on seals. Closure liners should be carefully selected since they greatly influence overall performance, inadequate liners are often found to be the cause of container defectives. The use of child resistant closures should be encouraged for household packs.

Closures are not designed to be in constant direct contact with the product, only with the vapor phase, and should not be expected to contain liquids when the container is inverted.

Closures should be applied to containers at a torque sufficient to maintain a seal. It is customary for the torque originally applied to reduce with time, usually within 24 hours. The correct method of measurement for closure torque is to measure the opening force.

3.6 Measuring Devices - The development and provision of suitable measuring devices as part of the container as pack should be encouraged. Whenever possible, measure packs should be supplied with the pack size being based on the needs of users in the region.

4. SPECIFICATION OF PESTICIDE CONTAINERS

Specification is not only a useful form of communication between vendor and buyer, but it is also an essential form of communication when purchasing pesticide containers, due to the critical requirements. A means of test or measurement should always be established, using agreed written methods or standard methods such as those developed by the American Society for Testing and Materials (A.S.T.M.). The use of agreed or written methods is often satisfactory for day-to-day use, with an added agreement to use A.S.T.M. methods for reference purposes.

5. TESTING OF PESTICIDE CONTAINERS

Container performance tests provide a useful means of determining prior to initial shipment the probability of the container providing the level of protection established in these guidelines. Confirmatory tests should be carried out prior to gearing up for production to ratify the efficacy of the original work. The use of specific test procedures improves communication between interested parties, such as regulatory bodies and container manufacturers and users. Test procedures can be developed with varying levels of complexity, depending on the facilities and personnel available. The determination of successful pesticide packaging can usually be done by means of practical procedures. For referee purposes, well established test procedures, such as those published by A.S.T.M. or other internationally recognized bodies should be used. Useful test procedures can be established based on the U.N. packaging

recommendations, or other test procedures established by the country, those listed by the British or U.S. Department of Transportation or those published in Chemistry and Industry No. 4, dated February 18, 1978, pages 107-115.

6. PESTICIDE CONTAINER STORAGE STANDARDS

6.1 Rules for Storing and Display of Pesticide Containers

6.1.1 Construct and maintain areas so that the risk of contamination to other products is avoided.

6.1.2 Clearly mark the area with warning signs.

6.1.3 Store pesticides in original labelled containers, positioned so that the label is clearly visible.

6.1.4 Design the area so that the chemical and physical properties of the product, shelf life, are likely to be maintained.

6.1.5 Separate volatile pesticides from other pesticides to avoid cross contamination and always store in an unrestricted atmosphere.

6.1.6 Rotate stock to avoid expiration of shelf life if the product is to be stored over seasons and try to maintain stock to a reasonable operating minimum.

6.1.7 Display separately from other products in the store through use of partitions or separate enclosures.

6.2 Security and Safety in Pesticide Storage Areas

6.2.1 All pesticide storage areas should be kept locked to avoid theft or unauthorized access.

6.2.2 Regular inspection of the storage area should be undertaken, giving special attention to damage, spills and deterioration. Cleanup and decontamination shall be done speedily, but not without reference to the product manufacturer's safety information.

204

Reference	Notes

APPENDIX E

INTERNATIONAL CODE OF CONDUCT ON THE DISTRIBUTION AND USE OF PESTICIDES

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1986

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The Food and Agriculture Organization of the United Nations wishes to encourage the dissemination of the material contained in this publication and welcomes applications for its reproduction and use. Such applications, with a statement of the purpose and extent of the reproduction, should be addressed to the Director, Publications Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.

© FAO 1986

Printed in Italy

CONTENTS

Introduction E-1

Text of the Code E-4

Article 1. Objectives of the Code E-4

Article 2. Definitions E-5

Article 3. Pesticide management E-8

Article 4. Testing of pesticides E-9

Article 5. Reducing health hazards E-10

Article 6. Regulatory and technical requirements E-12

Article 7. Availability and use E-12

Article 8. Distribution and trade E-13

Article 9. Information exchange E-15

Article 10. Labelling, packaging, storage and disposal . E-16

Article 11. Advertising E-17

Article 12. Monitoring the observance of the Code E-18

Annex: FAO Conference Resolution 10/85 . . . . . E-20

References E-22

Reference	Notes

INTERNATIONAL CODE OF CONDUCT ON THE DISTRIBUTION AND USE OF PESTICIDES

INTRODUCTION

The action by FAO to develop, in consultation with appropriate United Nations agencies and other organizations, an International Code of Conduct on the Distribution and Use of Pesticides follows and accompanies many other events, some going back 25 years. All these events were designed to benefit the international community and to serve to increase international confidence in the availability, regulation, marketing and use of pesticides for the improvement of agriculture, public health and personal comfort.

One of the basic functions of the Code, which is voluntary in nature, is to serve as a point of reference, particularly until such time as countries have established adequate regulatory infrastructures for pesticides.

The Director-General of FAO in 1981 suggested that such a Code could help to overcome a number of difficulties associated with pesticides. The FAO Panel of Experts on Pesticide Specifications, Registration Requirements and Application Standards, at its meeting in 1982, agreed that activities involving the export and import of pesticides, and thereby their safe use, might be best dealt with through the adoption of a Code of Conduct. To that end a working paper was prepared for the FAO Second Government Consultation on International Harmonization of Pesticide Registration Requirements, Rome, 11-15 October 1982. The formal decision to develop the Code was taken at that Consultation, which recommended that FAO, in consultation with the appropriate United Nations organizations and bodies and international organizations outside the United Nations system, should draft a Code (1). The Code itself was adopted by the FAO Conference at its Twenty-third Session in 1985 by way of Resolution 10/85, which appears as an Annex to the present publication.

A number of governments and organizations have expressed concern about the propriety of supplying pesticides to countries which do not have infrastructures to register pesticides and thereby to ensure their safe and effective use. It should be noted that the development of national regulatory programmes is the first priority of FAO activities in this field. There has also been concern over the possibility that residues of certain pesticides, not needed or not permitted in particular countries, are present in imported agricultural commodities produced in other countries where the use of such pesticides is not restricted. While recognizing that it is impossible to eliminate all such occurrences, because of diverging pest control needs, it is none the less essential that every effort be made to apply pesticides only in accordance with good and recognized practices. It is at the same time important for industrially developed countries to recognize, in their regulatory activities concerning residues, the pest control needs of developing countries, particularly the needs of countries in tropical regions.

210

In the absence of an effective pesticide registration process and of a governmental infrastructure for controlling the availability of pesticides, some countries importing pesticides must heavily rely on the pesticide industry to promote the safe and proper distribution and use of pesticides. In these circumstances foreign manufacturers, exporters and importers, as well as local formulators, distributors, repackers, advisers and users, must accept a share of the responsibility for safety and efficiency in distribution and use.

The role of the exporting country needs to be considered. Much emphasis has been given recently to the desirability of regulating the export of pesticides from producing countries. It is generally accepted that no company should trade in pesticides without a proper and thorough evaluation of the pesticide, including any risks. However, the fact that a product is not used or registered in a particular exporting country is not necessarily a valid reason for prohibiting the export of that pesticide. Developing countries are mostly situated in tropical and semi-tropical regions. Their climatic, ecological, agronomic, social, economic and environmental conditions and therefore their pest problems are usually quite different from those prevailing in countries in which pesticides are manufactured and exported. The government of the exporting country, therefore, is in no position to judge the suitability, efficacy, safety or fate of the pesticide under the conditions in the country where it may ultimately be used. Such a judgement must, therefore, be made by the responsible authority in the importing country in consultation with industry and other government authorities in the light of the scientific evaluation that has been made and a detailed knowledge of the conditions prevailing in the country of proposed use.

The export to developing countries of pesticides which have been banned in one or more other countries or whose use has been severely restricted in some industrialized countries has been a subject of public concern which has led to intensive discussions on whether the exporting country should assume responsibility for the marketing and use of such products in the importing country. In this respect it is essential to note that when pesticides are banned, the reasons are toxicological, environmental or social. Valid and adequate toxicological reasons justifying banning a product are of concern, though not necessarily of equal importance, to most countries. Consequently, such products should not be exported or imported without careful consideration of the toxicological implications for those likely to be exposed.

While a Code of Conduct may not solve all problems, nevertheless it should go a long way toward defining and clarifying the responsibilities of the various parties involved in the development, distribution and use of pesticides, and it should be of particular value in countries which do not yet have control procedures. Where there is a pesticide regulatory process in a country, the need for a Code of Conduct will obviously be less than where there is no such scheme in operation.

The Code of Conduct is not a short or simple document, mainly because the nature, properties, uses and effects of pesticides are diverse and therefore require comprehensive consideration. Furthermore, the strong public pressure for banning or restricting the use of some effective and

much-needed pesticides often stems from a lack of understanding of the many important issues involved. This document is designed, therefore, also to provide the general public with some basic guidance on these issues.

212

Article 1. Objectives of the Code

1.1 The objectives of this Code are to set forth responsibilities and establish voluntary standards of conduct for all public and private entities engaged in or affecting the distribution and use of pesticides, particularly where there is no or an inadequate national law to regulate pesticides.

1.2 The Code describes the shared responsibility of many segments of society, including governments, individually or in regional groupings, industry, trade and international institutions, to work together so that the benefits to be derived from the necessary and acceptable use of pesticides are achieved without significant adverse effects on people or the environment. To this end, all references in this Code to a government or governments shall be deemed to apply equally to regional groupings of governments for matters falling within their areas of competence.

1.3 The Code addresses the need for a cooperative effort between governments of exporting and importing countries to promote practices which ensure efficient and safe use while minimizing health and environmental concerns due to improper handling or use.

1.4 The entities which are addressed by this Code include international organizations; governments of exporting and importing countries; industry, including manufacturers, trade associations, formulators and distributors; users; and public-sector organizations such as environmental groups, consumer groups and trade unions.

1.5 The standards of conduct set forth by this Code:

1.5.1 encourage responsible and generally accepted trade practices;

1.5.2 assist countries which have not yet established controls designed to regulate the quality and suitability of pesticide products needed in that country and to address the safe handling and use of such products;

1.5.3 promote practices which encourage the safe and efficient use of pesticides, including minimizing adverse effects on humans and the environment and preventing accidental poisoning from improper handling;

1.5.4 ensure that pesticides are used effectively for the improvement of agricultural production and of human, animal and plant health.

1.6 The Code is designed to be used, within the context of national law, as a basis whereby government authorities, pesticide manufacturers, those engaged in trade and any citizens concerned may judge whether their proposed actions and the actions of others constitute acceptable practices.

213

Article 2. Definitions

For the purpose of this Code:

Active ingredient means the biologically active part of the pesticide present in a formulation.

Advertising means the promotion of the sale and use of pesticides by print and electronic media, signs, displays, gift, demonstration or word of mouth.

Banned means a pesticide for which all registered uses have been prohibited by final government regulatory action, or for which all requests for registration or equivalent action for all uses have, for health or environmental reasons, not been granted.

Common name means the name assigned to a pesticide active ingredient by the International Standards Organization or adopted by national standards authorities to be used as a generic or non-proprietary name for that particular active ingredient only.

Distinguishing name means the name under which the pesticide is labelled, registered and promoted by the manufacturer and which, if protected under national legislation, can be used exclusively by the manufacturer to distinguish the product from other pesticides containing the same active ingredient.

Distribution means the process by which pesticides are supplied through trade channels on local or international markets.

Environment means surroundings, including water, air, soil and their interrelationship as well as all relationships between them and any living organisms.

Extension service means those entities in the country concerned responsible for the transfer of information and advice to farmers regarding the improvement of agricultural practices, including production, handling, storage and marketing.

Formulation means the combination of various ingredients designed to render the product useful and effective for the purpose claimed; the form of the pesticide as purchased by users.

Hazard means the likelihood that a pesticide will cause an adverse effect (injury) under the conditions in which it is used.

Integrated pest management means 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 a manner as possible and maintains the pest populations at levels below those causing economically unacceptable damage or loss.

Label means the written, printed or graphic matter on, or attached to, the pesticide; or the immediate container thereof and the outside container or wrapper of the retail package of the pesticide.

Manufacturer means a corporation or other entity in the public or private sector or any individual engaged in the business or function (whether directly or through an agent or through an entity controlled by or under contract with it) of manufacturing a pesticide active ingredient or preparing its formulation or product.

Marketing means the overall process of product promotion, including advertising, product public relations and information services as well as distribution and selling on local or international markets.

Maximum residue limit (MRL) means the maximum concentration of a residue that is legally permitted or recognized as acceptable in or on a food, agricultural commodity or animal feedstuff.

Packaging means the container together with the protective wrapping used to carry pesticide products via wholesale or retail distribution to users.

Pesticide means any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant-growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Pesticide industry means all those organizations and individuals engaged in manufacturing, formulating or marketing pesticides and pesticide products.

Pesticide legislation means any laws or regulations introduced to regulate the manufacture, marketing, storage, labelling, packaging and use of pesticides in their qualitative, quantitative and environmental aspects.

Poison means a substance that can cause disturbance of structure or function, leading to injury or death when absorbed in relatively small amounts by human beings, plants or animals.

Poisoning means occurrence of damage or disturbance caused by a poison, and includes intoxication.

Product means the pesticide in the form in which it is packaged and sold; it usually contains an active ingredient plus adjuvants and may require dilution prior to use.

Protective clothing means any clothes, materials or devices that are designed to provide protection from pesticides when they are handled or applied.

Public-sector groups means (but is not limited to) scientific associations; farmer groups; citizens' organizations; environmental, consumer and health organizations; and labour unions.

Registration means the process whereby the responsible national government authority approves the sale and use of a pesticide following the evaluation of comprehensive scientific data demonstrating that the product is effective for the purposes intended and not unduly hazardous to human or animal health or the environment.

Repackaging means the transfer of pesticide from any commercial package into any other, usually smaller, container for subsequent sale.

Residue means any specified substances in food, agricultural commodities, or animal feed resulting from the use of a pesticide. The term includes any derivatives of a pesticide, such as conversion products, metabolites, reaction products, and impurities considered to be of toxicological significance. The term "pesticide residue" includes residues from unknown or unavoidable sources (e.g., environmental) as well as known uses of the chemical.

Responsible authority means the government agency or agencies responsible for regulating the manufacture, distribution or use of pesticides and more generally for implementing pesticide legislation.

Risk means the expected frequency of undesirable effects of exposure to the pesticide.

Severely restricted -- a limited ban -- means a pesticide for which virtually all registered uses have been prohibited by final government regulatory action but certain specific registered use or uses remain authorized.

Toxicity means a physiological or biological property which determines the capacity of a chemical to do harm or produce injury to a living organism by other than mechanical means.

Trader means anyone engaged in trade, including export, import, formulation and domestic distribution.

Use pattern embodies the combination of all factors involved in the use of a pesticide, including the concentration of active ingredient in the preparation being applied, rate of application, time of treatment, number of treatments, use of adjuvants and methods and sites of application which determine the quantity applied, timing of treatment and interval before harvest, etc.

Article 3. Pesticide management

3.1 Governments have the overall responsibility and should take the specific powers to regulate the distribution and use of pesticides in their countries.

3.2 The pesticide industry should adhere to the provisions of this Code as a standard for the manufacture, distribution and advertising of pesticides, particularly in countries lacking appropriate legislation and advisory services.

3.3 Governments of exporting countries should help to the extent possible, directly or through their pesticide industries, to:

3.3.1 provide technical assistance to other countries, especially those with shortages of technical expertise, in the assessment of the relevant data on pesticides, including those provided by industry (see also Article 4);

3.3.2 ensure that good trading practices are followed in the export of pesticides, especially to those countries with no or limited regulatory schemes (see also Articles 8 and 9).

3.4 Manufacturers and traders should observe the following practices in pesticide management, especially in countries without legislation or means of implementing regulations;

3.4.1 supply only pesticides of adequate quality, packaged and labelled as appropriate for each specific market;

3.4.2 pay special attention to formulations, presentation, packaging and labelling in order to reduce hazard to users, to the maximum extent possible consistent with the effective functioning of the pesticide in the particular circumstances in which it is to be used;

3.4.3 provide, with each package of pesticide, information and instructions in a form and language adequate to ensure safe and effective use;

3.4.4 retain an active interest in following their products to the ultimate consumer, keeping track of major uses and the occurrence of any problems arising in the actual use of their products as a basis for determining the need for changes in labelling, directions for use, packaging, formulation or product availability.

3.5 Pesticides whose handling and application require the use of uncomfortable and expensive protective clothing and equipment should be avoided, especially in the case of small-scale users in tropical climates.

3.6 National and international organizations, governments, and pesticide industries should take action in coordinated efforts to disseminate educational materials of all types to pesticide users, farmers, farmers' organizations, agricultural workers, unions and other interested parties.

Similarly, affected parties should seek and understand educational materials before using pesticides and should follow proper procedures.

3.7 Governments should allocate high priority and adequate resources to the task of effectively managing the availability, distribution and use of pesticides in their countries.

3.8 Concerted efforts should be made by governments and pesticide industries to develop and promote integrated pest management systems and the use of safe, efficient, cost-effective application methods. Public-sector groups and international organizations should actively support such activities.

3.9 International organizations should provide information on specific pesticides and give guidance on methods of analysis through the provision of criteria documents, fact sheets, training sessions, etc.

3.10 It is recognized that the development of resistance of pests to pesticides can be a major problem. Therefore, governments, industry, national institutions, international organizations and public-sector groups should collaborate in developing strategies which will prolong the useful life of valuable pesticides and reduce the adverse effects of the development of resistant species.

Article 4. Testing of pesticides

4.1 Pesticide manufacturers are expected to:

4.1.1 ensure that each pesticide and pesticide product is adequately and effectively tested by well-recognized procedures and test methods so as to fully evaluate its safety, efficacy (2) and fate (3) with regard to the various anticipated conditions in regions or countries of use;

4.1.2 ensure that such tests are conducted in accordance with sound scientific procedures and good laboratory practice (4) -- the data produced by such tests, when evaluated by competent experts, must be capable of showing whether the product can be handled and used safely without unacceptable hazard to human health, plants, animals, wildlife and the environment (3);

4.1.3 make available copies or summaries of the original reports of such tests for assessment by responsible government authorities in all countries where the pesticide is to be offered for sale. Evaluation of the data should be referred to qualified experts;

4.1.4 take care to see that the proposed use pattern, label claims and directions, packages, technical literature and advertising truly reflect the outcome of these scientific tests and assessments;

4.1.5 provide, at the request of a country, advice on methods for the analysis of any active ingredient of formulation that they manufacture, and provide the necessary analytical standards;

4.1.6 provide advice and assistance for training technical staff in relevant analytical work. Formulators should actively support this effort;

4.1.7 conduct residue trials prior to marketing in accordance with FAO guidelines on good analytical practice (5) and on crop residue data (6, 7) in order to provide a basis for establishing appropriate maximum residue limits (MRLs).

4.2 Each country should possess or have access to facilities to verify and exercise control over the quality of pesticides offered for sale, to establish the quantity of the active ingredient or ingredients and the suitability of their formulation (8).

4.3 International organizations and other interested bodies should, within available resources, consider assisting in the establishment of analytical laboratories in pesticide-importing countries, either on a country or on a multilateral regional basis; these laboratories should be capable of carrying out product and residue analysis and should have adequate supplies of analytical standards, solvents and reagents.

4.4 Exporting governments and international organizations must play an active role in assisting developing countries in training personnel in the interpretation and evaluation of test data.

4.5 Industry and governments should collaborate in conducting post-registration surveillance or monitoring studies to determine the fate and environmental effect of pesticides under field conditions (3).

Article 5. Reducing health hazards

5.1 Governments which have not already done so should:

5.1.1 implement a pesticide registration and control scheme along the lines set out in Article 6;

5.1.2 decide, and from time to time review, the pesticides to be marketed in their country, their acceptable uses and their availability to each segment of the public;

5.1.3 provide guidance and instructions for the treatment of suspected pesticide poisoning for their basic health workers, physicians and hospital staff;

5.1.4 establish national or regional poisoning information and control centres at strategic locations to provide immediate guidance on first aid and medical treatment, accessible at all times by telephone or radio. Governments should collect reliable information about the health aspects of pesticides. Suitably trained people with adequate resources must be made available to ensure that accurate information is collected;

5.1.5 keep extension and advisory services, as well as farmers' organizations, adequately informed about the range of pesticide products available for use in each area;

5.1.6 ensure, with the cooperation of industry, that where pesticides are available through outlets which also deal in food, medicines, other products for internal consumption or tropical application, or clothing, they are physically segregated from other merchandise, so as to avoid any possibility of contamination or of mistaken identity. Where appropriate, they should be clearly marked as hazardous materials. Every effort should be made to publicize the dangers of storing foodstuffs and pesticides together.

5.2 Even where a control scheme is in operation, industry should:

5.2.1 cooperate in the periodic reassessment of the pesticides which are marketed and in providing the poison control centres and other medical practitioners with information about hazards;

5.2.2 make every reasonable effort to reduce hazard by:

5.2.2.1 making less toxic formulations available;

5.2.2.2 introducing products in ready-to-use packages and otherwise developing safer and more efficient methods of application;

5.2.2.3 using containers that are not attractive for subsequent reuse and promoting programmes to discourage their reuse;

5.2.2.4 using containers that are safe (e.g., not attractive to or easily opened by children), particularly for the more toxic home-use products;

5.2.2.5 using clear and concise labelling;

5.2.3 halt sale, and recall products, when safe use does not seem possible under any use directions or restrictions.

5.3 Government and industry should further reduce hazards by making provision for safe storage and disposal of pesticides and containers at both warehouse and farm level, and through proper siting and control of wastes from formulating plants.

5.4 To avoid unjustified confusion and alarm among the public, public-sector groups should consider all available facts and try to distinguish between major differences in levels of risk among pesticides and uses.

5.5 In establishing production facilities in developing countries, manufacturers and governments should cooperate to:

5.5.1 adopt engineering standards and safe operating practices appropriate to the nature of the manufacturing and the hazards involved;

5.5.2 take all necessary precautions to protect the health and safety of operatives, bystanders and the environment;

5.5.3 maintain quality-assurance procedures to ensure that the products manufactured comply to the relevant standards of purity, performance, stability and safety.

Article 6. Regulatory and technical requirements

6.1 Governments should:

6.1.1 take action to introduce the necessary legislation for the regulation, including registration, of pesticides and make provisions for its effective enforcement, including the establishment of appropriate educational, advisory, extension and health-care services; the FAO guidelines for the registration and control of pesticides (9) should be followed, as far as possible, taking full account of local needs, social and economic conditions, levels of literacy, climatic conditions and availability of pesticide application equipment;

6.1.2 strive to establish pesticide registration schemes and infrastructures under which products can be registered prior to domestic use and, accordingly, ensure that each pesticide product is registered under the laws or regulations of the country of use before it can be made available there;

6.1.3 protect the proprietary rights to use of data;

6.1.4 collect and record data on the actual import, formulation and use of pesticides in each country in order to assess the extent of any possible effects on human health or the environment, and to follow trends in use levels for economic and other purposes.

6.2 The pesticides industry should:

6.2.1 provide an objective appraisal together with the necessary supporting data on each product;

6.2.2 ensure that the active ingredient and other ingredients of pesticide preparations marketed correspond in identity, quality, purity and composition to the substances tested, evaluated and cleared for toxicological and environmental acceptability;

6.2.3 ensure that active ingredients and formulated products for pesticides for which international specifications have been developed conform with the specifications of FAO (8), where intended for use in agriculture; and with WHO pesticide specifications (10), where intended for use in public health;

6.2.4 verify the quality and purity of the pesticides offered for sale;

6.2.5 when problems occur, voluntarily take corrective action, and when requested by governments, help find solutions to difficulties.

Article 7. Availability and use

7.1 Responsible authorities should give special attention to drafting rules and regulations on the availability of pesticides. These should be compatible with existing levels of training and expertise in handling pesticides on the part of the intended users. The parameters on which such

221

decisions are based vary widely and must be left to the discretion of each government, bearing in mind the situation prevailing in the country.

7.2 In addition, governments should take note of and, where appropriate, follow the WHO classifications of pesticides by hazard (11) and associate the hazard class with well-recognized hazard symbols as the basis for their own regulatory measures. In any event, the type of formulation and method of application should be taken into account in determining the risk and degree of restriction appropriate to the product.

7.3 Two methods of restricting availability can be exercised by the responsible authority; not registering a product; or, as a condition of registration, restricting the availability to certain groups of users in accordance with national assessments of hazards involved in the use of the product in the particular country.

7.4 All pesticides made available to the general public should be packaged and labelled in a manner which is consistent with the FAO guidelines on packaging (12) and labelling (13) and with appropriate national regulations.

7.5 Prohibition of the importation, sale and purchase of an extremely toxic product may be desirable if control measures or good marketing practices are insufficient to ensure that the product can be used safely. However, this is a matter for decision in the light of national circumstances.

Article 8. Distribution and trade

8.1 Industry should:

8.1.1 test all pesticide products to evaluate safety with regard to human health and the environment prior to marketing, as provided for in Article 4, and ensure that all pesticide products are likewise adequately tested for efficacy and stability and crop tolerance, under procedures that will predict performance under the conditions prevailing in the region where the product is to be used, before they are offered there for sale;

8.1.2 submit the results of all such tests to the local responsible authority for independent evaluation and approval before the products enter trade channels in that country;

8.1.3 take all necessary steps to ensure that pesticides entering international trade conform to relevant FAO, (8), WHO (10) or equivalent specifications for composition and quality (where such specifications have been developed) and to the principles embodied in pertinent FAO guidelines, and in rules and regulations on classification and packaging, marketing,

212

labelling and documentation laid down by international organizations concerned with modes of transport (ICAO, IMO, RID and IATA in particular);[1]

8.1.4 undertake to see that pesticides which are manufactured for export are subject to the same quality requirements and standards as those applied by the manufacturer to comparable domestic products;

8.1.5 ensure that pesticides manufactured or formulated by a subsidiary company meet appropriate quality requirements and standards which should be consistent with the requirements of the host country and of the parent company;

8.1.6 encourage importing agencies, national or regional formulators, and their respective trade organizations to cooperate in order to achieve fair practices and safe marketing and distribution practices and to collaborate with authorities in stamping out any malpractices within the industry;

8.1.7 recognize that the recall of a pesticide by a manufacturer and distributor may be desirable when faced with a pesticide which represents an unacceptable hazard to human and animal health and the environment when used as recommended, and cooperate accordingly;

8.1.8 endeavour to ensure that pesticides are traded by and purchased from reputable traders, who should preferably be members of a recognized trade organization;

8.1.9 see that persons involved in the sale of any pesticide are trained adequately to ensure that they are capable of providing the buyer with advice on safe and efficient use;

8.1.10 provide a range of pack sizes and types which are appropriate for the needs of small-scale farmers and other local users to avoid handling hazards and the risk that resellers will repackage products into unlabelled or inappropriate containers.

8.2 Governments and responsible authorities should take the necessary regulatory measures to prohibit the repackaging, decanting or dispensing of any pesticide in food or beverage containers and should rigidly enforce punitive measures that effectively deter such practices.

8.3 Governments of countries importing food and agricultural commodities should recognize good agricultural practices in countries with which they trade and, in accordance with recommendations of the Codex Alimentarius Commission, should establish a legal basis for the acceptance of pesticide residues resulting from such good agricultural practices (7, 14).

---

[1] ICAO: International Civil Aviation Organization
IMO: International Maritime Organization
RID: International regulations concerning the carriage of dangerous goods by rail
IATA: International Air Transport Association

Article 9. Information exchange

9.1 The government of a pesticide-exporting country which takes action to ban or severely restrict the use or handling of a pesticide in order to protect health or the environment domestically should notify, directly or indirectly, the designated national authorities in other countries of the action it has taken (15).

9.2 The purpose of the notification regarding control action is to give competent authorities in other countries the opportunity to assess the risks associated with the pesticide, and to make timely and informed decisions as to the importation and use of the pesticides concerned, after taking into account local, public-health, economic, environmental and administrative conditions. The minimum information to be provided for this purpose should be:

9.2.1 the identity (common name, distinguishing name and chemical name);

9.2.2 a summary of the control action taken and of the reasons for it -- if the control action bans or restricts certain uses but allows other uses, such information should be included;

9.2.3 the fact that additional information is available, and the name and address of the contact point in the country of export to which a request for further information should be addressed.

9.3 If export of a banned or severely restricted pesticide occurs, the country of export should ensure that necessary steps are taken to provide the designated national authority of the country of import with relevant information.

9.4 The purpose of information regarding exports is to remind the country of import of the original notification regarding control action and to alert it to the fact that an export is expected or is about to occur. The minimum information to be provided for this purpose should be:

9.4.1 a copy of, or reference to, the information provided at the time of the notification of control action;

9.4.2 indication that an export of the chemical concerned is expected or is about to occur.

9.5 Notification of control action should be provided as soon as practicable after the control action is taken. For pesticides banned or severely restricted before the implementation of the Code, an inventory of prior control action should be provided to the International Register of Potentially Toxic Chemicals (IRPTC), unless such information has already been provided.

9.6 Provision of information regarding exports should take place at the time of the first export following the control action, and should recur in the case of any significant development of new information or condition surrounding the control action. It is the intention that the information should be provided prior to export.

9.7 The provision of such information by the exporting country must take into account protection of the confidentiality of data in the importing country.

9.8 Governments of importing countries should:

9.8.1 establish internal procedures for the receipt and handling of such information from the exporting country;

9.8.2 ensure that such information received is not used in any manner which would be inconsistent with the provisions of the General Agreement on Tariffs and Trade (GATT).

Article 10. Labelling, packaging, storage and disposal

10.1 All pesticide containers should be clearly labelled in accordance with applicable international guidelines, such as the FAO guidelines on good labelling practice (13).

10.2 Industry should use labels that:

10.2.1 include recommendations consistent with those of the recognized research and advisory agencies in the country of sale;

10.2.2 include appropriate symbols and pictograms whenever possible, in addition to written instructions, warnings and precautions;

10.2.3 in international trade, clearly show appropriate WHO hazard classification of the contents (11) or, if this is inappropriate or inconsistent with national regulations, use the relevant classification;

10.2.4 include, in the appropriate language or languages, a warning against the reuse of containers, and instructions for the safe disposal or decontamination of empty containers;

10.2.5 identify each lot or batch of the product in numbers or letters that can be read, transcribed and communicated by anyone without the need for codes or other means of deciphering;

10.2.6 are marked with the date (month and year) of formulation of the lot or batch and with relevant information on the storage stability of the product.

10.3 Industry should ensure that:

10.3.1 packaging, storage and disposal of pesticides conform in principle to the FAO guidelines for packaging and storage (12), the FAO guidelines for the disposal of waste pesticides and containers (16), and WHO specifications for pesticides used in public health (10);

10.3.2 in cooperation with governments, packaging or repackaging is carried out only on licensed premises where the responsible authority is convinced that staff are adequately protected against toxic hazards, that

225

the resulting product will be properly packaged and labelled, and that the content will conform to the relevant quality standards.

10.4 Governments should take the necessary regulatory measures to prohibit the repackaging, decanting or dispensing of any pesticide into food or beverage containers in trade channels and rigidly enforce punitive measures that effectively deter such practices.

Article 11. Advertising

11.1 Industry should ensure that:

11.1.1 all statements used in advertising are capable of technical substantiation;

11.1.2 advertisements do not contain any statement or visual presentation which, directly or by implication, omission, ambiguity or exaggerated claim, is likely to mislead the buyer, in particular with regard to the safety of the product, its nature, composition, or suitability for use, or official recognition or approval;

11.1.3 pesticides which are legally restricted to use by trained or registered operators are not publicly advertised through journals other than those catering for such operations, unless the restricted availability is clearly and prominently shown;

11.1.4 no firm or individual in any one country simultaneously markets different pesticide active ingredients or combinations of ingredients under a single distinguishing name;

11.1.5 advertising does not encourage uses other than those specified on the approved label;

11.1.6 promotional material does not include use recommendations at variance with those of the recognized research and advisory agencies;

11.1.7 advertisements do not misuse research results or quotations from technical and scientific literature; and scientific jargon and irrelevances are not used to make claims appear to have a scientific basis they do not possess;

11.1.8 claims as to safety, including statements such as "safe", "non-poisonous", "harmless", "non-toxic", are not made, with or without a qualifying phrase such as "when used as directed";

11.1.9 statements comparing the safety of different products are not made;

11.1.10 misleading statements are not made concerning the effectiveness of the product;

11.1.11 no guarantees or implied guarantees -- e.g., "more profits with...", "guarantees high yields" -- are given unless definite evidence to substantiate such claims is available;

11.1.12 advertisements do not contain any visual representation of potentially dangerous practices, such as mixing or application without sufficient protective clothing, use near food, or use by or near children;

11.1.13 advertising or promotional material draws attention to the appropriate warning phrases and symbols as laid down in the labelling guidelines (13);

11.1.14 technical literature provides adequate information on correct practice, including the observance of recommended rates, frequency of applications, and safe pre-harvest intervals;

11.1.15 false or misleading comparisons with other pesticides are not made;

11.1.16 all staff involved in sales promotion are adequately trained and possess sufficient technical knowledge to present complete, accurate and valid information on the products sold;

11.1.17 advertisements encourage purchasers and users to read the label carefully, or have the label read to them if they cannot read.

11.2 International organizations and public-sector groups should call attention to departures from this Article.

11.3 Governments are encouraged to work with manufacturers to take advantage of their marketing skills and infrastructure, in order to provide public-service advertising regarding the safe and effective use of pesticides. This advertising could focus on such factors as proper maintenance and use of equipment, special precautions for children and pregnant women, the danger of reusing containers, and the importance of following label directions.

Article 12. Monitoring the observance of the Code

12.1 The Code should be published and should be observed through collaborative action on the part of governments, individually or in regional groupings, appropriate organizations and bodies of the United Nations system, international governmental organizations and the pesticide industry.

12.2 The Code should be brought to the attention of all concerned in the manufacture, marketing and use of pesticides and in the control of such activities so that governments, individually or in regional groupings, industry and international institutions understand their shared responsibilities in working together to ensure that the objectives of the Code are achieved.

12.3 All parties addressed by this Code should observe this Code and should promote the principles and ethics expressed by the Code, irrespective of other parties' ability to observe the Code. The pesticide industry should cooperate fully in the observance of the Code and promote the principles and ethics expressed by the Code, irrespective of a government's ability to observe the Code.

221

12.4 Independently of any measures taken with respect to the observance of this Code, all relevant legal rules, whether legislative, administrative, judicial or customary, dealing with liability, consumer protection, conservation, pollution control and other related subjects should be strictly applied.

12.5 FAO and other competent international organizations should give full support to the observance of the Code, as adopted.

12.6 Governments should monitor the observance of the Code and report on progress made to the Director-General of FAO.

12.7 Governing Bodies should periodically review the relevance and effectiveness of the Code. The Code should be considered a dynamic text which must be brought up to date as required, taking into account technical, economic and social progress.

FAO Conference Resolution 10/85:
International Code of Conduct
on the Distribution and Use of Pesticides

THE CONFERENCE,

Recognizing that increased food production is a high priority need in many parts of the world and that this need cannot be met without the use of indispensable agricultural inputs such as pesticides,

Noting that FAO's study entitled *Agriculture: toward 2000* foresees a steady increase in the worldwide use of pesticides,

Convinced that such growth in pesticide use is likely to take place in spite of necessary intensive parallel efforts to introduce biological and integrated pest control systems,

Acknowledging that pesticides can be hazardous to humans and the environment and that immediate action must be taken by all concerned, including governments, manufacturers, traders and users, to eliminate, as far as possible and within the scope of their responsibility, unreasonable risks, not only in the country of origin but also in the countries to which pesticides may be exported,

Being aware that the requirements for the safe and proper use of pesticides in some developed countries have led to the adoption of complex systems of regulations and of enforcement mechanisms, but that many other countries have neither such mechanisms nor the necessary legislation, regulations or infrastructures to control the import, availability, sale or use of pesticides,

Convinced that additional efforts are needed to enable such countries to control pesticides more effectively and to assess the hazards which could result from their use or misuse,

Recognizing that a voluntary International Code of Conduct, based on internationally agreed technical guidelines, would provide a practical framework for the control of pesticides, especially in countries that do not have adequate pesticide registration and control schemes,

Noting that such a draft Code was reviewed by the Committee on Agriculture at its Eighth Session, and endorsed by the Council at its Eighty-eighth Session,

Having further noted the conclusions and recommendations of these bodies,

1. *Hereby adopts* a voluntary International Code of Conduct on the Distribution and Use of Pesticides as given in the annex to this Resolution;

2. *Recommends* that all FAO Member Nations promote the use of this Code in the interests of safer and more efficient use of pesticides and of increased food production;

3. *Requests* governments to monitor the observance of the Code, in collaboration with the Director-General who will report periodically to the Committee on Agriculture;

4. *Invites* other United Nations agencies and other international organizations to collaborate in this endeavour within their respective spheres of competence.

(Adopted 28 November 1985)

1. *Report of Second Government Consultation on International Harmonization of Pesticide Registration Requirements*, FAO, Rome, 11-15 October 1982.

2. *Guidelines on efficacy data for the registration of pesticides for plant protection.* Rome, FAO. 1985.

3. *Guidelines on environmental criteria for the registration of pesticides.* Rome, FAO. 1985.

4. *Good laboratory practice. Paris, Organisation for Economic Co-operation and Development.* 1981.

5. *Codex guidelines on good practice in pesticide residue analysis.* Rome, FAO. 1984.

6. *Guidelines on crop residue data.* Rome, FAO. 1985.

7. *Codex recommended national regulatory practices to facilitate acceptance and use of Codex maximum limits for pesticide residues in foods.* Rome, FAO. 1985.

8. *The use of FAO specifications for plant protection products. Rome. 1979.* FAO Plant Production and Protection Paper 13.

9. *Guidelines for the registration and control of pesticides (including a model scheme for the establishment of national organizations).* Rome, FAO. 1985.

10. *Specifications for pesticides used in public health*, 6th ed. Geneva, World Health Organization. 1985.

11. *The WHO recommended classification of pesticides by hazard: guidelines to classification 1984-85.* Geneva, World Health Organization. 1984.

12. *Guidelines for the packaging and storage of pesticides.* Rome, FAO. 1985.

13. *Guidelines on good labelling practice for pesticides.* Rome, FAO. 1985.

14. *Guidelines on good agricultural practice in the use of pesticides: guide to Codex recommendations concerning pesticide residues.* Rome, FAO. 1984.

15. *Provisional notification scheme for banned or severely restricted chemicals.* Nairobi, UNEP. 1984.

16. *Guidelines for the disposal of waste pesticides and pesticide containers on the farm.* Rome, FAO. 1985.

APPENDIX F

The Disposal of Waste pesticide and Pesticide Containers

- FAO Guidelines for the Disposal of Waste pesticide Containers on the Farm
- CFR 165--Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticides Containers

Reference	Notes

GUIDELINES FOR THE DISPOSAL OF WASTE PESTICIDE AND PESTICIDE CONTAINERS ON THE FARM

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome - March 1985

Reference	Notes

CONTENTS

PAGE

1. INTRODUCTION F-1

2. DISPOSAL OF WASTE PESTICIDES AND PESTICIDE CONTAINERS ON THE FARM F-3

2.1 Pesticides F-3

2.1.1 Selection of disposal site F-3
2.1.2 Construction and use of the disposal pit F-4

2.2 Pesticide Containers F-4

2.2.1 Decontamination F-4
2.2.2 Disposal F-5

APPENDIX

1. METHODS OF DISPOSAL F-7

1.1 Disposal of Pesticides F-7

1.1.1 Physical methods of disposal F-8
1.1.2 Chemical methods of detoxification F-8
1.1.3 Biological methods of disposal F-9

A. Land disposal F-9
B. Composting F-11
C. Other biological methods F-11

1.1.4 Evaporation basins F-11
1.1.5 Communal disposal methods F-11

1.2 Disposal of Containers F-12

2. GENERAL CONSIDERATIONS F-12

3. RECOMMENDATIONS FOR FARM DISPOSAL F-13

4. FARMER EDUCATION F-14

5. FURTHER READING F-14

Reference	Notes

GUIDELINES FOR THE DISPOSAL OF WASTE PESTICIDE AND PESTICIDE CONTAINERS ON THE FARM

1. INTRODUCTION

Production and use of pesticides around the world leads to the generation of waste pesticide and used pesticide containers at a number of stages between the manufacturer and the farmer. Quantitatively, the processes of manufacture and formulation are the most important points of pesticide waste generation, but the potential hazards associated with waste pesticides and containers on the farm are sufficient to require special attention.

This document is aimed primarily at government agricultural officers, agricultural consultants and others "in the field" who may be asked by farmers for information about pesticide handling, use and disposal. It contains an outline of the nature of the disposal problem, detailed procedures for use by farmers in disposing of containers and waste pesticide and an Appendix which provides background information on the various approaches which may be made to effect disposal. The Appendix also provides a guide to further reading for those wishing to obtain more detail on particular methods.

In the period since World War II, there has been a steady increase in the production and use of synthetic pesticides throughout the world, and at present, the annual worldwide production of active ingredient is between two and three billion kilograms. The wide range of toxicological and environmental hazards associated with pesticides is well known, and much research effort is aimed at the development of pest control methods which will reduce the amount of pesticide necessary. At present, however, there is little to suggest that significant overall reductions will occur in the foreseeable future, and it is more likely that increasing use will be the continuing trend. A different approach to reducing some of the hazards is the move towards invention and commercialization of novel pesticides with a relatively low toxicity to nontarget species, and shorter duration of action in the environment. This favorable trend will probably be furthered by products emerging from biotechnology, and whilst such changes are welcome in terms of both use and disposal of pesticides, it is important that two important facts relating to disposal are recognised: firstly. the large number of pesticides currently in use involve a wide range of properties, and secondly, the quantities needing disposal will probably grow larger in parallel with increasing pesticide use. It therefore seems prudent that advice on safe and effective disposal methods for waste pesticide and containers is made readily and widely available to farmers, preferably before the information is actually required.

Empty or partly empty pesticide containers are found wherever pesticides are used on a farm, and in general the farmer views container disposal as a task which is neither easily nor quickly executed. In the case of pesticides, wastes at use-concentration or less would be generated on almost all farms on which pesticides are used. Wastes of pesticide concentrate (emulsions, powders, granules, etc.) are not as common, and for

example, in countries such as Australia or the UK, will be found on approximately 15% of farms at any one time.

Each aspect of pesticide handling has its own type and degree of potential hazard. In the case of managing waste pesticide and containers poor practices may lead to effects varying from acute through to chronic toxic exposure, in adults and children, pets, livestock and working animals, wildlife, and especially aquatic life. The result of exposure to waste pesticide will normally be the same as exposure in any other situation: whether exposure comes from concentrated or dilute pesticide, or from leaked, spilt, stored, or poorly disposed wastes, the toxicological outcome will depend upon the organism exposed, the situation in which exposure occurs, the duration of exposure, and upon the many variables relating to the pesticide itself, particularly concentration. These comments apply equally to waste pesticides and to the wastes in "empty" containers, which, in practice, differ little from pesticide in full containers.

As observed above, generation of empty pesticide containers, and of waste diluted pesticide is a routine occurrence on most farms where pesticides are used, whilst the generation of waste pesticide concentrates is not. The latter generally requires special circumstances, such as:

(i) suspension or banning of sale of a pesticide;

(ii) decreasing acceptance, for whatever reason, of a particular product among farmers;

(iii) contamination of a packaged pesticide by another pesticide (particularly if by a herbicide);

(iv) stockpiling on the farm of a pesticide, for whatever reason;

(v) increase in resistance of a target species to a particular pesticide or pesticide class;

(vi) the crop which was host to the target pest species is no longer grown;

(vii) the pesticide's shelf life has expired, or it is probable that its potency is significantly reduced;

(viii) degradation of a container to the point of breakage, or possible breakage if moved;

(ix) physical damage to a container making decanting of contents impossible.

It can be seen from the list that the reasons for the generation of waste pesticide concentrates may be grouped. In some cases, generation is the result of decisions by the individual farmer, and such occasions are largely unpredictable. In other cases, however, the casual factor may operate throughout an agricultural region, a state or a nation, or perhaps even worldwide. It is important that agricultural authorities, including

regional agricultural officers, etc., are alert to these various situations which trigger the generation of unwanted pesticides, and that they initiate suitable action. Ideally, preparation for coping with such eventualities should be made in advance.

2. DISPOSAL OF WASTE PESTICIDES AND PESTICIDE CONTAINERS ON THE FARM

Empty containers and unwanted pesticides can be serious hazards if they are not disposed of properly. There is hazard to the general public, children in particular, risk of contamination of environment and hazard to wildlife. The immediate effects of faulty disposal may be readily seen as sickness and death in people or animals but the long-term effects often pass unnoticed for months or years. The long-term effects can be prevented. Safe disposal is essential and is an important part of the overall responsibility of every person involved in the handling and application of pesticides.

2.1 Pesticides

The farmer should be encouraged to buy only the amount needed to treat the crop. Only as much pesticide as is needed for immediate use should be mixed at any one time.

The first choice in disposing of waste diluted pesticide should be double spraying of a small part of the infested crop or a field adjacent to that sprayed. This should, however, only be done if it will not result in a problem residue on a food or feed crop.

Before considering disposal, the farmer should attempt to find another farmer who could use the material for its normally intended purpose.

The disposal method outlined below is intended for on-farm disposal of surplus diluted pesticide, or pesticide concentrate. In disposing of the pesticide, all of the points below require attention. It is possible that all conditions cannot be met on every farm, but serious efforts should be made to meet as many as possible.

2.1.1 Selection of disposal site:

The hole for receiving the wastes should be dug on high flat land, at least 30-60 m away from free water such as streams, dams and wells. The hole should be situated where there is no risk of flooding by surface flow or streams, and it should be free of potential for erosion. The hole should be well away from homes and other buildings, crops and livestock, and should not be in erosion gullies, sinks, dry watercourses, quarries, or near aquifers or underground watercourses. The soil in which the disposal hole is dug should be well drained and readily penetrated by water. The soil should be deep, allowing for percolation through at least 2 - 3 m of soil, preferably partly through a clay horizon, before reaching bedrock. The hole should be situated at a site which takes advantage of warmth from the sun, but not where soil may be dry for

months, or cold or frozen. Finally, the hole should be situated in a place which will never be used for any other purpose.

THE HOLE SHOULD BE SOUNDLY FENCED TO KEEP OUT CHILDREN, LIVESTOCK AND WILDLIFE. A GATE SIGN REFERRING TO THE PRESENCE OF PESTICIDES OR POISONS IS RECOMMENDED.

2.1.2 Construction and use of the disposal pit: The surface of the pit should be horizontal, and depending on its surface area, need be no more than 5 to 8 cm below the surrounding surface. It must, however, be sufficiently deep to contain the volumes of liquid which are poured into it at any one time. The pressure of usage should not be such that long-standing pools of pesticide occur, nor should usage be such that a characteristic foul-smelling oxygen-depleted condition is created in the soil.

Where large volumes of pesticide are involved, it should be progressively disposed of into the hole via storage tanks (e.g., 200 litre drums) adjacent to the pit which allow periodic disposal of small parts of the total volume. Consideration could also be given to increasing the surface area of the hole, or to construction of a second hole.

Microbial action is the most important part of pesticide degradation in the soil, and microbial action may be enhanced by periodic incorporation of nitrogenous fertilizers, animal manure or vegetable wastes into the top layers of the pit. In acid soils, lime may also enhance microbial action.

Pesticide concentrates should be diluted to use-strength before disposal. To ensure ready penetration of the wastes into the soil, it may sometimes be necessary to break up the surface of the hole, prior to disposal.

2.2 Pesticide Containers

2.2.1 Decontamination

In general, all used pesticide containers should be decontaminated before disposal. The three stages for decontamination are:

i) empty the contents of the container into the mixing tank, and drain for 30 seconds;

ii) rinse the container at least three times with a volume of water not less than 10% of the container's total volume;

iii) add the rinse each time to the mixing tank.

Rinsing will not render any container suitable for use for storage of food, feed or water for domestic consumption.

2.2.2 Disposal

(a) Combustible containers should be burnt except where, in the case of some herbicides, labels warn against burning (see (c) below). Burning should be carried out where wind will not cause contaminated smoke to drift over nearby homes, people, livestock, crops, or the persons doing this job. Some municipalities have restrictions against burning; local authorities should therefore be consulted before burning pesticide containers.

Caution: drums or bottles may be under the pile to be burned. Ensure that bungs and caps are removed, or that containers are punctured to prevent explosions.

(b) Noncombustible containers

i) large containers: after rinsing, as above, 50 L and 200 L drums should be disposed of in one of the following ways:

- return them to the supplier; or
- sell them to a firm dealing in used drums or barrels that is equipped to neutralise the toxicity of adhering materials. Contact your pesticide dealer for the names and addresses of such firms; or
- take them to a sanitary landfill type of dump. Inform the operator of the dump that the drums contain residues of poisonous materials; warn him that poisonous vapors may be produced if the containers are burned. Before leaving, remove lids or bungs from the containers; chop holes in the containers with a sharpened pickaxe to prevent reuse. Make sure the site cannot contaminate a water supply; or
- if none of the preceding disposal means are available to you, find a private disposal site of the type described above which you will use only for empty containers and unwanted pesticides. Correct site selection is most important. Before leaving, again ensure lids or bungs are removed from the containers and chop holes in them with a pickaxe to avoid reuse.
- do not reuse for any purpose.

ii) small containers (up to 20 L): after rinsing, as above, small containers may be disposed of at a public dump or buried at least half a metre deep at a private disposal site. First remove the caps or lids, punch holes in metal containers, break glass containers. Do not use containers for storage of food, feed or water for domestic consumption.

(c) Herbicide containers: disposal of some herbicide containers, particularly those for phenoxy-acid herbicides, requires extra care to prevent crop damage. Take the precaution of triple rinsing as above, before disposal, preferably tipping the rinse into the spray vat for use. If this is not possible, tip rinse water into the disposal pit. Disposal of herbicide containers can then proceed as follows:

- burn containers except where labels advise against it. When some herbicides or defoliants volatilize the resulting vapors may be poisonous to humans, or they may damage nearby crops or shrubbery. Herbicides or defoliants containing chlorates may explode when heated.

- break glass herbicide containers. Chop holes in top, bottom and sides of metal containers, so they cannot collect water or be reused, or crush them under a tractor wheel or with an axe or sledge hammer. Also crush fibre drums, cardboard and paper containers. After breaking, crushing or puncturing them, bury the containers at a depth of half a metre or more at a safe disposal site, or take them to a dump that does not burn its refuse.

APPENDIX

1. METHODS OF DISPOSAL

This section outlines a number of methods of disposal which may be adopted. In each case, an outline of the method is given, as well as a consideration of the limitation, advantages and disadvantages of each. These guidelines will not be suitable for all situations, regions, or countries, it is suggested that in such a situation, further information is sought on other methods which may be more suitable. The reading list (page 12) guides the reader to suitable literature.

The methods described for disposing of pesticides and containers apply principally to disposal on the farm, but some information is given on page 9 on methods which may have application for central disposal.

1.1 Disposal of Pesticides

The ultimate aim of any disposal action is to render the pesticide permanently harmless to all life forms. Where this is not possible in the farm situation, it may be possible to adopt a compromise solution, which partly or largely achieves this goal.

The pesticide for disposal will generally be in one of three forms: it will be surplus diluted pesticide, rinsate from the cleaning of equipment, or pesticide concentrate (generally in the manufacturer's container, as emulsion, powder, granules, etc.). The method of disposal or detoxification generally subjects the pesticide to one or more of the three basic types of action:

- physical actions include fixation, adsorption, incineration, photodegradation or similar action;
- chemical methods may employ reagents which cause, for example, hydrolytic, oxidative or reductive degradation of the active ingredients;
- biological approaches generally utilize microbial action, or microbial products in one form or another.

Included in all three classes are methods which make use of highly sophisticated apparatus, which, because of cost, are suitable only for large quantities of pesticide, or for use on other types of chemicals as well. The methods outlined below are basic, and require relatively simple, but not always cheap apparatus suitable for the farm or closely allied situations.

In terms of cost, convenience and safety, it is better to avoid the necessity for disposal by the transfer of unwanted pesticide concentrate either to another farmer for normal use, or where possible, back to the retail supplier. Users should be encouraged to purchase the correct quantity of pesticide, and to prepare the correct volume of diluted pesticide to reduce the potential for generation of waste pesticide. In some circumstances it is possible to store the waste safely until disposal

is possible. Also, double spraying of a small part of the infested crop, or a field adjacent to that sprayed may avoid accumulation of waste diluted pesticide.

1.1.1 Physical methods of disposal include incineration, burning, photodegradation, fixation, containment or adsorption. Burning in the normal farm incinerator or rubbish tip will achieve temperatures of approximately 400° C, which is frequently inadequate for complete degradation of the pesticide molecule. In general, this method is not recommended because of its questionable efficacy and because it may produce noxious by-products or vaporize biologically active substances with possible risk of damage to the environment. At best, it is suitable only for disposal of small quantities of pesticide at any one time. The attraction of burning is that the method is simple and cheap and there are frequent opportunities for it to be used.

Incineration at high temperatures in sophisticated apparatus is suitable for safe and complete disposal of unlimited quantities of hazardous wastes but such methods are unavailable on the farm.

One method employing photodegradation involves exposure of diluted pesticide on impervious surfaces to strong sunlight. In addition to photodegradation, oxidation as well as some microbial action and fixation would be expected to occur. The surface used should be raised above the surroundings and may be concrete, soil, corrugated iron, or similar material. This method is simple, cheap, and convenient. However, it is suited only to small volumes, and is not free of risk to people, animals or the environment. Current research into other photodegradation methods having possible application on the farm includes assessment of the effectiveness and suitability of a combination of UV light and ozone.

Fixation of pesticides in concrete is not a viable option for disposal because of possible leaching, and chemical incompatibilities with the matrix. Adsorption of waste pesticides into activated carbon has potential application for farm disposal, but portable apparatus currently being developed requires more research. Adsorption on clay and organic matter in the soil has good potential for application on the farm, and is discussed further below.

1.1.2 Chemical methods of detoxification. A variety of chemical agents for promoting degradation of pesticides, including concentrated and dilute acids and alkalis, sodium or calcium hypochlorite, iodide, metals, sulphides, cyanide, acetone, and acetate salts has been assessed. For a chemical method of disposal to be acceptable for farm application, the reagents must be cheap and readily available and they must not introduce hazards greater than those presented by normal handling of the pesticide. The chemical reagents should not present fire or environmental hazards, and information should first be available on the degree of degradation which they produce, the identity of breakdown products and their potential for causing damage in the environment at the time of final disposal. For practical reasons, the disposal method used by a farmer should be suitable for all or most pesticides. Because of these constraints, chemical methods of disposal are generally unsuitable for application on farms. In special cases though, there would be merit in considering the possibility of using

chemical methods of degradation under supervision of government or municipal officers.

1.1.3 Biological methods of disposal employ living organisms, or their products. There are three main types of biologically mediated disposal:

A. Land disposal utilizes soil as the disposal medium. In the soil microbial action is the most important agent of degradation. Other important contributions include adsorption and volatilization, and of least importance are processes such as hydrolysis, photolysis, oxidation and other chemical reactions. Whilst much work has been done on the fate of pesticides and other chemicals in soil, relatively little of this has been directed at disposal per se on the farm. This fact, linked with the wide variety of environmental situations encountered in farm disposal, limits to some degree the applicability of some of the basic research. Nevertheless, because much is known of chemicals in the soil, and of the close interactions between some of these influences, it is possible to make a number of useful generalizations, which have application to disposal of waste pesticides in soil:

(a) water relations influence both hydrolytic and microbial degradation. The response to differing water relations varies between microbial species, but in general bacterial activity is greatest when soil moisture content is near, but not greater than field capacity.

(b) temperature has a profound influence upon growth and activity of soil microbes. Most soil microorganisms have greatest growth and activity at temperatures between 20°C and 35°C, and in general, activity is greater at the upper end of the range.

(c) soil pH influences both microbial activity and the chemical stability of pesticides. Microbial activity is influenced by effects of pH on nutrient availability, and in general, the optimum range is pH 6.5 - 8.5. Effect of pH on chemical stability of pesticides is variable, but, for example, many organophosphates are much less stable under alkaline conditions.

(d) soil aeration and oxygen supply must be maintained at the highest level for optimal microbial degradation, and for chemical oxidation. Oxygen supply is determined largely by soil structure and by water status. The presence of free water in the soil is conducive to reducing conditions and anaerobic degradation which is slower than aerobic action.

(e) available nutrients influence microbial growth and activity. Shortage of nitrogen may be a limiting

246

factor, particularly in situations where plant materials are also present.

Further procedures for disposal can be developed if these facts are recognised. For example, degradation by soil microbes will generally be slowed down by heavy or frequent loading with pesticide wastes due to toxic effects of the pesticide on the soil flora, or to development of anaerobic soil conditions resulting both from high microbial oxygen demand, and from frequent addition of water.

Land disposal of pesticides may be carried out in a number of ways:

- land cultivation involves placement of waste concentrate or preferably diluted pesticide onto the plough layer using a conventional mobile spray unit or spray irrigation, followed by disc-plowing. Alternatively, subsurface application may be used in order to reduce volatilization and obviate the need for discing. Ideally, a specific area should be set aside for disposal of pesticides. In order to avoid any contamination of adjacent areas, it should be surrounded by levee banks and drains at the edges, and have a sump for runoff. This method of disposal involves significant costs in time and money when preparing the disposal area, and lacks convenience because of the need for a specific soil-application operation and perhaps subsequent discing. The need to reserve the area for this purpose is also a drawback to this method. An alternative method of disposal involves application of the waste pesticide onto cereal stubble, followed by burial by plowing. This may be a significant disadvantage in terms of farm management, but otherwise the method is relatively simple and safe but is costly in terms of time and convenience.

  disposal pits on the farm may take two possible forms. Firstly, a pit may be a simple hole dug in the ground, and used for disposal of concentrate or diluted pesticides, and perhaps also for containers. For safety and effectiveness, location and design of such burial sites is important (see para 2.1.1, page 3). However, in general the method is simple, cheap, convenient and safe, and has reasonable flexibility of siting. There may be limitations on the frequency and rate of loading if degradation, as opposed to dispersal, is to be achieved, and if environmental pollution is to be completely avoided.

  The second type of pit does not strictly fit the definition of land disposal, and is best suited to disposal of relatively high volumes of waste as found on big farms, orchards, etc. The pit may be up to 4 m

by 10 m, is lined with concrete or plastic and contains alternating layers of soil and gravel. Developmental work on these pits has been carried out over a period of approximately fourteen years and the system has been shown highly effective for a wide variety of pesticides. The system is compact, contains the wastes at the site of disposal, and has reasonable flexibility of siting. The cost is considerable and not much is known of the suitability for degrading concentrates, or of the longevity of the system.

B. Composting of waste pesticide using sewage sludge, animal manures, cannery and other organic wastes as the detoxification and/or the disposal medium is presently receiving active research effort. Results to date are very promising, but data are insufficient to make any general recommendation for the use of these media alone. It would be expected, however, that the use of such wastes in association with soil disposal methods would enhance microbial action by virtue of the nutrient substrate and the "inoculum" provided, as well as any incidental improvement in soil structure, drainage and aeration.

C. Other biological approaches suitable for farm pesticide wastes are also still being researched. In particular, bacterial or enzyme preparations with specific degradative capacity have promise. Developments in this area are likely to be greatly accelerated by advances in genetic engineering.

1.1.4 Evaporation basins are probably best suited to the needs of manufacturers or others with considerable disposal requirements. Evaporation basins are shallow ponds, generally lined with a waterproof material such as plastic. Ideally, evaporation basins are made rainproof with a cover which does not reduce evaporation or the effects of sunlight. Wastes may be detoxified or immobilized by a variety of factors including photolysis, hydrolysis, fixation (by adsorption to sediment), or flocculation. Additionally, some microbial action would be expected. Volume reduction occurs through evaporation of the water.

This method of disposal is simple, convenient, relatively flexible so far as location is concerned and the wastes are largely confined. On the other hand, some initial costs must be incurred, and there is some potential for impairment of air quality through volatilization. There are also limitations imposed on the effectiveness by climate. Periodical cleaning of the basin would be necessary and this then raises a further problem of what to do with the material removed.

1.1.5 Communal disposal methods: there are a number of further methods of disposal, which, whilst suited to disposal of waste pesticides, are too expensive and/or complex for the normal farmer to consider. Such systems are generally suitable for disposal of nonpesticidal chemical waste also, and for that reason, may serve a wider purpose in the community.

Among these larger-scale options are incineration at elevated temperatures (1000°C, or more), biological degradation using trickle filters or activated sludge, or sanitary landfill techniques.

1.2 Disposal of containers

In general, all used pesticide containers should be decontaminated as far as possible prior to disposal. However, decontamination is strongly recommended for noncombustible containers, and for combustible containers which have held highly volatile compounds such as phenoxy herbicides, or particularly toxic compounds. The three steps for decontamination are outlined on page 3-4. Proper rinsing will allow containers to be used except for storage of food, water or feed. The importance and significance of this statement in countries where the utility and intrinsic value of empty containers is particularly high should be recognized.

The disposal method for containers varies according to type. Where containers are combustible, they should be burnt on an open fire, or deposited at a public tip which accepts toxic refuse of this type. Noncombustible containers should have their bungs or caps removed, their walls holed, then be crushed and buried on the farm, or delivered to a public tip which accepts such refuse.

It is sometimes possible for empty containers to be returned to the chemical manufacturer or recycled by a competent company.

2. GENERAL CONSIDERATIONS

Section 1 briefly outlined the major methods for disposal of surplus pesticide, the limitations of these methods, and some of the attendant safety considerations. The following comments outline the various general points which must be considered in selecting the best method of disposal:

(a) in general, it must be assumed that the farmer is a layman in terms of handling chemicals and understanding chemical reactions. It may also be generally assumed that the farmer will have only a minimal number of chemical reagents or suitable equipment on hand, and limited access to the chemicals necessary for detoxification;

(b) in general, and particularly where chemical methods of detoxification are involved, any reaction should not involve greater risk than normal handling of the product according to the manufacturer's instructions;

(c) it is preferable that any disposal method used should lead to complete detoxification rather than relying on containment, dilution, immobilization, adsorption, etc.;

(d) disposal should be carried out in a way which ensures permanent and effective exclusion of people, animals, etc., from risk of exposure right through until such time that detoxification is complete;

249

(e) disposal methods which lead to reduced water quality, or additional pesticide residues in foodstuffs should be avoided or minimized, or managed in such a way that water concentrations or residue levels do not exceed legal limits. Similarly, impairment of air quality, or contributions to solid waste disposal problems should be avoided;

(f) the method which is cheap and expedient (among other things) will find greatest favour with farmers. It is preferable also, in the interests of acceptance, that the farmer should need to use only one method of disposal for all products. In this context, it should be pointed out that some physical and chemical methods require two distinct steps - one of detoxification, and later, one of actual disposal.

3. RECOMMENDATION FOR FARM DISPOSAL

Disposal in the soil is the most suitable for the farm situation. Such a recommendation is made in a number of countries. The method is cheap and simple, particularly where carried out in a pit of reasonable size in relatively permeable soil, and it makes use of a variety of degrading or detoxifying mechanisms. It is probably effective in achieving the aim in most cases. In fact, with the correct use, effectiveness probably increases with time over the active life of a pit. The act of disposal brings with it no greater hazard than occurs with normal handling and no special equipment is required. With suitable care in siting, there is no significant contribution to water or air pollution, nor is there any significant threat to living organisms, other than soil-dwellers in the immediate vicinity of the pit.

It is possible, however, that disposal in such pits, even if carried out largely as recommended, is limited in its effectiveness and safety in some situations. For example, it may be necessary to adopt a different approach in areas where

- soil is sandy and dry (low microbial growth and activity, low soil adsorption capacity)
- quantities larger than the pit can effectively hold and/or degrade are involved
- water tables are high, and the possibilities of water pollution or low anaerobic degradation exist.

It is also possible that, in certain areas or countries, disposal by this means is illegal. Even where these various constraints exist, it is essential that the farmer has recourse to one of two possible sources of assistance. Either, he must be able to transport his wastes, without undue trouble, to a communal disposal service (or leave his wastes with a co-ordinating body such as a government agricultural department, for subsequent disposal), or he must be able to obtain quick reliable information on alternative and acceptable methods of farm disposal. It is important that government agricultural officers, particularly extension

250

officers, prepare themselves in advance with information on disposal which is appropriate for their region.

4. FARMER EDUCATION

The farmer or property manager must ultimately be responsible for the safe and effective disposal of waste pesticide on his property, or for removal of waste to another site where safe disposal is possible.

Education of farmers in methods for disposing of waste pesticides and containers is probably best carried out as part of a broader programme aimed at improving all aspects of pesticide handling and use. Whilst legislation relating to disposal of pesticides can be formulated or may already be laid down, unless it is both very specific and very actively policed, it will be at best, only a useful backup to education.

Because of the limited amount of space available, label instructions on disposal can generally only be brief, and therefore of limited value. For that reason it is recommended that separate educational material should be widely distributed among all users of pesticides.

5. FURTHER READING

1. Disposal by Chemical Means

- SHIH, C.C. and DAL PORTO, D.F., 1975; Hand book for pesticide disposal by common chemical methods, EPA 530/SW-112c; prepared for the Office of Solid Waste Management Programmes, Environmental Protection Agency, USA.

- LAWLESS, E.W., FERGUSON, T.L., and MEINERS, A.F., 1975; Guidelines for the disposal of small quantities of unused pesticides; EPA 670/22-75-057; prepared for National Environmental Research Centre, Office of Research and Development, Environmental Protection Agency, Cincinnati, Ohio, USA.

- LANDE, S.S., 1978; Identification and description of chemical deactivation/detoxification methods for the safe disposal of selected pesticides; EPA SW-165c prepared for the Office of Solid Waste, Environmental Protection Agency, USA.

2. Disposal on Land

- WORKING GROUP ON PESTICIDES, 1970; Group disposal of pesticides: the problem and criteria for guidelines, PB 197 144, National Technical Information Service, Virginia, USA.

- S.C.S. ENGINEERS, 1979; Disposal of dilute pesticide solutions; SW-174c; prepared for the Office of Solid Waste, Environmental Protection Agency, USA.

- LAWLESS, E.W., FERGUSON, T.L., and MEINERS, A.F., 1975; Guidelines for the disposal of small quantities of unused

pesticides; EPA 670/2-75-057 prepared for National Environment Research Centre, Office of Research and Development, Environmental Protection Agency, Cincinnati, Ohio, USA.

3. Large-scale Disposal

WILKINSON, R.E., KELSO, G.L., and HOPKINS, F.C., 1978; State-of-the-art-report: Pesticide disposal research; prepared for Municipal Environmental Research Laboratory, Office of Research and Development, Environmental Protection Agency, Cincinnati, Ohio, USA.

4. Disposal by Composting

MULLINS, D.E., PETRUSKA, J.A., NICOLSON, R.W., COLLINS, E.R., and YOUNG, R.W., 1981; Preliminary studies evaluating composting as a means for pesticide disposal in: Schultz, D. (ed), Seventh Annual Research Symposium on Land Disposal of Hazardous Wastes, held at Philadelphia, USA, March 1981, EPA 600/9-81-002B PB81-173 882; Environmental Protection Agency, USA.

WILLSON, G.B., SIKORA, L.J., and PARR, J.F., 1983; Composting of chemical industrial wastes prior to land application, in: Parr, J.F., Marsh, P.B., and Kla, J.M., (eds.), Land treatment of hazardous wastes, pp. 263-273; Noyes Data Corporation, New Jersey, USA.

5. Overview

MUNNECKE, D.M., 1979; Chemical, physical and biological methods for disposal and detoxification of pesticides, Residue Reviews Vol. 70.

262

Reference	Notes

PART 165--REGULATIONS FOR THE ACCEPTANCE OF CERTAIN PESTICIDES AND RECOMMENDED PROCEDURES FOR THE DISPOSAL AND STORAGE OF PESTICIDES AND PESTICIDES CONTAINERS

Subpart A--General

Sec.
165.1 Definitions.
165.2 Authorization and scope.

Subpart B--Acceptance Regulations

165.3 Acceptable pesticides.
165.4 Request for acceptance.
165.5 Delivery.
165.6 Disposal.

Subpart C--Pesticides and Containers

165.7 Procedures not recommended.
165.8 Recommended procedures for the disposal of pesticides.
165.9 Recommended procedures for the disposal of pesticide containers and residues.
165.10 Recommended procedures and criteria for storage of pesticides and pesticide containers.

Subpart D--Pesticide-Related Wastes

165.11 Procedures for disposal and storage of pesticide-related wastes.

AUTHORITY: 7 U.S.C. 136q and 136w.

SOURCE: 39 FR 15236, May 1, 1974, unless otherwise noted.

Subpart A--General

§165.1 Definitions

As used in this part, all terms not defined herein shall have the meaning given them by the Act.

(a) "The Act" means the Federal Insecticide, Fungicide, and Rodenticide Act as amended by the Federal Environmental Pesticide Control Act of 1972 (Pub. L. 92-516, 86 Stat. 973).

(b) "Agency" means the U.S. Environmental Protection Agency.

(c) (1) "Administrator" means the Administrator of the Agency, or any officer or employee thereof to whom authority has been heretofore delegated or to whom authority may hereafter be delegated, to act in his stead.

(2) "Regional Administrator" means the Administrator of a Regional Office of the Agency or his delegatee.

(d) "Adequate storage" means placing of pesticides in proper containers and in safe areas as per §165.10 as to minimize the possibility of escape which could result in unreasonable adverse effects on the environment.

(e) "Complete destruction" of pesticides means alteration by physical or chemical processes to inorganic forms.

(f) "Container" means many package, can, bottle, bag, barrel, drum, tank, or other containing-device (excluding spray applicator tanks) used to enclose a pesticide or pesticide-related waste.

(g) "Decontamination/detoxification" means processes which will convert pesticides into nontoxic compounds.

(h) "Degradation products" means those chemicals resulting from partial decomposition or chemical breakdown of pesticides.

(i) "Diluent" means the material added to a pesticide by the user or manufacturer to reduce the concentration of active ingredient in the mixture.

(j) "Encapsulate" means to seal a pesticide, and its container if appropriate, in an impervious container made of plastic, glass, or other suitable material which will not be chemically degraded by the contents. This container then should be sealed within a durable container made from steel, plastic, concrete, or other suitable material of sufficient thickness and strength to resist physical damage during and subsequent to burial or storage.

(k) "Heavy metals" means metallic elements of higher atomic weights, including but not limited to arsenic, cadmium, copper, lead, mercury, manganese, zinc, chromium, tin, thallium, and selenium.

(l) "Imminent hazard" means a situation which exists when the continued use of a pesticide during the time required for cancellation proceedings would be likely to result in unreasonable adverse effects on the environment or will involve unreasonable hazard to the survival of a species declared endangered by the Secretary of the Interior under Pub. L. 91-135.

(m) "Ocean dumping" means the disposal of pesticides in or on the oceans and seas, as defined in Pub. L. 92-532.

(n) "Open burning" means the combustion of a pesticide or pesticide container in any fashion other than incineration.

(o) "Open dumping" means the placing of pesticides or containers in a land site in a manner which does not protect the environment and is exposed to the elements, vectors, and scavengers.

(p) "Pesticide" means (1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

(1) "Excess pesticides" means all pesticides which cannot be legally sold pursuant to the Act or which are to be discarded.

(2) "Organic pesticides" means carbon-containing substances used as pesticides, excluding metallo-organic compounds.

(3) "Inorganic pesticides" means noncarbon-containing substances used as pesticides.

(4) "Metallo-organic pesticides" means a class of organic pesticides containing one or more metal or metalloid atoms in the structure.

(q) "Pesticide-related wastes" means all pesticide-containing wastes or by-products which are produced in the manufacturing or processing of a pesticide and which are to be discarded, but which, pursuant to acceptable pesticide manufacturing or processing operations, are not ordinarily a part of or contained within an industrial waste stream discharged into a sewer or the waters of a state.

(r) "Pesticide incinerator" means any installation capable of the controlled combustion of pesticides, at a temperature of 1000° C (1832° F) for two seconds dwell time in the combustion zone, or lower temperatures

and related dwell times that will assure complete conversion of the specific pesticide to inorganic gases and solid ash residues. Such installation complies with the Agency Guidelines for the Thermal Processing of Solid Wastes as prescribed in 40 CFR Part 240.

(s) "Safe disposal" means discarding pesticides or containers, in a permanent manner so as to comply with these proposed procedures and so as to avoid unreasonable adverse effects on the environment.

(t) "Sanitary landfill" means a disposal facility employing an engineered method of disposing of solid wastes on land in a manner which minimizes environmental hazards by spreading the solid wastes in thin layers, compacting the solid wastes to the smallest practical volume, and applying cover material at the end of each working day. Such facility complies with the Agency Guidelines for the Land Disposal of Solid Wastes as prescribed in 40 CFR Part 241.

(u) "Scrubbing" means the washing of impurities from any process gas stream.

(v) "soil injection" means the emplacement of pesticides by ordinary tillage practices within the plow layer of a soil.

(w) "Specially designated landfill" means a landfill at which complete long term protection is provided for the quality of surface and subsurface waters from pesticides, pesticide containers, and pesticide-related wastes deposited therein, and against hazard to public health and the environment. Such sites should be located and engineered to avoid direct hydraulic continuity with surface and subsurface waters, and any leachate or subsurface flow into the disposal area should be contained within the site unless treatment is provided. Monitoring wells should be established and a sampling and analysis program conducted. The location of the disposal site should be permanently recorded in the appropriate local office of legal jurisdiction. Such facility complies with the Agency Guidelines for the Land Disposal of Solid Wastes as prescribed in 40 CFR Part 241.

(x) "Triple rinse" means the flushing of containers three times, each time using a volume of the normal diluent equal to approximately ten percent of the container's capacity, and adding the rinse liquid to the spray mixture or disposing of it by a method prescribed for disposing of the pesticide.

(y) "Unreclaimable residues" means residual materials of little or no value remaining after incineration.

(z) "Water dumping" means the disposal of pesticides in or on lakes, ponds, rivers, sewers, or other water systems as defined in Pub. L. 92-500.

(aa) "Well injection" means disposal of liquid wastes through a hole or shaft to a subsurface stratum.

§165.2 Authorization and scope.

(a) The regulations in this part and recommended procedures are published pursuant to sections 19(a) and 25(a) of the Act, which give the Administrator the authority to establish regulations and procedures for the disposal or storage of packages and containers of pesticides, and for disposal or storage of excess amounts of such pesticides, and require the Administrator to accept for safe disposal a pesticide the registration of which is canceled under section 6(c) of the Act, if requested by the owner of the pesticide. Section 165.11 of these recommended procedures (Pesticide-Related Wastes) is published pursuant to Section 204 of the Solid Waste Disposal Act (Pub. L. 89-272 as amended by Pub. L. 91-512)

which authorizes the Administrator to make information available and to make recommendations concerning the disposal and handling of wastes.

(b) Regulations for acceptance for safe disposal of pesticides canceled under section 6(c) and recommended procedures for disposal or storage of pesticides, pesticide containers, and pesticide-related wastes are those which the Administrator judges as necessary, with an adequate margin of safety, to protect public health and the environment. Such procedures are subject to addition and revision as the Administrator deems necessary.

(c) The recommended procedures for the disposal of pesticides and pesticide containers apply to all pesticides, pesticide-related wastes (and their containers) including those which are or may in the future be registered for general use or restricted use, or covered under an experimental use permit, except those single containers discussed in paragraph (e) of this section. These disposal procedures are mandatory only for the Agency in carrying out its pesticide and container disposal operations.

(d) The recommended procedures and criteria for the storage of pesticides and pesticide containers apply to all pesticides and excess pesticides and to used empty containers and containers which contain pesticides. These procedures and criteria apply to sites and facilities where pesticides that are classed as highly toxic or moderately toxic, and bear the signal words DANGER, POISON, or WARNING, or the skull and crossbones symbol, on the label are stored. Pesticides covered by an experimental use permit should also be stored in accordance with these procedures. These storage procedures are mandatory only for the Agency in carrying out its pesticide and container storage operations. Temporary storage by the user of the quantity of pesticide needed for a single application may be undertaken in isolated areas in accordance with the procedures and criteria given in §165.10(a).

(e) Recommended pesticide and pesticide container disposal procedures shall not apply to containers of pesticides registered for use in the home and garden if securely wrapped in several layers of paper and disposed of singly during routine municipal solid waste disposal, nor to containers of pesticides used on farms and ranches where disposal by open-field burial of single containers is undertaken with due regard to the protection of surface and sub-surface waters.

(f) As a general guideline, the owner of excess pesticides should first exhaust the two following avenues before undertaking final disposal:

(1) Use for the purposes originally intended, at the prescribed dosage rates, providing these are currently legal under all Federal, State, and local laws and regulations.

(2) Return to the manufacturer or distributor for potential re-labelling, recovery of resources, or reprocessing into other materials. Transportation must be in accordance with all currently applicable U.S. Department of Transportation regulations, including those prescribed in 49 CFR Parts 170-179 and 397, 46 CFR Part 146, and 14 CFR Part 103. The "for hire" transportation of unregistered pesticides across state lines may be subject to the Interstate Commerce Commission's economic regulations (49 U.S.C. 1 et seq. for rail carriers: 306, 307, and 309 for motor carriers; and 909 for domestic water carriers), and the Commission should be contacted in case of doubt.

Note: Some excess pesticides may be suitable for export to a country where use of the pesticide is legal. All pesticides so exported should be in good condition and packed according to specifications of the foreign

purchaser, and must be transported to the port of embarkation in accordance with all Department of Transportation regulations. All shipments should be in conformance with sections 17(a) of the Act.

(g) To provide documentation of actual situations, all accidents or incidents involving the storage or disposal of pesticides, pesticide containers, or pesticide-related wastes should be reported to the appropriate Regional Administrator.

Subpart B--Acceptance Regulations

§165.3 Acceptable pesticides.

The Administrator will accept for safe disposal those pesticides the registrations of which have been canceled, after first having been suspended to prevent an imminent hazard during the time required for cancellation proceedings as specified in section 6(c) of the Act. However, no other pesticides will be accepted pursuant to section 19(a) of the Act, and nothing herein shall obligate the Federal Government to own or operate any disposal facility.

§165.4 Request for acceptance.

(a) Before the owner of such a pesticide requests acceptance by the Administrator for disposal, he shall make every reasonable effort to return the material to either its manufacturer, distributor, or to another agent capable of using the material.

(b) If such an effort is unsuccessful, the following procedure shall be used by the owner of a suspended pesticide to request acceptance by the Administrator:

(1) The owner of such a pesticide must make a formal request for acceptance, in writing, to the Regional Administrator for the area where such pesticides are located.

(2) Records and data pertaining to the amount, location, physical form, type and condition of containers, and date of manufacture or purchase of individúal lots must be submitted. Certification that the owner of the suspended pesticide has made every reasonable effort to return the material to the manufacturer, distributor of the pesticide, or to other agents capable of relabeling, recovering, recycling or reprocessing the material and has been refused on the basis of technological infeasibility, must also be submitted.

§165.5 Delivery.

If it is found that a canceled pesticide meets the requirements for acceptance, the Regional Administrator will confer with the owner for purposes of arranging a mutually convenient location for acceptance of individual lots of such canceled pesticides. Transportation to the acceptance location will be the responsibility of, and transportation costs will be borne by, the owner of the pesticide.

§165.6 Disposal.

Following such acceptance, the Regional Administrator will cause the disposal or storage of such pesticide as appropriate, in accordance with the procedures outlined in subparts A and C of this part.

Subpart C--Pesticides and Containers

§165.7 Procedures not recommended.

No person should dispose of or store (or receive for disposal or storage) any pesticide or dispose of or store any pesticide container or pesticide container residue:

(a) In a manner inconsistent with its label or labeling.

(b) So as to cause or allow open dumping of pesticides or pesticide containers.

(c) So as to cause or allow open burning of pesticides or pesticide containers; except the open burning by the user of small quantities of combustible containers formerly containing organic or metallo-organic pesticides, except organic mercury, lead, cadmium or arsenic compounds, is acceptable when allowed by State and local regulations.

(d) So as to cause or allow water dumping or ocean dumping, except in conformance with regulations developed pursuant to the National Marine Protection, Research and Sanctuaries Act of 1972 (Pub. L. 92-532), and to Sections 304, 307, and 311 of the Federal Water Pollution Control Act as Amended (Pub. L. 92-500).

(e) So as to violate any applicable Federal or State pollution control standard.

(f) So as to violate any applicable provisions of the act.

§165.8 Recommended procedures for the disposal of pesticides.

Recommended procedures for the disposal of pesticides are given below:

(a) Organic pesticides, (except organic mercury, lead, cadmium, and arsenic compounds which are discussed in paragraph (c) of this section) should be disposed of according to the following procedures:

(1) Incinerate in a pesticide incinerator at the specified temperature/dwell time combination, or at such other lower temperature and related dwell time that will cause complete destruction of the pesticide. As a minimum it should be verified that all emissions meet the requirements of the Clean Air Act of 1970 (42 U.S.C. 1857 et seq.) relating to gaseous emissions: Specifically any performance regulations and standards promulgated under sections 111 and 112 should be adhered to. Any liquids, sludges, or solid residues generated should be disposed of in accordance with all applicable Federal, State and local pollution control requirements. Municipal solid waste incinerators may be used to incinerate excess pesticides or pesticide containers provided they meet the criteria of a pesticide incinerator and precautions are taken to ensure proper operation.

(2) If appropriate incineration facilities are not available, organic pesticides may be disposed of by burial in a specially designated landfill. Records to locate such buried pesticides within the landfill site should be maintained.

(3) The environmental impact of the soil injection method of pesticide disposal has not been clearly defined nationally, and therefore this disposal method should be undertaken only with specific guidance. It is recommended that advice be requested from the Regional Administrator in the region where the material will be disposed of prior to undertaking such disposal by this method.

(4) There are chemical methods and procedures which will degrade some pesticides to forms which are not hazardous to the environment. However, practicable methods are not available for all groups of pesticides. Until

201

a list of such methods is available, it is recommended that advice be requested from the Regional Administrator in the region where the material will be disposed of prior to undertaking disposal by such method.

(5) If adequate incineration facilities, specially designated landfill facilities, or other approved procedures are not available, temporary storage of pesticides for disposal should be undertaken. Storage facilities, management procedures, safety precautions and fire and explosion control procedures should conform to those set forth in §165.10.

(6) The effects of subsurface emplacement of liquid by well injection and the fate of injection materials are uncertain with available knowledge, and could result in serious environmental damage requiring complex and costly solutions on a long-term basis. Well injection should not be considered for pesticide disposal unless all reasonable alternative measures have been explored and found less satisfactory in terms of environmental protection. As noted in the Administrator's Decision Statement No. 5, dated February 6, 1973, the Agency's policy is to oppose well injection of fluid pesticides "without strict controls and a clear demonstration that such emplacement will not interfere with present or potential use of the subsurface environment, contaminate ground water resources or otherwise damage the environment." Adequate pre-injection tests, provisions for monitoring the operation and the environmental effects, contingency plans to cope with well failures, and provisions for plugging injection wells when abandoned should be made. The Regional Administrator should be advised of each operation.

(b) Metallo-organic pesticides (except organic mercury, lead, cadmium, or arsenic compounds which are discussed in paragraph (c) of this section), should be disposed of according to the following procedures:

(1) After first subjecting such compounds to an appropriate chemical or physical treatment to recover the heavy metals from the hydrocarbon structure, incinerate in a pesticide incinerator as described in paragraph (a)(1) of this section.

(2) If appropriate treatment and incineration are not available, bury in a specially designated landfill as noted in paragraph (a)(2) of this section.

(3) Disposal by soil injection of metallo-organic pesticides should be undertaken only in accordance with the procedure set forth in paragraph (a)(3) of this section.

(4) Chemical degradation methods and procedures that can be demonstrated to provide safety to public health and the environment should be undertaken only as noted in paragraph (a)(4) of this section.

(5) If adequate disposal methods as listed above in this section are not available, the pesticides should be stored according to the procedures in §165.10 until disposal facilities become available.

(6) Well injection of metallo-organic pesticides should be undertaken only in accordance with the procedures set forth in §165.8(a)(6).

(c) Organic mercury, lead, cadmium, arsenic, and all inorganic pesticides should be disposed of according to the following procedures:

(1) Chemically deactivate the pesticides by conversion to non-hazardous compounds, and recover the heavy metal resources. Methods that are appropriate will be described and classified according to their applicability to the different groups of pesticides. Until a list of practical methods is available, however, each use of such procedures should be undertaken only as noted in §165.8(a)(4).

26

(2) If chemical deactivation facilities are not available, such pesticides should be encapsulated and buried in a specially designated landfill. Records sufficient to permit location for retrieval should be maintained.

(3) If none of the above options is available, place in suitable containers (if necessary) and provide temporary storage until such time as adequate disposal facilities or procedures are available. The general criteria for acceptable storage are noted in §165.10.

§165.9 Recommended procedures for the disposal of pesticide containers and residues.

(a) *Group I Containers.* Combustible containers which formerly contained organic or metallo-organic pesticides, except organic mercury, lead, cadmium, or arsenic compounds, should be disposed of in a pesticide incinerator, or buried in a specially designated landfill, as noted in §165.8(a); except that small quantities of such containers may be burned in open fields by the user of the pesticide when such open burning is permitted by State and local regulations, or buried singly by the user in open fields with due regard for protection of surface and sub-surface water.

(b) *Group II Containers.* Non-combustible containers which formerly contained organic or metallo-organic pesticides, except organic mercury, lead, cadmium, or arsenic compounds, should first be triple-rinsed. Containers in good condition may then be returned to the pesticide manufacturer or formulator, or drum reconditioner for reuse with the same chemical class of pesticide previously contained providing such reuse is legal under currently applicable U.S. Department of Transportation regulations including those set forth in 49 CFR 173.28. Other rinsed metal containers should be punctured to facilitate drainage prior to transport to a facility for recycle as scrap metal or for disposal. All rinsed containers may be crushed and disposed of by burial in a sanitary landfill, in conformance with State and local standards or buried in the field by the user of the pesticide. Unrinsed containers should be disposed of in a specially designated landfill, or subjected to incineration in a pesticide incinerator.

(c) *Group III Containers.* Containers (both combustible and noncombustible) which formerly contained organic mercury, lead, cadmium, or arsenic or inorganic pesticides and which have been triple-rinsed and punctured to facilitate drainage, may be disposed of in a sanitary landfill. Such containers which are not rinsed should be encapsulated and buried in a specially designated landfill.

(d) *Residue disposal.* Residues and rinse liquids should be added to spray mixtures in the field. If not, they should be disposed of in the manner prescribed for each specific type of pesticide as set forth in §165.8.

§165.10 Recommended procedures and criteria for storage of pesticides and pesticide containers.

(a) *General.* (1) Pesticides and excess pesticides and their containers whose uncontrolled release into the environment would cause unreasonable adverse effects on the environment should be stored only in facilities where due regard has been given to the hazardous nature of the pesticide, site selection, protective enclosures, and operating procedures, and where adequate measures are taken to assure personal safety, accident prevention,

and detection of potential environmental damages. These storage procedures and criteria should be observed at sites and facilities where pesticides and excess pesticides (and their containers) that are classed as highly toxic or moderately toxic and are required to bear the signal words DANGER, POISON, or WARNING, or the skull and crossbones symbol on the label are stored. These procedures and criteria are not necessary at facilities where most pesticides registered for use in the home and garden, or pesticides classed as slightly toxic (word CAUTION on the label) are stored. All facilities where pesticides which are or may in the future be covered by an experimental use permit or other special permit are stored should be in conformance with these procedures and criteria.

(2) Temporary storage of highly toxic or moderately toxic pesticides for the period immediately prior to, and of the quantity required for a single application, may be undertaken by the user at isolated sites and facilities where flooding is unlikely, where provisions are made to prevent unauthorized entry, and where separation from water systems and buildings is sufficient to prevent contamination by runoff, percolation, or wind-blown particles or vapors.

(b) *Storage sites.* Storage sites should be selected with due regard to the amount, toxicity, and environmental hazard of pesticides, and the number and sizes of containers to be handled. When practicable, sites should be located where flooding is unlikely and where soil texture/structure and geologic/hydrologic characteristics will prevent the contamination of any water system by runoff or percolation. Where warranted, drainage from the site should be contained (by natural or artificial barriers or dikes), monitored, and if contaminated, disposed of as an excess pesticide as discussed in §165.8. Consideration should also be given to containing windblown pesticide dusts or particles.

(c) *Storage facilities.* Pesticides should be stored in a dry, well ventilated, separate room, building or covered area where fire protection is provided. Where relevant and practicable, the following precautions should be taken:

(1) The entire storage facility should be secured by a climb-proof fence, and doors and gates should be kept locked to prevent unauthorized entry.

(2) Identification signs should be placed on rooms, buildings, and fences to advise of the contents and warn of their hazardous nature, in accordance with suggestions given in paragraph (g)(1)(i) of this section.

(3) All items of movable equipment used for handling pesticides at the storage site which might be used for other purposes should be labeled "contaminated with pesticides" and should not be removed from the site unless thoroughly decontaminated.

(4) Provision should be made for decontamination of personnel and equipment such as delivery trucks, tarpaulin covers, etc. Where feasible, a wash basin, and shower with a delayed-closing pull chain valve should be provided. All contaminated water should be disposed of as an excess pesticide. Where required, decontamination area should be paved or lined with impervious materials, and should include gutters. Contaminated runoff should be collected, and treated as an excess pesticide.

(d) *Operational procedures.* Pesticide containers should be stored with the label plainly visible. If containers are not in good condition when received, the contents should be placed in a suitable container and properly relabeled. If dry excess pesticides are received in paper bags that are damaged, the bag and the contents should be placed in a sound

262

container that can be sealed. Metal or rigid plastic containers should be checked carefully to insure that the lids and bungs are tight. Where relevant and practicable, the following provisions should be considered:

(1) *Classification and separation.* (i) Each pesticide formulation should be segregated and stored under a sign containing the name of the formulation. Rigid containers should be stored in an upright position and all containers should be stored off the ground, in an orderly way, so as to permit ready access and inspection. They should be accumulated in rows or units so that all labels are visible, and with lanes to provide effective access. A complete inventory should be maintained indicating the number and identity of containers in each storage unit.

(ii) Excess pesticides and containers should be further segregated according to the method of disposal to ensure that entire shipments of the same class of pesticides are disposed of properly, and that accidental mixing of containers of different categories does not occur during the removal operation.

(2) *Container inspection and maintenance.* Containers should be checked regularly for corrosion and leaks. If such is found, the container should be transferred to a sound, suitable larger container and be properly labeled. Materials such as adsorptive clay, hydrated lime, and sodium hypochlorite should be kept on hand for use as appropriate for the emergency treatment or detoxification of spills or leaks. (Specific information relating to other spill treatment procedures and materials will be published as it is confirmed.)

(e) *Safety precautions.* In addition to precautions specified on the label and in the labeling, rules for personal safety and accident prevention similar to those listed below should be available in areas where personnel congregate:

(1) *Accident prevention measures.* (i) Inspect all containers of pesticides for leaks before handling them.

(ii) Do not mishandle containers and thereby create emergencies by carelessness.

(iii) Do not permit unauthorized persons in the storage area.

(iv) Do not store pesticides next to food or feed or other articles intended for consumption by humans or animals.

(v) Inspect all vehicles prior to departure, and treat those found to be contaminated.

(2) *Safety measures.* (i) Do not store food, beverages, tobacco, eating utensils, or smoking equipment in the storage or loading areas.

(ii) Do not drink, eat food, smoke, or use tobacco in areas where pesticides are present.

(iii) Wear rubber gloves while handling containers of pesticides.

(iv) Do not put fingers in mouth or rub eyes while working.

(v) Wash hands before eating, smoking, or using toilet and immediately after loading, or transferring pesticides.

(vi) Persons working regularly with organophosphate and N-alkyl carbamate pesticides should have periodic physical examinations, including cholinesterase tests.

(f) *Protective clothing and respirators.* (1) When handling pesticides which are in concentrated form, protective clothing should be worn. Contaminated garments should be removed immediately, and extra sets of clean clothing should be maintained nearby.

(2) Particular care should be taken when handling certain pesticides to protect against absorption through skin, and inhalation of fumes.

Respirators or gas masks with proper canisters approved for the particular type of exposure noted in the label directions, should be used when such pesticides are handled.

(g) *Fire control.* (1) Where large quantities of pesticides are stored, or where conditions may otherwise warrant, the owner of stored pesticides should inform the local fire department, hospitals, public health officials, and police department in writing of the hazards that such pesticides may present in the event of a fire. A floor plan of the storage area, indicating where different pesticide classifications are regularly stored should be provided to the fire department. The fire chief should be furnished with the home telephone numbers of (i) the person(s) responsible for the pesticide storage facility, (ii) the appropriate Regional Administrator, who can summon the appropriate Agency emergency response team, (iii) the U.S. Coast Guard, and (iv) the Pesticide Safety Team Network of the National Agricultural Chemicals Association.

(2) *Suggestions for Fire Hazard Abatement.* (i) Where applicable, plainly label the outside of each storage area with "DANGER," "POISON," "PESTICIDE STORAGE" signs. Consult with the local fire department, regarding the use of the current hazard signal system of the National Fire Protection Association.

(ii) Post a list on the outside of the storage area of the types of chemicals stored therein. The list should be updated to reflect changes in types stored.

(3) *Suggested Fire Fighting Precautions.* (i) Wear air-supplied breathing apparatus and rubber clothing.

(ii) Avoid breathing or otherwise contacting toxic smoke and fumes.

(iii) Wash completely as soon as possible after encountering smoke and fumes.

(iv) Contain the water used in fire fighting within the storage site drainage system.

(v) Firemen should take cholinesterase tests after fighting a fire involving organophosphate or N-alkyl carbamate pesticides, if they have been heavily exposed to the smoke. Baseline cholinesterase tests should be part of the regular physical examination for such firemen.

(vi) Evacuate persons near such fires who may come in contact with smoke or fumes or contaminated surfaces.

(h) *Monitoring.* An environmental monitoring system should be considered in the vicinity of storage facilities. Samples from the surrounding ground and surface water, wildlife, and plant environment, as appropriate, should be tested in a regular program to assure minimal environmental insult. Analyses should be performed according to "Official Methods of the Association of Official Analytical Chemists (AOAC)," and such other methods and procedures as may be suitable.

Subpart D--Pesticide-Related Wastes

§165.11 Procedures for disposal and storage of pesticide-related wastes.

(a) In general all pesticide-related wastes should be disposed of as excess pesticides in accordance with the procedures set forth in §§165.7 and 165.8. Such wastes should not be disposed of by addition to an industrial effluent stream if not ordinarily a part of or contained within such industrial effluent stream, except as regulated by and in compliance with effluent standards established pursuant to sections 304 and 307 of the Federal Water Pollution Control Act as amended.

264

(b) Pesticide-related wastes which are to be stored should be managed in accordance with the provisions of §165.10.

APPENDIX G

Control Operations Requirements - Aerial

- Some Thoughts on Coordination at Dakar Airport
- Notice to Prospective Offerors Prospectus No. 50-APHIS-86 for Aerial Spraying
- Prospectus 50 -M-APHIS-86 Aerial Spraying

Reference	Notes

SOME THOUGHTS ON COORDINATION AT DAKAR AIRPORT

VEHICLES:

- Tug to move DC-7s.
- Water tank truck with pump, to wash ramp and personnel in emergency. (Note: Fire truck ASECNA)
- Fork lift to handle 4 barrels on pallet 1150 kg. (Note: Air France or transit rental)
- Large truck also for moving barrels from airfreight to loading area.

REFUELING:

A)
- Refueler (tank truck) with fuel screens.
- Each DC-7 may take 9500 L, or more!
- Need grounding points and wires.

B)
- Refuel at pit.
- Capacity of storage?
- Rate of pumping?
- Length of hose? (Note: Check on hose length and availability)
- "Taxi plan", use of tug.

QUELQUES IDEES SUR LA COORDINATION DE L'OPERATION DE LUTTE ANTI-ACRIDIENNE AU NIVEAU DE L'AEREPORT DE DAKAR-YOFF

VEHICULES:

- Remorqueur pour déplacer les DC-7.
- Camion citerne équippé de pompe pour laver la rampe et le personnel en cas d'urgence. (Remarque: Camion citerne des Sapeurs Pompiers de l'ASECNA).
- Souleveuse capable de prendre 4 fûts sur palette de 1150 kg. (Remarque: location par Air France ou Service de Transit).
- Gros camion aussi pour déplacer les fûts du fret au lieu de chargement.

REAPPROVISIONNEMENT EN CARBURANT:

A)
- Camion citerne équippé de filtres.
- Chaque DC-7 peut prendre 9500 L ou plus.
- Nécessité d'avoir des prises de terre et des cables.

B)
- Réapprovisionnement à partir de bouches de carburant.
- Capacité de stockage?
- Vitesse de pompage?
- Longueur du tuyau? (Remarque: Vérifier la longueur du tuyau et sa disponibilité).
- "Plan de roulement au sol", utilisation de remorqueur.

PESTICIDE LOADING:

- Move approx. 1000 drums (200 L) from airfreight to area.
- Spot 56 drums at each DC-7 parking site.
- Contractor has pump with stinger (to pump from bottom of barrel).
- Empty drums to be held at loading area. (Note: CPS is working on this)
- Wash any spillage from ramp (with fire truck). (Note: Clearance of drums through customs - Senegalese Air Force and Minister of Rural Development)

PERSONNEL FOR LOADING:

- Supervisor
- 5 laborers per aircraft.
- Personal Protective Equipment (PPE)
  - hard hats
  - goggles
  - disposable coveralls
  - rubber gloves
  - rubber boots (safety toes?)
  - dust respirators (mask)

(Notes: 1) A.I.D. hires. 2) Passes from ASECNA. 3) Bring to airport in vehicles. 4) A.I.D. stores PPE between shifts. 5) PPE will be stored at work site.)

CHARGEMENT DES PESTICIDES:

- Déplacer environ 1000 fûts (200 L) du frêt au lieu de chargement.
- Placer 56 fûts au niveau de chaque site de stationnement de DC-7.
- Le contractant dispose d'une pompe munie d'une sonde (pour permettre de pomper à partir du fond du fût).
- Fûts vides à garder au niveau du lieu de chargement. (Remarque: Le Service de la Protection des Végétaux travaille à cela).
- Laver tous les insecticides répandus depuis la rampe (avec le camion citrene des pompiers de l'ASECNA). (Remarque: Dédouanement des fûts - L'Armée de l'Air et le MDR).

PERSONNEL POUR LE CHARGEMENT:

- Superviseur.
- 5 manoeuvres par avion.
- Equipement de protection individuelle.
- Casques en fer.
- Lunettes de protection.
- Combinaisons à jeter.
- Gants en caoutchouc.
- Bottes en caoutchouc (protection en fer au niveau des orteils?)
- Masques anti-poussière. (Remarque: 1) Recrutement par l'USAID. 2) Laisser-passer délivrés par l'ASECNA). 3) Amener à l'aéroport les véhicules de service. 4) L'USAID garde les équipements après les heures de travail. 5) Ces équipements seront gardés au niveau du lieu de travail).

SECURITY:

. Aircraft.
. Pesticide storage including used barrels before disposal.
. Fuel storage area?
. 24 hours.

OPERATIONS:

A) AIR

. "In-country brief", for all flyers.
. Filing procedures.
. "Stereo" flight plans i.e. one plan for "flight of 4".
. Air Traffice Control procedures.
. Emergencies at Dakar (crash/rescue).
. Divert bases. Where are they?
. Search and Rescue (SAR).
. Unique in-country procedure? (Note: One of the four DC-7's has HF radio)

B) GROUND

. Passes/ID for aircrew, essential personnel, labor, etc. and vehicles.
. "Follow-me" for first arrival.
. Taxi plan.
. Night operations call for taxiway and runway lights.

SECURITE:

. Avions.
. Stockage des pesticides y compris des fûts utilisés avant leur destruction.
. Lieu d'entreposage du carburant?
. 24 heures.

OPERATIONS:

A) AIR

. Briefing de tout l'équipage sur les conditions et procédures de travail à l'Aéroport de Yoff.
. Procédures de fixation de plans de vols.
. Plans de vols "Stereo" c'est-à-dire un plan par "vol de 4".
. Procédures de contrôle de trafic aérien.
. Cas d'urgence à Dakar (accident/sauvetage).
. Bases de déviation. Où sont-elles situées?
. Recherche et sauvetage.
. Procédure locale particulière (Remarque: L'un des quatre DC-7 est équippé de radio HF).

B) AU SOL

. Laisser-passer/Identité de l'équipage, le personnel principal, les manoeuvres etc. et les véhicules).
. Un guide pour ceux qui arrivent pour la première fois.
. Plan de roulement au sol.
. Opérations de nuit nécessitant un éclairage de la piste de roulement et de la voie de départ.

Reference	Notes

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE

February, 1986

THIS IS NOT A SOLICITATION

NOTICE TO PROSPECTIVE OFFERORS

PROSPECTUS NO. 50-M-APHIS-86 FOR AERIAL SPRAYING

The U.S. Department of Agriculture, APHIS, Field Servicing Office, will contract for aerial spraying of insecticides for the Plant Protection and Quarantine Programs. Solicitations will incorporate all applicable provisions and specifications of this Prospectus by reference only and will become a part of any resultant contract. In order that prospective offerors may be fully apprised of all requirements, a copy of the Solitication format is attached for your information. Accordingly, each prospective offeror shall retain this copy for reference purposes when offers are requested. In most cases telegraphic offers are requested.

All Representations and Certifications, Section K, as stated in the Solicitation Mailing List Application, will be applicable to all solicitations and contracts referencing this Prospectus.

It is the responsibility of each offeror to advise us in writing of any changes in the Representations and Certifications during this prospectus year.

Issued by: U.S. Department of Agriculture
APHIS, Field Servicing Office
Procurement and Realty Services
Butler Square West, 5th Floor
100 North Sixth Street
Minneapolis, MN 55403

Telephone No. 612/349-3111

212

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE

April 25, 1986

THIS IS NOT A SOLICITATION

NOTICE TO PROSPECTIVE OFFERORS

PROSPECTUS NO. 50-M-APHIS-86 FOR AERIAL SPRAYING

Addendum No. 1

Prospectus No. 50-M-APHIS-86 for Aerial Spraying dated February, 1986, is amended as follows:

Section IV, paragraph P, page 14, is changed to read:

*P. Insurance

Notwithstanding the provisions of Paragraph O, the Government requires the Contractor to maintain aircraft liability insurance coverage on all aircraft in the amounts required by the States in which operations are conducted, but not less than:

$100,000.00 bodily injury, one person
$300,000.00 bodily injury, more than one person
$100,000.00 property damage, per accident

All other terms and conditions remain unchanged.

Issued by: U.S. Department of Agriculture
APHIS, Field Servicing Office
Procurement and Realty Services
Butler Square West, 5th Floor
100 North Sixth Street
Minneapolis, MN 55403

Telephone No. 612/349-3111

27

PROSPECTUS 50-M-APHIS-86

FEBRUARY 1986

AERIAL SPRAYING

TABLE OF CONTENTS

	PAGE NUMBER
Sample Solicitation, Offer and Award (Form SF 33)	G-9
Representations, & Certifications, Section K	G-10
Solicitation Instructions and Conditions, Section L	G-15
Description/Bid Schedule	G-20
Aircraft Categories	G-22

GENERAL CONDITIONS AND SPECIFICATIONS

SECTION I - GENERAL

	A.	Scope	G-23
	B.	Importance of Starting on Time	G-23
	C.	Gallons Plus or Minus 25%	G-23
	D.	Notice of Award	G-23
	E.	Contracting Officer's Representative	G-23
	F.	Airport - Definition	G-23
	G.	Day - Definition	G-23
	H.	Reporting and Starting Date - 5 Days Advance Notice	G-24
	I.	Operational Hours Allowed to Complete Program . . .	G-24
	J.	Formation Flying	G-25
	K.	Swath Checks	G-25
	L.	Areas not to be Sprayed	G-25
*	M.	Operating Performance Standards for Responsible Contractors	G-26

SECTION II - THE CONTRACTOR AGREES

*	A.	Aircraft and Spraying Systems	G-27
	B.	Radios	G-28
*	C.	Aircraft Guidance	G-28
	D.	Certifications - State/Federal	G-29
	E.	Personnel	G-29
	F.	Transport of Insecticide	G-30
	G.	Insecticide Mixing Equipment	G-30
	H.	Water Transport for Powder Insecticide	G-31
	I.	Loading Facilities	G-31
	J.	Responsibility for Insecticides	G-32
	K.	Observation Aircraft	G-32
	L.	Airport Selection	G-32
	M.	Passengers	G-33
	N.	Withdrawal, Substitution of Aircraft or Personnel .	G-33

274

SECTION III - THE GOVERNMENT AGREES

A. Maps, Briefing, Information G-34
B. Insecticides G-34
C. Daily Flight Record G-34
D. Payment for Gallons Sprayed G-34
* E. Payment for Observation Aircraft G-34

SECTION IV - IT IS MUTUALLY AGREED

A. Rejection of Aircraft/Spraying Systems G-35
B. Rejection of Radio Guidance System G-35
C. Rejection of Personnel G-35
D. Spray Boom Timer G-35
* E. Sequence of Spraying - Stopping, Starting G-35
F. Voluntary Additional Aircraft and Pilots G-35
G. Program Progress - Additional Aircraft G-35
* H. Liquidated Damages G-36
I. Delays Beyond Control of Contractor G-36
J. Termination for Default G-36
K. Cost of Insecticide to Respray Inadequately Treated Areas G-37
L. Cost of Insecticide Jettisoned G-37
* M. Cost of Insecticide Lost G-37
N. Height of Flight G-37
O. Liabilities of Contractor and Government G-37
* P. Insurance G-38
Q. Wage Determinations G-38
R. Statement of Federal Wage Rates and Fringe Benefits G-38

Appendix A - Wage Determinations

The attached Contract Clauses, Sections E, F, I, K, and L form a part of this Prospectus.

NOTE: The margins of this document are marked with an asterisk (*) to indicate where changes, additions, modifications, corrections, or deletions from the previous issue were made. This is done as a convenience only. Bidders and Contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the previous issue.

SOLICITATION, OFFER AND AWARD

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 350) ▶ | RATING | PAGE OF 2 | 14 PAGES

2. CONTRACT NO. | 3. SOLICITATION NO. | 4. TYPE OF SOLICITATION: [**] SEALED BID (IFB) [**] NEGOTIATED (RFP) | 5. DATE ISSUED: ** | 6. REQUISITION/PURCHASE NO.: **

7. ISSUED BY — CODE

U.S. Department of Agriculture
APHIS, Field Servicing Office
Butler Square, Fifth Floor
100 North Sixth Street
Minneapolis, MN 55403

8. ADDRESS OFFER TO (If other than Item 7)

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

SOLICITATION

9. Sealed offers in original and 0 copies for furnishing the supplies or services in the Schedule will be received at the place specified in Item 8, or if handcarried, in the depository located in Block 7 until ** local time ** (Hour) (Date)

NOTE: CHANGES

** To be specified in solicitation

CAUTION — LATE Submissions, Modifications, and Withdrawals: See Section L, Provision No. 52.214-7 or 52.215-10. All offers are subject to all terms and conditions contained in this solicitation.

10. FOR INFORMATION CALL: ▶ A. NAME: ** | B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS): **

11. TABLE OF CONTENTS

(V)	SEC.	DESCRIPTION	PAGE(S)	(V)	SEC.	DESCRIPTION	PAGE(S)
		PART I — THE SCHEDULE				PART II — CONTRACT CLAUSES	
X	A	SOLICITATION/CONTRACT FORM		X	I	CONTRACT CLAUSES	
	B	SUPPLIES OR SERVICES AND PRICES/COSTS				PART III — LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACH.	
	C	DESCRIPTION/SPECS /WORK STATEMENT			J	LIST OF ATTACHMENTS	
	D	PACKAGING AND MARKING				PART IV — REPRESENTATIONS AND INSTRUCTIONS	
X	E	INSPECTION AND ACCEPTANCE		X	K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
X	F	DELIVERIES OR PERFORMANCE					
	G	CONTRACT ADMINISTRATION DATA		X	L	INSTRS., CONDS., AND NOTICES TO OFFERORS	
	H	SPECIAL CONTRACT REQUIREMENTS			M	EVALUATION FACTORS FOR AWARD	

OFFER (Must be fully completed by offeror)

NOTE: Item 12 does not apply if the solicitation includes the provisions at 52.214-16, Minimum Bid Acceptance Period.

12. In compliance with the above, the undersigned agrees, if this offer is accepted within _____ calendar days (60 calendar days unless a different period is inserted by the offeror) from the date for receipt of offers specified above, to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), within the time specified in the schedule.

13. DISCOUNT FOR PROMPT PAYMENT (See Section I, Clause No. 52-232-8) ▶ | 10 CALENDAR DAYS % | 20 CALENDAR DAYS % | 30 CALENDAR DAYS % | CALENDAR DAYS %

14. ACKNOWLEDGMENT OF AMENDMENTS (The offeror acknowledges receipt of amendments to the SOLICITATION for offerors and related documents numbered and dated:

AMENDMENT NO.	DATE	AMENDMENT NO.	DATE

15A. NAME AND ADDRESS OF OFFEROR — CODE — FACILITY

16. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

15B. TELEPHONE NO. (Include area code)

15C. [ ] CHECK IF REMITTANCE ADDRESS IS DIFFERENT FROM ABOVE - ENTER SUCH ADDRESS IN SCHEDULE.

17. SIGNATURE | 18. OFFER DATE

AWARD (To be completed by Government)

19. ACCEPTED AS TO ITEMS NUMBERED | 20. AMOUNT | 21. ACCOUNTING AND APPROPRIATION

22. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:

[ ] 10 U.S.C. 2304(c)( ) [ ] 41 U.S.C. 253(c)( )

23. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified) ▶ ITEM Block 25

24. ADMINISTERED BY (If other than Item 7) — CODE

25. PAYMENT WILL BE MADE BY — CODE

USDA, APHIS, FSO, APS
100 North Sixth Street
Minneapolis, MN 55403

26. NAME OF CONTRACTING OFFICER (Type or print)

27. UNITED STATES OF AMERICA (Signature of Contracting Officer)

28. AWARD DATE

IMPORTANT — Award will be made on this Form, or on Standard Form 26, or by other authorized official written notice.

NSN 7540-01-152-8064
PREVIOUS EDITION NOT USABLE

33-133

STANDARD FORM 33 (REV. 4-85)
Prescribed by GSA
FAR (48 CFR) 53.214(c)

☆ GPO : 1985 O - 461-275 (419)

276

SECTION K - REPRESENTATIONS, CERTIFICATIONS, and OTHER STATEMENTS of OFFERORS

APPLICABLE TO ALL SOLICITATIONS

K-1 CONTINGENT FEE REPRESENTATION AND AGREEMENT (APR 1984)

(a) Representation. The offeror represents that, except for full-time bona fide employees working solely for the offeror, the offeror --

Note: The offeror must check the appropriate boxes. For interpretation of the representation, including the term "bona fide employee," see Subpart 3.4 of the Federal Acquisition Regulation. Not applicable to formal advertising or perishable subsistence items under $25,000, below the small purchase threshold, personal services on a time basis, regulated utilities, or foreign country.

(1) [ ] has, [ ] has not employed or retained any person or company to solicit or obtain this contract; and

(2) [ ] has, [ ] has not paid or agreed to pay to any person or company employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(b) Agreement. The offeror agrees to provide information relating to the above Representation requested by the Contracting Officer and, when subparagraph (a)(1) or (a)(2) is answered affirmatively, to promptly submit to the Contracting Officer --

(1) A completed Standard Form 119, Statement of Contingent or Other Fees (SF 119); or

(2) A signed statement indicating that the SF 119 was previously submitted to the same contracting office, including the date and applicable solicitation or contract number, and representing that the prior SF 119 applies to this offer or quotation. (FAR 52.203-4)

K-2 PARENT COMPANY and IDENTIFYING DATA (APR 1984)

(a) A "parent" company, for the purpose of this provision, is one that owns or controls the activities and basic business policies of the bidder. To own the bidding company means that the parent company must own more than 50 percent of the voting rights in that company. A company may control a bidder as a parent even though not meeting the requirement for such ownership if the parent company is able to formulate, determine, or veto basic policy decisions of the offeror through the use of dominant minority voting rights, use of proxy voting, or otherwise.

(b) The bidder [ ] is, [ ] is not owned or controlled by a parent company.

271

(c) If the bidder checked "is" in paragraph 2 above, it shall provide the following information:

Name and Main Office Address of Parent Company (Include Zip Code)	Parent Company's EI Number
_____	_____
_____	
_____	

(FAR 52.214-8)

K-3 SMALL BUSINESS CONCERN REPRESENTATION (APR 1984)

That offeror represents and certifies as part of its offer that it [ ] is, [ ] is not a small business concern and that [ ] all, [ ] not all supplies to be furnished will be manufactured or produced by a small business concern in the United States, its possessions, or Puerto Rico. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the size standards in this solicitation.

(FAR 52.219-1)

K-4 SMALL DISADVANTAGED BUSINESS CONCERN REPRESENTATION (APR 1984)

(a) Representation. The offeror represents that it [ ] is, [ ] is not a small disadvantaged business concern.

(b) Definitions.

"Asian-Indian American," as used in this provision, means a United States citizen whose origins are in India, Pakistan, or Bangladesh.

"Asian-Pacific American," as used in this provision, means a United States citizen whose origins are in Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, the U.S. Trust Territory of the Pacific Islands, the Northern Mariana Islands, Laos, Cambodia, or Taiwan.

"Native Americans," as used in this provision, means American Indians, Eskimos, Aleuts, and native Hawaiians.

"Small business concern," as used to this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria and size standards in 13 CFR 121.

"Small disadvantaged business concern," as used in this provision, means a small business concern that (1) is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged, or a publicly owned business having at least 51

215

percent of its stock owned by one or more socially and economically disadvantaged individuals and (2) has its management and daily business controlled by one or more such individuals.

(c) Qualified groups. The offeror shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Asian-Indian Americans, and other individuals found to be qualified by the SBA under 13 CFR 124.1. (FAR 52.219-2)

K-5 WOMEN-OWNED SMALL BUSINESS REPRESENTATION (APR 1984)

(a) Representation. The offeror represents that it [ ] is, [ ] is not a women-owned small business concern.

(b) Definitions.

"Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria and size standards in 13 CFR 121.

"Women-owned," as used in this provision, means a small business that is at least 51 percent owned by a woman or women who are U.S. citizens and who control and operate the business. (FAR 52.219-3)

K-9 DATA UNIVERSAL NUMBERING SYSTEM (DUNS)

1. The bidder/offer is requested to insert the DUNS number applicable to the Contractor's address shown on the solicitation form.

DUNS No. _____

2. If the production point (point of final assembly) is other than the location entered on the solicitation form, or if additional production points are involved, enter the DUNS number applicable to each production point in the space provided below.

Item No.	Manufacturer	Production Point	DUNS No.

If DUNS numbers have not been established for the Contractor, or the production point(s) shown above, a number will be assigned upon request by Dun & Bradstreet, Allentown, Pennsylvania, phone (215) 776-4388, 89, 90, or 91. (FAR 15.406-2, FPR TR-48)

K-11 PERSONS AUTHORIZED TO NEGOTIATE, SIGN AND ADMINISTER CONTRACTS AND CONTRACT MODIFICATIONS

The officer or quoter represents that the following persons are authorized to negotiate on its behalf with the Government on connection with this request for proposals or quotations:

219

Name	Location	Phone
_____	_____	_____
_____	_____	_____
_____	_____	_____

(FAR 52.215-11)

K-13 AFFIRMATIVE ACTION COMPLIANCE (APR 1984)

The offeror represents that (a) it [ ] has developed and has on file, [ ] has not developed and does not have on file, at each establishment, affirmative action programs required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2), or (b) it [ ] has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

K-15 CERTIFICATION OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above: _____ _____ [insert full name of person(s) in the offeror's organization responsible for determining the prices offered

in this bid or proposal, and the title of his or her position in the offeror's organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure. (FAR 52.203-2)

SECTION L - INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

L-31 SOLICITATION DEFINITIONS--NEGOTIATED (APR 1984)

"Offer" means "proposal" in negotiation.

"Solicitation" means a request for proposals (RFP) or a request for quotations (RFQ) in negotiation. (FAR 52.215-5)

L-32 ACKNOWLEDGMENT OF AMENDMENTS TO SOLICITATIONS (APR 1984)

Offerors shall acknowledge receipt of any amendment to this solicitation (a) by signing and returning the amendment, (b) by identifying the amendment number and date in the space provided for this purpose on the form for submitting an offer, or (c) by letter or telegram. The Government must receive the acknowledgement by the time and at the place specified for receipt of offers.

(FAR 52.215-8)

L-33 UNNECESSARILY ELABORATE PROPOSALS OR QUOTATIONS (APR 1984)

Unnecessarily elaborate brochures or other presentations beyond those sufficient to present a complete and effective response to this solicitation are not desired and may be construed as an indication of the offeror's or quoter's lack of cost consciousness. Elaborate art work, expensive paper and bindings, and expensive visual and other presentation aids are neither necessary nor wanted. (FAR 52.215-7)

L-34 SUBMISSION OF OFFERS (APR 1984)

(a) Offers and modifications thereof shall be submitted in sealed envelopes or packages (1) addressed to the office specified in the solicitation and (2) showing the time specified for receipt, the solicitation number, and the name and address of the offeror.

(b) Telegraphic offers will not be considered unless authorized by the solicitation; however, offers may be modified or withdrawn by written or telegraphic notice, if such notice is received by the time specified for receipt of offers.

(c) Item samples, if required, must be submitted within the time specified for receipt of offers. Unless otherwise specified in the solicitation, these samples shall be (1) submitted at no expense to the Government and (2) returned at the sender's request and expense, unless they are destroyed during preaward testing. (FAR 52.215-9)

L-35 EXPLANATION TO PROSPECTIVE OFFERORS (APR 1984)

Any prospective offeror desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective offerors before the submission of their offers. Oral explanations or instructions given before the award of the contract will not be

257

binding. Any information given to a prospective offeror concerning a solicitation will be furnished promptly to all other prospective offerors as an amendment to the solicitation, if that information is necessary in submitting offers or if the lack of it would be prejudicial to other prospective bidders. (FAR 52.215-14)

L-36 LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF PROPOSALS (APR 1984)

(a) Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it --

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail (or telegram if authorized) and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation; or

(3) Is the only proposal received.

(b) Any modification of a proposal or quotation, except a modification resulting from the Contracting Officer's request for "best and final" offer, is subject to the same conditions as in subparagraphs (a)(1) and (2) above.

(c) A modification resulting from the Contracting Officer's request for "best and final" offer received after the time and date specified in the request will not be considered unless received before award and the late receipt is due solely to mishandling by the Government after receipt at the Government installation.

(d) The only acceptable evidence to establish the date of mailing of a late proposal or modification sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark on the wrapper or on the original receipt from the U.S. or Canadian Postal Service. If neither postmark shows a legible date, the proposal, quotation, or modification shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, offerors or quoters should request the postal clerks to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(e) The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that

287

installation on the proposal wrapper or other documentary evidence of receipt maintained by the installation.

(f) Notwithstanding paragraph (a) above, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(g) Proposals may be withdrawn by written notice or telegram (including mailgram) received at any time before award. Proposals may be withdrawn in person by an offeror or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the proposal before award.
(FAR 52.215-10)

L-37 FAILURE TO SUBMIT OFFER (APR 1984)

Recipients of this solicitation not responding with an offer should not return this solicitation, unless it specifies otherwise. Instead, they should advise the issuing office by letter or postcard whether they want to receive future solicitations for similar requirements. If a recipient does not submit an offer and does not notify the issuing office that future solicitations are desired, the recipient's name may be removed from the applicable mailing list.
(FAR 215-15)

L-38 CONTRACT AWARD (APR 1984)

(a) The Government will award a contract resulting from this solicitation to the responsible offeror whose offer, conforming to the solicitation, will be most advantageous to the Government, cost or price and other factors, specified elsewhere in this solicitation, considered.

(b) The Government may (1) reject any or all offers, (2) accept other than the lowest offer, and (3) waive informalities and minor irregularities in offers received.

(c) The Government may award a contract on the basis of initial offers received, without discussions. Therefore, each initial offer should contain the offeror's best terms from a cost or price and technical standpoint.

(d) The Government may accept any item or group of items of an offer, unless the offeror qualifies the offer by specific limitations. Unless otherwise provided in the Schedule, offers may be submitted for quantities less than those specified. The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the offer.

(e) A written award or acceptance of offer mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer shall result in a binding contract without

further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer, as provided in paragraph (d) above), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award. Negotiations conducted after receipt of an offer do not constitute a rejection or counteroffer by the Government.

(f) Neither financial data submitted with an offer, nor representations concerning facilities or financing, will form a part of the resulting contract. However, if the resulting contract contains a clause providing for price reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished is incomplete, inaccurate, or not current.
(FAR 52-215-16)

L-39 PREPARATION OF OFFERS (APR 1984)

(a) Offerors are expected to examine the drawings, specifications, Schedule, and all instructions. Failure to do so will be at the offeror's risk.

(b) Each offeror shall furnish the information required by the solicitation. The offeror shall sign the offer and print or type its name on the Schedule and each continuation sheet on which it makes an entry. Erasures or other changes must be initialed by the person signing the offer. Offers signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(c) For each item offered, offerors shall (1) show the unit price, including, unless otherwise specified, packaging, packing, and preservation and (2) enter the extended price for the quantity of each item offered in the "Amount" column of the Schedule. In case of discrepancy between a unit price and an extended price, the unit price will be presumed to be correct, subject, however, to correction to the same extent and in the same manner as any other mistake.

(d) Offers for supplies or services other than those specified will not be considered unless authorized by the solicitation.

(e) Offerors must state a definite time for delivery of supplies or for performance of services, unless otherwise specified in the solicitation.

(f) Time, if stated as a number of days, will include Saturdays, Sundays, and holidays.
(FAR 52.215-13)

L-41 ORDER OF PRECEDENCE (APR 1985)

Any inconsistency in this solicitation shall be resolved by giving precedence in the following order: (a) the Schedule (excluding the specifications); (b) representations and other instructions; (c)

contract clauses; (d) other documents, exhibits, and attachments; and (e) the specifications. (FAR 52.215-18)

L-42 DISCOUNTS FOR PROMPT PAYMENT (APR 1984)

In connection with any discount offered for prompt payment, time shall be computed from (1) the date of completion of performance of the services or delivery of the supplies to the carrier if acceptance is at point of origin, or date of delivery at destination or port of embarkation if delivery and acceptance are at either of these points, or (2) the date the correct invoice or voucher is received in the office specified by the Government, if the latter is later than date of performance or delivery. For the purpose of computing the discount earned, payment shall be considered to have been made on the date the Government check was mailed. (FAR 52.232-8)

280

The following information will be included with each Solicitation.

DESCRIPTION

1. Insecticide: _____ gallons, plus or minus 25 percent, to be sprayed for control of _____ in the State(s) of _____ _____, estimated number of acres _____

2. Location: _____

3. Insecticide: _____ Rate of Application (Actual Formulation): _____ oz./acre

4. Nozzles: Tip Type: _____ Size: _____

5. Location of insecticide storage site(s): _____

6. Insecticide will be delivered in: _____ (bulk, barrels, or boxes).

7. Aircraft Required:

   (a) Spraying: _____ Matched: Yes or No _____; Same Make & Model: (Category & Number) Yes or No _____; Fixed Wing: Yes or No _____

   (b) Observation: _____ with minimum speed of _____ m.p.h.

8. Estimated Average Ferry Distance: _____ Elevation range of work area: _____

9. Minimum Block Size: _____

10. Estimated reporting date: _____

11. Estimated starting date: _____

12. Number of days required for State certification: _____

13. Congested areas, percent: _____

14. Guidance: (Type to be furnished and by whom): _____

15. Number operational hours allowed to complete the contract: _____

16. Insecticide mixing equipment required: Yes or No, Type _____ (See Sec. II, Paragraph G, Prospectus)

17. Insecticide loading equipment required: Yes or No

18. Water Transport: Yes or No (See Section II, Paragraph H, Prospectus)

19. Name and phone number of contract specialist _____

20. Any additional information:

BID SCHEDULE

ITEM NO. 1

Offeror to furnish all Aircraft, Personnel, Facilitating Equipment, and services that fully comply with all terms and provisions herein specified and Prospectus No. _____, dated _____.

PRICE PER GALLON $_____

Prompt Payment Discount _____ % _____ DAYS

AIRCRAFT CATEGORIES

Aircraft Categories have been established to facilitate program planning for desired aircraft based on the insect life cycle, timing of application, support personnel, adequate airport space, length and strength of runways, taxiways, and the elevation and type of terrain to be treated.

Shown below is the swath spacing each will be allowed. For aircraft other than those listed, the Government shall establish the Category and swath spacing for each type.

When Loran C radio guidance is provided, the swath spacing may be adjusted to the next higher multiple of 60 feet. When Del Norte and Motorola radio guidance is provided, the swath spacing may be adjusted to the next higher multiple of 10 feet.

Aircraft	Malathion, Sevin 4-Oil and All Oil Mixtures Feet	All Water Mixtures Feet	Aircraft	Malathion, Sevin 4-Oil and All Oil Mixtures Feet	All Water Mixtures Feet
		CATEGORY A - Fixed Wing			
Boeing B-17	500	350	Fairchild C-119	500	350
Douglas DC-4/DC-6	550	400	Douglas DC-7 (B&C)	650	500
		CATEGORY B - Fixed Wing			
Curtiss C-46	500	350	Martin 404	500	350
Douglas C-47 or DC-3	400	300	Douglas B-26	400	300
Lockheed Lodestar PV-2	400	300			
		CATEGORY C - Fixed Wing			
Grumman TBM	250	200	Twin Beech D-18	150	100
Turbine Thrush	150	100	Grumman C AgCat	150	100
Commander Thrust (800 hp & above)	150	100	(800 hp & above)		
Snow Turbine	150	100	M18 Dromader	150	100
		CATEGORY C Helicopters			
Bell 212 or 205A	150	100	Bell 204	100	75
Sikorsky S-55T & 58T	150	100	Alouette III	100	75
			Hughes 500	100	75
		CATEGORY D - Fixed Wing			
Cessna AgCarryall & AgPickup	100	75	Grumman AgCats (200-300 hp)	100	75
Cessna AgTruck & AgWagons	100	75	Murray MA-1	125	100
Commander Thrush & New Air Tractor (Snow)	125	100	Piper Brave	100	75
			Piper Pawnee (230-260 hp)	100	75
Commander Quail	100	75	Stearman (450-600 hp)	100	75
Grumman AgCats (Long Wing)	125	100	Weatherly	100	75
Grumman AgCats (400-600 hp)	100	75			
		CATEGORY D Helicopters			
Sikorsky S-55 & S-58	150	100	Bell 206	100	75
Hiller Seloy UH12E	100	75			
		CATEGORY E - Fixed Wing			
Callair (150-180 hp)	75	50	Piper PA-18	75	50
Piper Pawnee (150-180 hp)	75	50			
		CATEGORY E Helicopters			
Alouette II	100	75	Hiller	75	50
Fairchild FH-1100	100	75	Hughes	50	35
Bell - All others	100	75			

GENERAL CONDITIONS AND SPECIFICATIONS

SECTION I

A. Scope

The USDA, APHIS, Plant Protection and Quarantine, hereinafter referred to as the Government, requires aircraft, personnel, facilitating equipment, and services to spray insecticide.

B. Importance of Starting on Time

Offerors are reminded that there are numerous biological and entomological factors that determine the time and sequence of treatments. The importance of starting and completing a program within specified limits is critical. The objective of each program is to achieve complete and uniform coverage of the designated geographic areas within the time available.

C. Gallons Plus or Minus 25%

Any offeror submitting an offer in response to a solicitation subject to this Prospectus acknowledges, without qualification, that he understands and agrees to spray the total gallons specified in the Description, plus or minus 25%. All such spraying, whether plus or minus 25% of the total specified, will be made at the contract price per gallon.

D. Notice of Award

Notice of Award and Notice to Proceed will be issued by the Contracting Officer only. Each contract covers the period from the date of award until the contract is completed or terminated.

E. Contracting Officer's Representative (COR)

The Contracting Officer will designate a representative who will have authority to secure orderly administration of each contract. The COR will have no authority to change the basic terms of the contract. The COR will be a certified insecticide applicator.

F. Airport - Definitions

1. Airport, as used in this Prospectus and each solicitation, means any airport, airstrip, or worksite where the Contractor will load his aircraft during contract operations.

2. Reporting airport means the airport to which the Contractor shall deliver his aircraft for inspection and acceptance tests.

G. Day - Definition

Day, as used in this Prospectus, means calendar day. Unless ordered otherwise by the COR during the program, operations will be conducted 5 days per week, Saturdays, Sundays, and National holidays excluded.

the program. Example: It is estimated that a Category C aircraft should be able to spray at least 500 acres per operational hour. Thus, one Category C aircraft, at 500 acres per hour, would be allowed 100 operational hours to treat 50,000 acres; two C aircraft, at 1,000 acres per hour (2 x 500), would be allowed 50 operational hours; and four C aircraft, at 2000 acres per hour (4 x 500), would be allowed 25 operational hours.

3. If, during an operational day, the COR suspends operations due to wind or other reasons, and then clears the aircraft to continue operations later in the day, the operational hours charged for that day will be for the total hours (to the last full half hour) used during those operating periods.

4. On an operational day when all aircraft on the program cannot operate for reasons beyond the control of the Contractor, a proportional adjustment will be made in the operational hours charged for that day. Such conditions would include (a) when one or more aircraft are grounded due to guidance failures, or (b) when one or more aircraft are grounded due to fog or poor visibility in their areas while others can operate. Example: If only two aircraft on a four-aircraft contract can operate the operational hours charged will be one-half of those used on that day.

5. When the contract acreage is increased to exceed 100%, the operational hours allowed to complete the program will be increased proportionately.

6. A Contractor who fails to operate on an operational day will be charged for each operational hour he could have operated, up to a maximum of 6 hours for each such day.

J. Formation Flying

1. When aircraft are to be flown in formation, they must be the same make and model capable of operating at the same speed, and swath spacing. Pilots must have formation flying experience.

2. When formation flying is agreed upon by the COR and the Contractor's Representative, each Category A or B aircraft pilot will maintain a trail position no more than 1,500 feet from the lead aircraft. Each pilot of all other Category aircraft will maintain a trail position no more than 1,000 feet from the lead aircraft.

K. Swath Checks

Swath checks will be conducted when there is a reason to believe that the spraying system does not produce a uniform pattern or the spraying system does not produce a swath as wide as that shown for each aircraft type listed on the Aircraft Category sheet.

L. Areas Not to be Sprayed

There may be areas within the program boundaries that will not be sprayed. Such areas will be designated by the COR. Each pilot will be

briefed thoroughly and every effort must be exerted to avoid spraying such areas.

*M. Operating Performance Standards for Responsible Contractors

1. Obtaining the necessary FAA and State clearances, including certification as an applicator of restricted use pesticides (certified pesticide applicator) when required, for all pilots and aircraft prior to the starting date. Contractor's compliance in a timely manner with all FAA regulations for maintenance and overhaul, all FAA airworthiness directives, and other applicable directives in force.

2. Pilots obtaining the proper certifications for agricultural flying prior to the starting date.

3. The attitude of Contractor and his personnel and their cooperation in following instructions, based on contract specifications.

4. Contractor's personnel reporting to work on time daily and remaining on the job until officially released.

5. Contractor reporting on date as directed and providing all required equipment, personnel, and facilities.

6. All equipment meeting contract requirements.

7. Avoiding repeated delays caused by malfunction of equipment or delays in loading between trips which affect the total overall length of time in performing the contract.

8. All Items in Section II, Paragraph L.

9. The Contractor's aircraft safety program. His utilization and fostering of good safety habits and attitudes in his employees.

At the end of the contract program, the COR will submit to the Contracting Officer a written report on the Contractor based on the Operating Performance Standards. An unsatisfactory report and other documentary evidence will be used in considering a Contractor's responsibility for future contracts.

SECTION II

THE CONTRACTOR AGREES:

*A. Aircraft and Spraying Systems

To provide the required number of aircraft and that each spraying aircraft will have:

1. An insecticide dispersal system that has been cleaned thoroughly inside. All hoses shall be in good condition and shall be a chemical resistant type.

2. Leakproof insecticide tank(s) and spray booms of corrosion resistant materials, such as stainless steel, aluminum or fiberglass. Contractors are cautioned that insecticide may loosen some sealants and plug the spraying system. Sealants should be tested before use.

a. The tank(s) in each aircraft shall be installed so that the tank(s) will empty in flight. Certain aircraft may require the installation of a sump and manifold system which assures full flow to the pump, regardless of aircraft attitude. Sight gauges or other means shall be provided to determine the quantity contained in each tank before reloading.

b. A drain valve shall be provided at the low point of the spray system to facilitate the complete draining of the tanks and system while the aircraft is parked so that unused insecticide can be recovered.

3. A pump that will provide the required flow rate at not less than 40 psi during spraying operations to assure uniform flow and proper functioning of the nozzles. Gear, centrifugal, or other rotary types will be acceptable. For safety reasons, wind-driven pumps are not acceptable on aircraft with a working speed above 150 mph.

a. For ULV spraying systems with a pumping capacity that exceeds the discharge calibration rate shall have the bypass flow return to the tank bottom in a manner that prevents aeration and/or foaming of the spray formulation. Pumps utilizing hydraulic drive or other variable speed drives are not required to have this bypass, provided the pump speed is set to provide only the required pressure and the system three-way valve is used for on/off control at full throw position. Any bypass normally used to circulate materials other than the ULV will be closed for ULV spraying.

b. For suspensions, including Sevin 4-oil, a pressure agitation system is required.

4. A leakproof spraying system of the boom-type capable of spraying the insecticide uniformly. The boom length shall be equal to 3/4 of the wing span equipped with properly spaced nozzles along the boom span and in each end of the boom. A boom longer than 3/4 of the wing span must be effectively shortened by removal of the excess by use of 3/8 inch minimum sized bleed lines from the tips of the boom back to the tank or back to a

nozzle at the 3/4 position. Flow from the boom to this nozzle must be blocked to be effective.

5. A positive on/off system that will prevent dribble from the nozzles.

6. A positive emergency shut-off valve between the tank(s) and the pump, as close to the tank(s) as possible. This valve shall be controllable from the cockpit and supplemented by check valves and/or flight crew training which will minimize inadvertent loss of insecticide due to broken lines or other spray system malfunctions (see Section IV, paragraph M).

7. Bleed lines on any point that may trap air on the pressure side of the spraying system.

8. A spraying system pressure gauge with an operating range from zero to 100 psi.

9. A 50-mesh in-line screen between the pump and the boom, unless otherwise specified and nozzle screens as specified by the nozzle manufacturer. When using Sevin 4-oil install the 4514-20 slotted screen in each nozzle replacing other type nozzle screens.

10. Nozzles:

a. Nozzle tip type and size shall be as specified in the Solicitation.

b. Provisions shall be made on all aircraft so that nozzle direction can be changed from 45 degrees down and forward to straight back when it is necessary to change droplet size.

c. All nozzles not in use shall be removed and the openings plugged.

d. Nozzle tips for all insecticides shall be made of stainless steel. (Brass is not acceptable because of its corrosive susceptibility to certain chemicals).

e. Operating pressure will be 40 psi unless otherwise specified in the Solicitation.

B. Radios

Each aircraft must be equipped with a fully operative two-way VHF radio capable of transmitting and receiving on 122.925 MHz.

*C. Aircraft Guidance

When electronic guidance is required:

1. To provide all equipment, materials, personnel, and services required for the system to be used. This equipment shall be capable of

accurately guiding the aircraft while flying at an altitude of 100 feet above the terrain along parallel flight lines in blocks designated by the Government.

2. When application aircraft are flown in formation, only the lead aircraft need be equipped with a guidance receiver. To facilitate the treatment of large spray blocks and the use of certain high frequency systems, guidance equipment may be installed in a light aircraft that can be safely flown at the same speed as the application aircraft, no higher than 500 feet above the terrain. Application aircraft will then guide on this lead aircraft when making swath runs.

3. The system shall be sufficiently sensitive to provide immediate deviation indications and sufficiently accurate to keep the aircraft within 100 feet of the desired flight path.

4. The Contractor may be required to install Government-furnished electronic guidance or recording equipment.

D. Certification - State/Federal

To be certified by the FAA, and to comply with all applicable FAA regulations and applicable regulations of the State in which operations will be conducted.

1. Immediately upon award of a contract, the Contractor shall contact the appropriate Agency in such State to fulfill, prior to the official starting date any State requirements for aircraft and pilot certifications, insurance and/or other State requirements, including pesticide applicator certification, to perform aerial spraying operations.

2. When congested areas are included in the area(s) to be sprayed, operations will be conducted in accordance with FAA regulations, Part 137. The Contractor shall, prior to the reporting date, complete all flight tests required by the FAA to operate his aircraft over congested areas. The COR will reject any aircraft that has not completed such tests prior to the reporting date.

3. Documents which shall be available at the reporting airport include the Agricultural Aircraft Operator Certificate, Aircraft Registration and Airworthiness Certificates, aircraft and engine log books, Pilot Certificates, Medical Certificates, and proof of insurance coverage.

E. Personnel

To provide the following:

1. A Contractor's Representative (CR) at each airport the Contractor is using. The CR shall have full authority to make decisions for the Contractor and direct the Contractor's operations. The CR shall be stationed at the airport for the duration of the contract and shall be available for consultation at all times as requested by the COR. If the CR is a fully qualified agricultural pilot, the CR may operate the observation aircraft when an observation aircraft is required on the program. The CR

will not be permitted to operate a spraying aircraft except when authorized by the COR, unless there are three or less spraying aircraft required on the program.

2. A qualified commercial pilot for each spraying aircraft who has:

a. More than 1,000 solo hours, and
b. More than 100 hours aerial application experience.
c. On the Gypsy Moth program, more than 25 hours of forest spraying experience.

3. A copilot for each Category A and B aircraft, who shall have a commercial or Air Transport Pilot certificate. No spraying flights will be permitted without a qualified copilot on board.

4. A qualified commercial pilot for each observation aircraft who has:

a. More than 500 solo hours,
b. More than 50 hours aerial application experience.

5. Experienced personnel in the use of the Guidance System(s) furnished.

6. Personnel to mix insecticide when mixing equipment is required in the solicitation.

7. Personnel to load and service the aircraft.

8. When required, a person or persons certified as an applicator of restricted use pesticides (certified pesticide applicator) by the State in which the operations will be conducted.

F. Transport of Insecticide

To provide personnel and transport for the insecticide from the storage site(s) to the aircraft loading site on each airport and deliver empty insecticide containers to the site(s) designated by the COR.

G. Insecticide Mixing Equipment

To provide insecticide mixing equipment, when specified in the Solicitation, to mix the materials provided by the Government. The capacity of the mixing equipment shall be at least equal to the total gallons that will be carried on one trip by all aircraft on the Program. The capacity of the mixing equipment shall be sufficient to prevent delays in applicator aircraft flight schedules.

Mixing equipment basic design shall include:

Interchangeable strainer screens
Internal agitator for mixing the formulation
A lowest point drain to completely empty the tank
Opening on the top side to allow for thorough cleaning and inspection of each compartment.

Specific requirements for various formulations will be specified for each contract (i.e., hydraulic or paddle agitation, etc.).

The Contractor shall make provisions to measure each batch of insecticide formulation mixed, either by means of a calibrated measuring stick, sight gauge, or other acceptable means. An engine-driven centrifugal pump shall be attached to each tank to thoroughly mix and circulate the insecticide. This pump may be used to add diluent to the tank through fitting and valve combinations. It may also be used to load the aircraft.

H. Water Transport for Powder Insecticide

When Sevin 80S, Acephate, or similar powder is the insecticide specified in the Solicitation, to provide clean tankers to haul water for mixing the insecticide in sufficient quantities to insure uninterrupted aircraft operation. Each tanker shall be equipped with a pump of at least 50 gallons per minute capacity, so arranged that it can be used to load or unload the tank. Water for mixing insecticide may be drawn from city water supplies, wells, farm tanks, streams, or lakes, provided it is clean. The COR will decide whether questionable water may be used and his decision shall be final.

I. Loading Facilities

When specified in the Solicitation, to provide complete aircraft loading facilities that include:

1. Pumps capable of loading each aircraft at a minimum rate of 50 gallons per minute. The mixing pump can also be used for this purpose. The Solicitation will specify whether the insecticide will be delivered in bulk or barrels or whether it will require mixing. The pumping equipment must be adaptable to the containers from which the aircraft will be loaded.

2. Meters of adequate capacity to accurately measure the insecticide into each aircraft. The metering system shall be equipped with an air elimination device to assure proper measure of the liquids being used. The air elimination device will be required on aerial spraying jobs in excess of 2,000 gallons. The Contractor shall provide evidence that each meter has been inspected and calibrated by a licensed inspector within one month or less prior to the estimated starting date shown in the Solicitation. Some insecticides will cause meters to wear and it will be necessary to recheck each meter for accuracy during the course of the spraying program. When a meter is found inaccurate and it is not adjusted, a correction factor will be applied to each gallon measured thereafter by that meter.

3. Strainers no larger than 30-mesh or compatible to the orifice size of the spray system, to clean the insecticide prior to loading into the aircraft, or prior to entering the meter when a meter is used.

4. Loading Nozzle. Positive shut-off, quick-disconnect couplings, valves, or attachments so installed as to eliminate loss of insecticide during loading or uncoupling.

5. All hoses shall be in good condition and shall be resistant to all agricultural chemicals.

J. Responsibility for Insecticides

To be responsible for all insecticide and materials accepted from the Government until properly sprayed on assigned areas.

K. Observation Aircraft

When observation aircraft are specified in the Solicitation, each will be four-place, have a rated cruising speed of not less than 160 mph, unless a slower speed is acceptable and is so stated in the Solicitation. It shall be equipped with a device to record flight hours, and be capable of safe operation from the airport(s) used by the spraying aircraft. It shall be in good mechanical condition with a current 100-hour inspection. The aircraft will not qualify for acceptance when its engine time reaches manufacturer's recommended overhaul time. New or overhauled engines shall have been flown a minimum of 5 hours before use on a program. Should a 100-hour inspection be performed on the aircraft during the course of the program, the Contractor shall test fly the aircraft prior to carrying Government personnel. Current logbooks shall be provided to verify aircraft and engine time and inspections. The aircraft engine shall be equipped with a standard muffler. The maximum noise level in the cabin shall be such that the occupants can converse without shouting and understand radio communications without using earphones. Each observation aircraft and its pilot will be available at the airport specified by the COR throughout the period of the contract to acquaint pilots with specific areas to be sprayed and at the request of the COR, to carry Government personnel to monitor spraying operations. The Government will pay the Contractor only for flight hours requested and approved by the COR.

L. Airport Selection

To select the airport(s) to be used and make the necessary arrangements with proper authority for:

1. The use of each airport.

2. The payment of any fees charged for its use.

3. The payment for repairs or damages that result from the Contractor's aircraft, equipment, or contamination from insecticide.

4. Immediate removal of all aircraft and equipment from the airport(s), after the program is completed unless other satisfactory arrangements are made with the airport authorities.

5. Maintaining the areas used by the Contractor in a clean and orderly fashion during their use and cleanup after use, to the satisfaction of the COR.

6. In addition, within 3 calendar days after receipt of award, the Contractor and COR shall agree on which airport will be used first at the

beginning of the program. That airport will then be designated as the reporting airport.

7. Operations will be conducted from only one airport at a time, unless otherwise authorized or directed by the COR.

M. Passengers

1. No passengers will be carried in application aircraft. Personnel will be limited to the necessary crew members.

2. No passengers will be carried in the observation aircraft without the approval of the COR. This approval must be recorded in the program log.

N. Withdrawal, Substitution of Aircraft or Personnel

The Contractor shall notify the COR promptly in writing of any withdrawal or substitution of aircraft, pilot or copilot.

SECTION III

THE GOVERNMENT AGREES:

A. Maps, Briefing Information

To provide maps, briefing, and information for the pilot(s) of the areas to be sprayed.

B. Insecticides

To provide insecticide (and special diluents or stickers when required) delivered to the storage site(s) listed in the Solicitation.

C. Daily Flight Record

To provide and maintain an accurate Daily Flight Record and furnish the Contractor with a copy.

D. Payment for Gallons Sprayed

To pay the Contractor for each gallon of insecticide acceptably sprayed, based on the flight records and partial delivery receipts prepared by the Government. Payment will be made in accordance with FAR 52.232-1, providing the following conditions are met:

1. Invoices shall show the total number of gallons of insecticide acceptably sprayed with inclusive date for the period covered.

2. The Daily Flight Record has been signed by the Contractor's Representative.

3. Invoices shall not be submitted for less than a one-week period, except upon completion of the contract.

4. Invoices shall be forwarded to the billing address shown on the Purchase Order or Block 25 of the Standard Form 33 (Solicitation, Offer, and Award).

Failure to comply with the above conditions may result in delay of payment.

*E. Payment for Observation Aircraft

To pay the Contractor an hourly rate, computed to the nearest tenth of an hour, for the use of the observation aircraft when it is flown at the request of the COR. Such payment will be at the rate of $120 per hour for a 160 mph aircraft and $110 per hour for a slower type when specified. If a slower type is specified, payment will be at the $110 rate even though a faster aircraft is furnished. The Contractor will be paid, as standby time, the specified rate equal to 1 hour of flight time for each operational day the observation aircraft is not used. A record of ordered flight time, based on flight recorder readings, will be kept on a Daily Flight Record by the Government.

SECTION IV

IT IS MUTUALLY AGREED:

A. Rejection of Aircraft/Spraying Systems

The Government may reject at any time any aircraft and/or spraying system deemed to be unsafe or which does not comply with all contract specifications. Qualifying tests of aircraft may be conducted by the Government to assure that contract requirements are met. All operational costs incurred in conducting these tests will be borne by the Contractor except that the Government will furnish the insecticide used for swath checks.

B. Rejection of Radio Guidance System

The Government may reject at any time, the entire radio guidance system or any component which does not comply with the contract specifications.

C. Rejection of Personnel

The Government may reject at any time, the Contractor's Representative or any pilot found unqualified or incompetent, who operates his aircraft in a negligent manner, or fails to perform satisfactorily.

D. Spray Boom Timer

The Government reserves the right to require the Contractor to install Government-furnished timing devices on the boom or boom line of each application aircraft.

*E. Sequence of Spraying - Stopping, Starting

The COR will determine the time and sequence of spraying individual areas and the time to start and stop spraying each day. In addition, if the COR is not in the treatment area and is unaware of deteriorating weather conditions, the pilot(s) are responsible to voluntarily stop spraying to avoid possible liquidated damages.

F. Voluntary Additional Aircraft and Pilots

This Solicitation specifies the category and the number of aircraft required for the program. Should the Contractor wish to provide an additional aircraft and pilot(s), that meet all contract requirements, he may do so provided it is agreeable with the COR. No adjustment will be made in the contract price for providing additional aircraft.

G. Program Progress - Additional Aircraft

The COR will determine whether program progress is satisfactory. If the Contractor has not completed spraying 40 percent of the gallons of insecticide within 40 percent of the operational hours allowed, he will be required to furnish additional aircraft within 2 calendar days when requested by the Contracting Officer. Such aircraft shall be of the same

201

category as those specified in the Description; shall meet all contract requirements, including qualified pilot(s) to operate the aircraft; and shall be fully operational within 1 day after reporting. No adjustment will be made in the contract price for furnishing such additional aircraft.

*H. Liquidated Damages

All charges assessed in the following suparagraphs shall be paid to the Government as fixed, agreed, and liquidated damages, not as a penalty.

1. Should the Contractor delay the program for any reason, there will be charged and/or deducted from payment to the Contractor, the following sums of money:

$1,000 per day for each aircraft

The rates above will be charged for:

a. Each aircraft that fails to report on the official reporting date.

b. Each aircraft that fails to spray on the official starting date, provided it is an operational day, and for each operational day thereafter until it begins spraying operations.

c. Each aircraft that fails to spray on an operational day and each operational day thereafter, until it begins spraying operations. However, when an aircraft fails to spray for more than one reason on a day for which liquidated damages are charged, no more than the daily liquidated damage rate for that aircraft will be charged for that day.

d. Each additional aircraft that fails to report within three calendar days, when requested, and qualify within one day after reporting, such charges to begin after the fourth day and continue until it is operational.

2. Should the Contractor fail to complete the program within the specified number of operational hours, he will be charged an hourly rate equal to 1/6 of the daily liquidated damage rate shown above for each aircraft on the program (including the additional aircraft when required) for each full additional operational hour needed to complete the program.

I. Delays Beyond Control of Contractor

The Contractor will not be liable for delays or failures caused by the Government, or reasons beyond the control of the Contractor.

J. Termination for Default

A Contractor, who through his fault or negligence delays program progress for reasons within his control may, at the discretion of the Contracting Officer, be terminated for default under the Default Clause (FAR 52.249-8). The right to terminate for default is in addition to the Government's right to charge liquidation damages.

K. Cost of Insecticide to Respray Inadequately Treated Areas

The Contractor will be liable for the cost of insecticide required to respray inadequately sprayed areas when respraying is necessary because of the Contractor's failure to perform satisfactorily.

L. Cost of Insecticide Jettisoned

An estimate of the amount of insecticide that is jettisoned for any reason, will be made by the Government and the cost thereof deducted from any amounts due the Contractor.

*M. Cost of Insecticide Lost

An estimate will be made by the COR of the amount of insecticide lost due to spillage, overflowing of tanks, leakage of tanks, or loading devices, due to the Contractor's personnel, and the cost thereof deducted from any amounts due the Contractor under this contract.

N. Height of Flight

The height of flight for each Category aircraft on each program will be specified by the COR.

O. Liabilities of Contractor and Government

The Government will not assume any responsibility whatsoever for loss or damage of equipment owned or operated by the Contractor, his agents, or employees or subcontractor or for the injury to or death of the Contractor, his agents or employees or subcontractor. The Contractor will hold and save the Government, its officers, agents, servants and employees harmless from liability of any nature or kind for or on account of the use of any copyrighted or uncopyrighted composition, secret process, patented or unpatented invention, articles or appliance, used in the performance of this contract, including their use by the Government unless otherwise specifically stipulated in the contract. The Contractor will be responsible for any negligent or wrongful acts or omissions of the Contractor, his employees, agents or subcontractors and employees or agents of the subcontractor(s) incident to the performance of this contract. The Contractor will hold and save the Government, its officers, and employees harmless from all liability for any death or damage to all persons (other than the liability of the Government to Agriculture employees directly engaged in performing work under this contract as provided under the Federal Employee's Compensation Act) or to real or personal property, including negligent use of spray material, which results from the operation of, or incident to, equipment furnished by the Contractor, or otherwise incident to performance of the contract. However, the Contractor will not be responsible for any negligent or wrongful acts or omissions of the U.S. Department of Agriculture, its employees, the U.S. Department of Agriculture's cooperators, or their employees.

*P. Insurance

Notwithstanding the provisions of Paragraph O, the Government requires the Contractor to maintain aircraft liability insurance coverage on all aircraft in the amounts required by the States in which operations are conducted, but not less than:

$200,000.00 bodily injury, one person
$500,000.00 bodily injury, more than one person
$200,000.00 property damage, per accident

Q. Wage Determinations

The Contractor shall be obligated under the Service Contract Act of 1965 to pay the minimum hourly wage and fringe benefits to the class of service employees that will be used on the job and who are covered under the Department of Labor wage determinations. (See Appendix A.) No increase in contract price shall be allowed or authorized on account of payment of wage rates in excess of those listed in attached wage determinations.

R. Statement of Federal Wage Rates and Fringe Benefits

1. If this service were performed by Wage Board service employees of a Federal Agency, the following wage rates and fringe benefits would be applicable:

Basic Hourly Rate: This information will be included in each solicitation.

Location:

Wage Board employees are entitled to their scheduled rate of pay plus a differential of 7-1/2% of the scheduled rate for regularly scheduled non-overtime work, when a majority of the work hours occur between 3 p.m. and midnight; or 10% of the scheduled rate if the majority of the work hours occur between 11 p.m. and 8 a.m.

2. Fringe Benefits

a. The Federal Government provides coverage for Federal Wage Board Employees in Life, Accident, and Health Insurance, and Sick Leave programs at 5.1 percent of the basic hourly rate.

b. The following paid holidays are provided by law to Federal Wage Board Employees:

New Year's Day	Columbus Day
Washington's Birthday	Veteran's Day
Memorial Day	Thanksgiving Day
Independence Day	Christmas Day
Labor Day	

c. The amount of paid annual leave provided by law to Federal Wage Board Employees is as follows:

(1) Two hours of annual leave each week for an employee with less than 3 years of service.

(2) Three hours of annual leave each week for an employee with between 3 and 15 years of service.

(3) Four hours of annual leave each week for an employee with 15 or more years of service.

d. Seven percent of a Wage Board's Employee's basic hourly rate is contributed by the Government for retirement.

Should the successful bidder enter into a collective bargaining action with any employee(s) engaged in the performance of any contract entered as a result of this solicitation during the contract period, the successful offeror will at the conclusion of such collective bargaining, notify the Contracting Officer in writing of the results of such collective bargaining.

U.S. DEPARTMENT OF LABOR
EMPLOYMENT STANDARDS ADMINISTRATION
WAGE AND HOUR DIVISION
WASHINGTON, D.C. 20210

REGISTER OF WAGE DETERMINATIONS UNDER
THE SERVICE CONTRACT ACT
By direction of the Secretary of Labor

W.H. Otter — Administrator

LOCALITY	State: Nationwide	XX
	Area: Various Localities (THIS WAGE DETERMINATION DOES NOT APPLY TO CONTRACTS FOR WHICH SEPARATE WAGE DETERMINATIONS HAVE BEEN ISSUED)	

Wage determination number: 80-256 (Rev. 4) Date: 7/17/84

Class of service employee	Minimum hourly wage	Fringe benefit payments			
		Health & Welfare	Vacation	Holiday	Other
Employed on U.S. Government contracts for aerial seeding, aerial spraying, transportation of personnel and cargo, fire reconnaissance, administrative flying, fire detection, air taxi mail service, and other flying services except scheduled airline transportation (this determination does not apply to modification and/or repair of aircraft contracts to which flying services are incidental):					
1. Pilot 1/	$12.56				
2. Aircraft Mechanic, Journeyman	10.26				
3. Aircraft Mechanic, Junior	7.65				
4. Aircraft Cleaner	5.26				
5. Laborer	5.26				
Fringe benefits applicable to classes of service employees engaged in contract performance:		2/	3/	4/	

Occupational Definition:

Aircraft Mechanic, Junior - This occupational classification may be part of a planned program of training and development for advancement to journeyman level. Work is generally performed under the guidance and supervision of the journeymen mechanic. Workers who assist or directly help higher level mechanics by performing simple or common tasks (getting tools and supplies, carrying materials and lifting and holding materials in place during operation, cleaning work areas, tools and machines, and, lubricating machines) are excluded.

U.S. DEPARTMENT OF LABOR
EMPLOYMENT STANDARDS ADMINISTRATION
WAGE AND HOUR DIVISION
WASHINGTON, D.C. 20210

REGISTER OF WAGE DETERMINATIONS UNDER
THE SERVICE CONTRACT ACT
By direction of the Secretary of Labor

W.H. Otter Administrator

LOCALITY	State: Nationwide	XX
	Area: Various Localities (THIS WAGE DETERMINATION DOES NOT APPLY TO CONTRACTS FOR WHICH SEPARATE WAGE DETERMINATIONS HAVE BEEN ISSUED)	

Wage determination number: 80-256 (Rev. 4) Date: 7/17/84

Class of service employee	Minimum hourly wage	Fringe benefit payments			
		Health & Welfare	Vacation	Holiday	Other

1/ Base hourly wages inclusive of differential bonus, and/or premium payments for flight time. Not applicable to a "co-pilot" classification where such is required in the performance of the contract, see note below.

2/ $.32 an hour or $12.80 a week or $55.46 a month.

3/ One week paid vacation after 1 year's service with contractor or successor; two weeks after 2 years. (Length of service includes the whole span of continuous service with the present (successor) contractor wherever employed, and with predecessor contractors in the performance of similar work at the same Federal facility. (Reg. 4.171(b)(2).)

4/ 9 paid holidays per year: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Columbus Day and Christmas Day. (A contractor may substitute for any of the named holiday's another day off with pay in accordance with a plan communicated to the employees involved.)

Any class of service employee required in the performance of the contract but not listed above shall be classified by the contractor so as to provide a reasonable relationship between such classes and those listed above, and shall be paid such monetary wages as are determined by agreement (evidenced in writing) of the interested parties, who shall be deemed to be the contracting agency, the contractor, and the employees who will perform on the contract or their representatives. In the absence of an agreement, the question of proper conformable wage rates is to be submitted to the Department of Labor by the contracting officer for a final determination. (See Section 4.6(b) of Regulations 29 CFR 4.)

ATTACHMENT
50-M-APHIS-86

Referenced Contract Clauses

Contract clauses are incorporated herein by reference and are made a part of this contract with the same force and effect as those set forth in full text. All of the references are from the Federal Acquisition Regulation (48 CFR Chapter I) unless otherwise indicated. The month and year of each clause applicable to this contract are shown in parenthesis following the clause title. Contractors are CAUTIONED that they should not alter any of the clauses listed below. The complete text of any or all of the clauses referenced herein may be obtained by submitting a request, identifying the Prospectus number, to the Department of Agriculture office issuing the Prospectus. Complete copies of the FAR in loose-leaf or CFR form may be purchased from the Superintendent of Documents, Government Printing Office, Washington, DC 20402. (Clauses that deviate from the text as shown in the FAR shall be annotated with DEVIATION after the title and date.)

All references to "formal advertising" in this solicitation shall be deemed to mean "sealed bidding." This change made in accordance with Federal Acquisition Circular 84-5 implementing the Competition in Contracting Act of 1984 (CICA), Public Law 98-369.

CLAUSE REFERENCE	TITLE AND DATE
SECTION E - INSPECTION AND ACCEPTANCE	
52.246.4	INSPECTION OF SERVICES - FIXED PRICE (APR 84)
52.246-16	RESPONSIBILITY FOR SUPPLIES (APR 84)
SECTION F - DELIVERIES OR PERFORMANCE	
52.212-13	STOP WORK ORDER (APR 84)
52.212-15	GOVERNMENT DELAY OF WORK (APR 84)
SECTION I - CONTRACT CLAUSES	
52.202-1	DEFINITIONS (APR 84)
52.203-1	OFFICIALS NOT TO BENEFIT (APR 84)
52.203-3	GRATUITIES (APR 84)
52.203-5	COVENANT AGAINST CONTINGENT FEES (APR 84)
52.215-1	EXAMINATION OF RECORDS BY COMPTROLLER GEN (APR 84)
52.219-6	NOTICE OF TOTAL SMALL BUSINESS SET-ASIDE (APR 84)
52.219-8	UTILIZATION OF SMALL BUSINESS CONCERNS AND SMALL DISADVANTAGED BUSINESS CONCERNS (APR 84)

ATTACHMENT
50-M-APHIS-86

CLAUSE REFERENCE	TITLE AND DATE
52.219-13	UTILIZATION OF WOMEN-OWNED SMALL BUSINESS (APR 84)
52.220-1	PREFERENCE FOR LABOR SURPLUS AREA CONCERNS (APR 84)
52.220-2	NOTICE OF TOTAL LABOR SURPLUS AREA SET-ASIDE (APR 84)
52.220-3	UTILIZATION OF LABOR SURPLUS AREA CONCERNS (APR 84)
52.222-1	NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (APR 84)
52.222-3	CONVICT LABOR (APR 84)
FPR TR-76, 2/23/84 (FAC 84-1) (29 CFR 4.6)	SERVICE CONTRACT ACT OF 1965
FPR TR-76, 2/23/84 (FAC 84-1) (29 CFR 4.7)	SERVICE CONTRACT ACT - CONTRACTS LESS THAN $2,500
52.222-4	CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION - GENERAL (APR 84)
52.222-26	EQUAL OPPORTUNITY (APR 84) [ ] ALT I
52.222-35	AFFIRMATIVE ACTION FOR SPECIAL DISABLED AND VIETNAM VETERANS (APR 84) [ ] ALT I
52.222-36	AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (APR 84)
52.227-1	AUTHORIZATION AND CONSENT (APR 84) [ ] ALT I, [ ] ALT II
52.229-3	FEDERAL, STATE, AND LOCAL TAXES (APR 84)
52.232-1	PAYMENTS (APR 84)
52.232-8	DISCOUNTS FOR PROMPT PAYMENTS (APR 84)
52.232-11	EXTRAS (APR 84)
52.232-17	INTEREST (APR 84)
52.233-1	DISPUTES (APR 84)
52.243-1	CHANGES - FIXED PRICE (SUPPLY) (APR 84) [ ] ALT I (SERVICE EXCEPT A/E OR OTHER PROFESSIONAL) [ ] ALT II (SERVICE & SUPPLY EXCEPT A/E. TRANS., AND R & D)
52.245-2	GOVERNMENT PROPERTY (FIXED-PRICE) (APR 84) [ ] ALT I
52.249-1	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT ($100,000 OR LESS) (SHORT FORM) (APR 84)
52.249-2	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT ($100,000 OR MORE) (APR 84)
52.249-8	DEFAULT (SUPPLY AND SERVICE) (APR 84)

ATTACHMENT
50-M-APHIS-86

CLAUSE REFERENCE	TITLE AND DATE
APPLICABLE TO CONTRACTS OVER $100,000	
52.230-3	COST ACCOUNTING STANDARDS (APR 84)
52.230-4	ADMINISTRATION OF COST ACCOUNTING STANDARDS (APR 84)
52.230-5	DISCLOSURE AND CONSISTENCY OF COST ACCOUNTING PRACTICES (APR 84)
52.243-6	CHANGE ORDER ACCOUNTING (APR 84)
SECTION L - INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS	
APPLICABLE TO NEGOTIATED SOLICITATIONS	
52.215-5	SOLICITATION DEFINITIONS (APR 84)
52.215-7	UNNECESSARILY ELABORATE PROPOSALS OR QUOTES (APR 84)
52.215-8	ACKNOWLEDGMENT OF AMENDMENTS TO SOLICITATION (APR 84)
52.215-9	SUBMISSION OF OFFERS (APR 84)
52.215-10	LATE SUBMISSIONS, MODS, WITHDRAWALS OF PROP (APR 84)
52.215-12	RESTRICTION ON DISCLOSURE AND USE OF DATA (APR 84)
52.215-13	PREPARATION OF OFFERS (APR 84)
52.215-14	EXPLANATION TO PROSPECTIVE OFFERORS (APR 84)
52.215-15	FAILURE TO SUBMIT OFFER (APR 84)
52.215-16	CONTRACT AWARD (NEGOTIATED) (APR 84)
52.215-17	TELEGRAPHIC PROPOSALS (APR 84)
52.215-18	ORDER OF PRECEDENCE (APR 84)

CONTINGENCY PLAN FOR LARGE AIRCRAFT - DC-7

Prepared by TDY Grasshopper Team

An Action Plan for the 1987 Grasshopper Control Campaign has been prepared. Although this plan is based upon the best information and experience available, the complexity of the campaign suggested that it would be prudent to be prepared with an alternative strategy in the event the infestation of grasshoppers rapidly exceeds the action plan's resources. To prepare for this possibility, the following contingency plan for large aircraft is submitted:

A. Operations Center

The Operations Center for the Action Plan shall serve as the Operations Center for the large aircraft. Logistical support and cooperation will be rendered to the large aircraft as described herein.

The Contingency Operation shall become an integral, though self-contained, component of the overall Action Plan. Cooperation with and expansion into multi-national campaigns will be open to expeditious negotiation as required to meet all regional emergencies.

B. Field Operation Base

A base of operations will be established at the Dakar Airport to facilitate operations of the large aircraft.

C. Criteria for Activation of Contingency Plan

The Contingency Plan shall be activated when the Project Coordinator of the Operations Center determines it is appropriate. The Project Coordinator shall receive recommendations from the entomologists of the Operations Center. The entomologists will make their recommendation at the earliest sign that conditions are such that they constitute a serious infestation hazard over an area too large to be contained by control measures in place, and that there is judged to be a reasonable certainty of a need for a large aircraft operation. Population thresholds for triggering this type of intervention will be proposed by the entomologists early in the season and adjusted regularly as they are able to monitor and evaluate field data.

It is understood that timing is of the essence both as an effective means of control and economy of operation. The cost of supplies, primarily pesticides, will be very expensive if they must be air shipped.

While weather patterns and unpredictable aspects of grasshopper population dynamics may vary from year to year, the following will serve as approximate dates of action:

> July 15 to August 1: Within this time frame we are likely to know whether large aircraft will be required.

September 1 to 21: The most critical dates for control when large aircraft will most likely be employed, if needed.

The economic threshold for spraying with large aircraft will be tentatively assumed to be at least 400,000 ha. in need of large aircraft spraying.

D. Supplies

Suppliers shall be alerted and full contingency arrangements for purchase and shipment on an emergency basis by no later than July 15, 1987.

Pesticide manufacturer should prepare shipment for export boxing with complete description of pesticide and stencil address as follows:

American Ambassador
American Embassy
Dakar, Republic of Senegal
Purchase Order #_____
For USAID Grasshopper Project

When ready for shipment, vendor will be instructed to contact:

Elsie Joseph
U.S. Despatch Agent
Baltimore, Maryland
(301) 962-1753

When all fiscal data (funding and allocation nos.) are available, mail or cable it to the above Despatch Agent along with P.O. number. Items not prepared for export boxing will require an extra 5 to 10 days for such preparation which will likely be a prohibitive delay.

It is estimated that between 100 and 300 tons of pesticide will require shipment, plus as many other items as it is deemed appropriate to import from the U.S.

Operations Center Logistician will monitor shipping schedules beginning June 1 and make any adjustments that are deemed appropriate to the expeditious acquisition of supplies. The Logistician will also bear responsibility to see that all aspects of this contingency plan are being followed in a timely manner and amend the plan as new information becomes available.

If it is not possible to meet the surface shipping deadlines due to lack of timely certainty of serious infestation, air transport will have to be arranged on short notice. Arrangement for this on a contingency basis shall be in place no later than August 15, 1987.

E. Contractual Agreement for Large Aircraft

It is suggested that the APHIS contract be used as the contractual agreement with large aircraft operators. APHIS has developed this contract

over a number of years, making it well tested and appropriate to this type of operation.

F. Staff

The aircraft shall be contracted to provide for all crew and maintenance personnel. In addition, the contracting office shall provide the following:

1. Aerial Application Specialist.
2. Contracting Office Representative/Logistician
3. Assistant to Contracting Office Representative
4. Ground Crew Foreman.
5. Assistant Ground Crew Foreman.
6. Eighteen laborers.
7. Three Flaggers (English Speaking).
8. One Technician for checking spray deposit during application.
9. One Driver for Gas Truck.
10. One Driver for Insecticide Truck.
11. Three Drivers for 4 WD Vehicles.
12. One Driver for Technician vehicle.

G. Provisions Arranged and Provided by Aircraft Contractor

1. Parts Source

2. Expeditious Shipping Arrangements

3. Mechanics
   - Contractor will be responsible for all maintenance and clothing

4. Flyaway Kits (tools, spare tires, linkages, spark plugs, insecticide loading hoses and adapters ... any supplies that might be needed)

5. Routing and Charges
   Aircraft should have sufficient funds on board to cover fuel, landing fees, maintenance costs and all other expenses that may be incurred en route.

6. Couplers and adapters to the Aircraft Chemical Tank Loading Valves.

7. Engine Oil

   Estimate: 10 gal (37.85 L)/aircraft/hour at 4 hours flight time/day 10 (37.75) X 3 X 20 X 4 = 2400 gal (9,084 L)
   plus
   25% surplus 600 gal (2,271 L)
   3,000 gal (11,355 L)

   Type of Oil: Aeroshell-W 60 wt
   Transport 90 bbl. of Engine Oil with aircraft.
   Last year's consumption: 89 bbl.

8. Hydraulic Fluid

One 55 gal (208 L) drum

Type of Hydraulic Fluid: Standard Red

H. <u>Ground Support Supplies and Equipment Provided by Contracting Office</u>

1. Reliable Fuel Source to service three DC-7s

Estimate: 2000 gal (7,570 L)/aircraft/day
2000 (7,570) X 3 X 20 = 120,000 gal (454,200 L)
plus
25% surplus 30,000 gal (113,550 L)
150,000 gal (567,750 L)

Type of gas: 100 octane (minimum) Avgas
Last year's consumption: 171,502 gal (664,572 L)

2. 10,000 gal (37,850 L) gas truck with suitable refueling nozzle

3. 3 vehicles (4WD) for flaggers
1 vehicle for technician

4. 1 bus (20 passenger) contracted with driver

5. 28 Volt Ground Power Unit (GPU)

6. Fork Lift

7. Two Maintenance Stands
size: 10 ft. (3.048 m) minimum

8. Fire Extinguisher and Grounding Cable for Aircraft

9. 30 Goggles

10. First Aid Kit

11. Eye Wash Kits (10)

12. Folding Tables

13. Chairs

14. Tents with Poles

15. Head Lamps with Batteries (30)

16. Rubber Gloves (300)

17. 4 VHF Handheld Radios with Power Converter Cables
(cigarette lighter adapters)

18. 1 HF Radio compatible with Operations Center Radio

19. Generator and Lights

20. 5 Folding Cots

21. Wash water and drinking water

22. Office Trailer

23. Extra Batteries for Radios

24. 5-5 gal. Safety Gas Cans

25. Spool of Shroud Line

26. 20 rolls all red engineering flagging

I. Phase III Aircraft

The 1986 grasshopper campaign demonstrated the utility of long range high payload aircraft in Senegal and bordering countries.

If it becomes necessary to spray grasshoppers over a large area (440,000 ha. or more), aircraft requirements will change.

The DC-7C aircraft used in 1986 are capable of ferrying to any area in Senegal from Dakar, applying a full 3,000 gal. (11,355 L) payload and returning to Dakar with good reserve fuel. This capability greatly simplifies the logistics of supplying fuel and chemical to the application aircraft. Assuming an 8 oz. (224 g) per acre application rate and 128 oz. per gallon of pesticide each DC-7C is capable of treating 48,000 (19,200 ha.) acres per day (128 oz./gal - 8 oz./acre X 3000 gal = 48,000 acres). Three aircraft will then be able to spray 144,000 acres (57,600 ha.) per day (3 aircraft X 48,000 acres/aircraft/day = 144,000 acres).

T & G Aviation DC-7C was swath checked at the New Mexico State University spray test facility in late February. The final report on these tests are not yet available. The preliminary report indicates the DC-7C has about a 750 ft. (225 m) working swath with a 300 ft. (90 m) overlap. T & G is planning to remove the insecticide pod and install tanks in the fuselage. This should help even out a somewhat erratic deposit pattern and provide an increase in working speed. The New Mexico tests also showed that 8015 flat fan nozzle tips mounted 90° to the slip stream provided the best droplet spectrum. The DC-7 flight crews had some problems locating the spray areas and their starting point for the spray areas. The Omega guidance system utilized by the DC-7s has an accuracy of 1 mile. Although this is better than nothing it is not very desirable. When applying short residual insecticides, precise application becomes very important.

DC-7 AIRCRAFT OPERATION COST ANALYSIS

SWATH WIDTH 750 FT.	SPEED 220 MPH	MAX LOAD 3000 GAL = 48,000 ACRES	ACRES PER MIN 330	AVERAGE TIME PER LOAD 3 HRS AVERAGE 16,000 ACRES/HR.
AIRCRAFT COST PER ACRE .60 X 16000 = $9600 AVERAGE PER HR.	FUEL CONSUMPTION 500 GAL/HR. X $2.99 = $1495 .093 PER ACRE 100 OCT MINI.	OIL 10 GAL/HR. X $7.50 = $75 .004 PER ACRE	SUPPORT COSTS .12 PER ACRE	TOTAL COSTS/ACRE .60 AIRCRAFT .093 FUEL .004 OIL .12 SUPPORT $0.817 PER ACRE
100,000 ACRES 6,25 HRS $60,000	3125 GAL $ 9,343	62.5 GAL $468.75	$12,000	$ 6,000 AIRCRAFT 9,343 FUEL 468.75 OIL 1,200 SUPPORT $71,011.75 TOTAL
864,500 ACRES (350,000 HA.) 54.03 HRS $517,700	27,015 GAL $80,774.85	540.3 GAL $4,052.25	$103,740	$517,700 AIRCRAFT 80,774 FUEL 4,052 OIL 103,740 SUPPORT $706,266 TOTAL

Application rate: Based on 8 oz. per acre.
Positioning Cost for Four Aircraft $400,000. (This cost should be averaged over the total acreage treated at the end of the program to determine cost/ha.)

PESTICIDES

Malathion is estimated to cost $14.27/gal delivered by sea (airfreight will at least double this cost). Each acre requires 8 oz. of Malathion. At 128 oz./gal, each gallon will treat 16 acres (i.e., 128 oz./gal ÷ 8 oz. = 16 acres).

The per acre cost of pesticides is $0.89. ($14.27/gal ÷ 16 acres/gal = $0.89)

Estimated Cost of treating 400,000 ha.

Operating Cost: ($71,011.75/100,000 acres X 2.47 acres/ha. X 4 = $701,596)	$701,596
Positioning Cost:	$400,000
Pesticide Cost: ($0.89/acre X $2.47 acres/ha. X 400,000 ha. = $879,320)	$879,320
TOTAL	$1,980,916
Cost/ha. ($1,980,916 ÷ 400,000 ha.)	$ 4.95

Economies of scale will result if larger areas are sprayed due to the fixed cost of positioning of aircraft.

Doc 3619A

Reference	Notes

BIBLIOGRAPHY

Reference	Notes

BIBLIOGRAPHY

GENERAL BIOLOGY

Blackith, R.E. and F.O. Albrecht. 1979. Locust plagues: the interplay of endogenous and exogenous control. Acrida 8(2):83-94.

Chapman, R.F. 1976. A Biology of Locusts. Centre for Overseas Pest Research. Edward Arnold Ltd., London. 67 pp.

Dempster, J.P. 1963. The population dynamics of grasshoppers and locusts. Biol. Rev. 38:490-529.

Dirsh, V.M. The African Genera of Acridoidea. University Press, Cambridge. 579 pp.

Duranton, J.F. Manuel de Prospection Acridienne en Zone Tropicale Seche. 1982. 2 vols. Ministère des Relations Exterieurs -- Coopération et Développement; Groupement d'etudes et de recherches pour le développement de l'agronomie tropicale, Paris. 1496 pp.

Duranton, J.F., M. Launois, M.H. Launois-Luong, and M. Lecoq. 1980. Contribution d l'informatique a la caractérisation des temperaments écologiques des acridiens. Actes de 8 Colloque Informatique et Biosphere: Faune, microfaune et informatique, Paris. pp. 95-119.

Duranton, J.F. and M. Lecoq. 1980. Ecology of locusts and grasshoppers in Sudanese West Africa. Acta Oecologica/Oecol. Gener. 1(2):151-164.

Johnston, H.B. 1956. Annotated Catalogue of African Grasshoppers. Cambridge University Press. 833 pp.

Popov, G.B. 1984. Les Sauteriaux du Sahel. FAO, Rome, Italy.

Johnston, H.B. 1968. Annotated Catalogue of African Grasshoppers, Supplement. Cambridge University Press. 448 pp.

Launois, M. 1978. Manuel Pratique d'Identification des Principaux Acridiens du Sahel. Ministère de la Coopération et GERDAT, Paris. 303 pp.

Uvarov, B.P. 1966. Grasshoppers and Locusts. A Handbook of General Acridology, Vol. 1. Cambridge University Press. 481 pp.

Uvarov, B.P. 1977. Grasshoppers and Locusts. A Handbook of General Acridology, Vol. 2. Centre for Overseas Pest Research, London. 613 pp.

CONTROL

Akesson and Yates. 1974. The Use of Aircraft in Agriculture. FAO, Rome, Italy. 209 pp.

Agriculture and Forestry Aviation. 1984. Symposium on Future Role of Aviation in Agriculture. National Research Council of Canada, Ottawa, Canada. 479 pp.

Agriculture and Forestry Aviation. 1968. Recommended Training Program - Pilots and Ground Personnel. National Research Council of Canada, Ottawa, Canada. 16 pp.

American Cyanamid Co. 1976. Malathion LV Concentrate, Aerial Insecticide Application. PE 5352 5M Rev. #4. 27 pp.

Anti-Locust Research Center. 1966. The Use of Aircraft in Locust Control. The Locust Handbook. London, England.

Bals, E. 1980. Controlled Droplet Application and ULV Spraying Handbook for Use of Micron ULV Hand Sprayers. Micron Sprayers, Ltd., Bromyard England.

Dow Chemical Co. 1985. Manual - Aerial Application of Herbicides and Insecticides. Dow Chemical Company, Midland, Michigan.

Fisher, H., et al. 1985. Lever-Operated Knapsack Sprayers - Operations. International Plant Protection Center, Oregon State University, Corvallis, Oregon.

Fraser, F., et al. 1979. Knapsack Sprayers Use and Maintenance. International Plant Protection Center, Oregon State University, Corvallis, Oregon.

Hardy, Charles E. 1987. Aerial Application Equipment, USDA Forest Service, Missoula, Montana. 207 pp.

ICAO. 1984. Manual on Aerial Work. International Civil Aviation Organization, Montreal, Canada.

ICAO. 1969. Training Manual, Part 19 - Agricultural Pilot. International Civil Aviation Organization, Montreal, Canada.

Kuhlman, D. 1981. Aerial Application Handbook for Applicators. Cooperative Extension Service, Kansas State University, Manhattan, Kansas.

Matthews, G.A. 1979. Pesticide Application Methods. Longman Group, Ltd., Essex, England. 327 pp.

McCulloch, L. and M. Gorta. 1987. Locust Survey and Control Unit Training Manual. Khartoum, Sudan.

322

Micronair. 1982. Micronair Application Monitor Handbook. Micronair (Aerial) Ltd., Isle of Wight, England.

Micronair. 1982. Micronair Mini Atomiser Handbook. Micronair (Aerial) Ltd., Isle of Wight, England.

Overholt, William. 1984. Pesticide User's Guide for Extension Workers in West Africa. Agency for International Development, Washington, D.C. 107 pp.

PANS. 1975. Pesticide Application Equipment. Overseas Spraying Machinery Center, Imperial College Station, Berkshire, England. Vol. 21, No. 4 (December).

Quantick, H.R. 1985. Aviation in Crop Protection, Pollution, and Insect Control. Collins Professional and Technical Books, London, England. 425 pp.

Quantick, H.R. 1985. Handbook for Agricultural Pilots. Collins Professional and Technical Books, London, England. 260 pp.

Shell Chemical Company. 1984. Aerial Application of Pesticides. ADP 84-016. Shell Chemical Co., Houston, Texas. 39 pp.

Simplex Manufacturing Company. 1987. Helicopter, Fixed Wing Ag Equipment and Accessories Catalog. Simplex Manufacturing Co., Portland, Oregon. 33 pp.

Singer, J. 1986. Pesticide Safety Guidelines. FPM83-1. USDA Forest Pest Management, Davis, California. 458 pp.

Spraying Systems Co. 1987. Tee Jet Agricultural Spray Products, Agricultural Catalog 39. Spraying Systems Co., Wheaton, Illinois. 34 pp.

Taylor, J., et al. 1984. Professional Standards of Aerial Application of Pesticides in California, Vols. I and II. California Agricultural Aircraft Association, Sacramento, California.

United Nations. 1981. Development of Airborne Equipment to Intensify World Food Production. United Nations Economic Commission for Europe. 218 pp.

Yates, W., et al. 1984. Measurement of Drop Size Frequency from Nozzles and Atomizers Used for Aerial Applications. USDA Forest Service, Missoula, Montana. 221 pp.

Castel, J.M. and R. Ouattara. 1979. Les insecticides en lutte anti-acridienne. Congres sur la lutte contre les insectes en milieu rurale, Marseilles. Tome 1, pp. 705-724.

Commonwealth Institute Biol. Control. 1978. Possibilities for Biological Control of Grasshoppers. Status Paper No. 7. CIBC. 7 pp.

Gunn, D.L. 1960. The biological background of locust control. A. Rev. Ent. 5:279-300.

Gunn, D.L. and R.C. Rainey. 1977. Strategy and Tactics of Control of Migrant Pests. The Royal Society, London.

Henry, J.E. 1979. Development of microbial agents for the control of Acrididae. Rev. Soc. Ent. Argentina 36:125-134.

Henry, J.E., K. Teahrt, and E.A. Oma. 1973. Importance of timing, spore concentration, and levels of spore carrier in applications of Nosema locustae for control of grasshoppers. J. Invert. Path. 21:263-272.

Launois-Luong, M.H. 1978. Comparaison des valeurs appetitives de deux substrats d'appats empoisonnes, pour quatorze acridiens du Sahel. Agron. Trop. 33:237-240.

MacCuaig, R.D. 1983. Insecticide Index. FAO, Rome. 191 pp.

OEDALEUS SENEGALENSIS

Batten, A. 1969. The Senegalese grasshopper (Oedaleus senegalensis Krauss). Journal of Applied Ecology 6:27-45.

Boys, H.A. 1978. Food selection by Oedaleus senegalensis in grassland and millet fields. Ent. Exp. and Appl. 24:78-86.

Cheke, R.A., L.D.C. Fishpool, and G.A. Forrest. Oedaleus senegalensis (Krauss): An account of the 1977 outbreak in West Africa. Acrida 9:107-132.

Launois, M. 1979. An ecological model for the study of the Oedaleus senegalensis grasshopper in West Africa. Phil. Trans. R. Soc. Lond. (B)287:345-355.

Launois, M. 1978. Modelisation Ecologique et Simulation Opérationnelle en Acridologie: Application a Oedaleus senegalensis. Ministère de la Coopération et GERDAT, Paris. 214 pp.

Lecoq, M. 1978. Long distance movements of grasshoppers in the Sahelian and Sudanese area of West Africa. Comptes Rendus Hebdomadaires des Séances, Serie D: Science Naturelles 286(5):419-422.

Popov, G.B. 1980. Studies on Oviposition, Egg Development and Mortality in Oedaleus senegalensis. COPR Miscellaneous Report No. 53, London. 48 pp.

Ritchie, J.M. 1983. Determination of sex of instar number of nymphs of the Senegalese grasshopper. Entomolgist's Monthly Magazine 119:97-101.

RED LOCUST

Burnett, G.F. 1951. Observations on the life-history of the Red Locust in the solitary phase. Bull. Ent. Research 42:473-490.

Dean, G.J.W. 1969. Operational research into the formation of swarms and aerial control of adult Red Locusts. Journal of the Entomological Society of Southern Africa. pp. 333-350.

Kuhne, K.W. 1973. The 'outbreak area' theory in relation to the Red Locust. Plant Protection Bulletin - FAO 21(1):8-13.

Materu, M.E.A. 1984. The ecology and control of the Red Locust. Intl. Red Locust Control Organisation for Central & S. Africa. Insect Science and its Application 5(2):79-82.

Morant, V. 1947. Migration and Breeding of the Red Locust in Africa, 1927-1945. Anti-Locust Memoir 2, London. 60 pp.

Plessis, C. du and K.W. Kuhne. 1970. Recent developments in preventive control in outbreak areas of the Red Locust. Journal of the Entomological Society of Southern Africa 33(1):95-117.

Stortenbeker, C.W. 1967. Observations on the Population Dynamics of the Red Locust in its Outbreak Areas. Pudoc. Agric. Res. Rep. 694. 118 pp.

Symmons, P.M. 1977. The prevention of plagues of the Red Locust, Nomadacris septemfasciata (Serv.). Acrida 7(1):55-78.

Symmons, P.M. and A.J.M. Carnegie. 1959. Some factors affecting breeding and oviposition of the Red Locust. Bull. Ent. Res. 50:333-353.

Whellan, J.A. The problems of locust plague prevention organizations as exemplified by the Intl. Red Locust Control Service. Intl. Study Conference on the Current & Future Problems of Acridology, London. pp. 491-498.

BROWN LOCUST

Botha, D.H. and A. Lea. Do Brown Locust plague periods come in cycles? Farming South Africa 45(11):17-24.

Lea, A. 1969. The population ecology of Brown Locusts on fixed observation areas. Phytophylactica 1(2):93-102.

Smith, C.J.B. 1960. The Behaviour of the Brown Locust in its Solitary Phase. Tech. Commun. Dep. Agri. Techn. Serv., Pretoria 1. 132 pp.

Cilliers, J., J. van Someren-Greve and A. Lea. 1964. A Case of converging swarms of the brown locust and implications for control strategy. S. Afr. J. Agric. Sci., Johannesburg, So. Africa. pp. 867-874.

MIGRATORY LOCUST

Alomenu, H.S. 1985. Current trends in African Migratory Locust plague prevention. Outlook on Agriculture, London 14(4):165-173.

Batten, A. 1966. The course of the last major plague of the African Migratory Locust, 1928-1941. Pl. Prot. Bull., FAO 14, Rome. pp. 1-16.

Batten, A. 1967. Seasonal movements of swarms of Locusta migratoria migratorioides in West Africa from 1928-31. Bull. Ent. Res. 57:357-380.

Betts, E. 1961. Outbreaks of the African Migratory Locust Since 1871. Anti-Locust Memoir 6. 25 pp.

Darnhofer, T. and M. Launois. 1974. L'Optimum Pluviométrique du Criquet migrateur malgache: Principle et Applications. FAO Rapport PNUD (FS) MML/MET/9, Rome. 77 pp.

Duranton, J.F. 1980. Etudes sur le Criquet Migrateur Africain dans son Aire Gregarigene du Bassin Tchadien. FAO Project RAF/77/049, Report n 1980/1, Rome. 77 pp.

Farrow, R. 1975. The African Migratory Locust in its Main Outbreak Area of the Middle Niger. Locusta 11. 198 pp.

Farrow, R. 1977. First captures of the Migratory Locust at light traps and their ecological significance. J. Aust. Ent. Soc. 16:59-61.

Muller, W. 1975. Recherches sur l'Optimum Eco-climatique du Criquet Migrateur Africain. FAO Project PNUD (FS) FAO/RAF/69/146, Rome. 56 pp.

Popov, G.B. 1980. Studies on the African Migratory Locust in its Outbreak Area in the Lake Chad. FAO Project RAF/77/049. Mission Oct.-Dec. 1979, Assist. a l'OICMA. 47 pp.

Poras, M. 1972. Etude bio-écologique du Criquet Migrateur Afr. (Loc. migratoria migratorioides) dans son milieu naturel an Mali. Ann. Univ. Abidjan, serie E (Ecologie) 5.

Remaudiere, G. 1948. Sur la resistance des oeufs de Locusta migratoria L. ssp. gallica au froid, et a l'imersion. Rev. Path. Veg. Ent. Agric. Fr. 27:25-34.

Remaudiere, G. 1954. Etude Ecologique de Locusta migratoria migratorioides dans la Zone d'Inondation du Niger en 1950. Locusta 2. 248 pp.

DESERT LOCUST

Akhtar, M. 1983. Synopsis of Research on Desert Locust (Schistocerca gregaria Forsk) 1947-1982. Department of Plant Protection, Karachi, Pakistan Technical Bulletin III. 39 pp.

Ashall, C. and I. Chaney. 1979. A strategy for Desert Locust control. Span 1979 22(3):98-100.

Bennett, L.V. 1976. The development and termination of the 1968 plague of the Desert Locust. Bulletin of Entomological Research 66(3):511-552.

Draper, J. 1980. The direction of Desert Locust migration (Schistocerca gregaria). The Journal of Animal Ecology 49(3):959-974.

Duranton, J.F. and M. Launois. 1980. Eléments conceptuels, méthodologiques et logistiques pour la mise en oeuvre d'un, programme opérational de recherches bio-écologiques sur le criquet pèlerin. FAO Project PNUD (FS) RAF/77/048, doc. dactylographie. 79 pp.

Hemming, C.F. and G.B. Popov. 1979. Characteristics of Desert Locust (Schistocerca gregaria) plague upsurges (Review). Phil. Trans. of the Royal Soc., London, B 287. pp. 375-386.

Hielkema, Jelle U. 1977. Application of Landsat Data in Desert Locust Survey and Control. FAO, Panel of Experts on Forest Gene Resources AGP, LCC/77/11. 28 pp.

Hielkema, J.U. 1981. Desert Locust habitat monitoring with satellite remote sensing (Schistocerca gregaria). ITC Journal - Intl. Instit. for Aerial Survey & Earth Sciences (4):387-417.

Pedgley, D.E. 1981. Desert Locust Forecasting Manual. 2 vols. Centre for Overseas Pest Research, London. 410 pp.

Pedgley, D.E. 1979. Weather during Desert Locust (Schistocerca gregaria) plague upsurges (Review). Phil. Trans. of Royal Soc., London, B 287. pp. 387-391.

Rainey, R.C. and E. Betts. 1979. Continuity in major populations of migrant pests: the Desert Locust and the African armyworm. Strategy and tactics of control of migrant pests. Phil. Trans. of Royal Soc., London, B 287. pp. 359-374.

Rainey, R.C. 1980. Wild plants in the ecology of the Desert Locust (Schistocera gregaria). Proceedings: Pest, pathogens and vegetations. Pitman Publishing Program. pp. 327-337.

Rainey, R.C. and E. Betts. 1979. The decline of the Desert Locust plague in the 1960s: Control operations or natural causes. Phil. Trans. of Royal Soc., London, B 287. pp. 315-344.

Sayer, H.J. 1970. A review of modern methods of chemical control of the Desert Locust. Intl. Study Conference on the Current and Future Problems of Acridology, London. pp. 403-406.

Stedman, A. 1977. Movements of swarms of the Desert Locust across the northern Red Sea. Acrida 6(2):109-140.

Symmons, P.M. and S.M. Green. 1974. The production of distribution maps of the incubation and hopper development periods of the Desert Locust. Bulletin of Entomological Research 64(3):443-451.

Taylor, R.A.J. 1979. A simulation model of locust (Schistocerca gregaria) migratory behaviour. Journal of Animal Ecology 48(2):577-602.

Waloff, Z. 1946. Seasonal Breeding and Migrations of the Desert Locust in Eastern Africa. Anti-Locust Memoir 1. Center for Overseas Pest Research, London, England. 74 pp.

Waloff, Z. 1953. Flight of Desert Locust in relation to humidity. Bull. Ent. Res. 43:575-80.

Waloff, Z. 1963. Field Studies on Solitary and Transient Desert Locusts in the Red Sea Area. Anti-Locust Bull. 4. Center for Overseas Pest Research, London, England. 93 pp.

Waloff, Z. 1966. The Upsurge and Recessions of the Desert Locust Plague: An Historical Survey. Anti-Locust Memoir 8. Center for Overseas Pest Research, London, England. 111 pp.

Waloff, Z. and R.C. Rainey. 1951. Field Studies on Factors Affecting the Displacements of Desert Locust Swarms in Eastern Africa. Anti-Locust Bull. 9. Center for Overseas Pest Research, London, England. pp. 1-50.

Waloff, Z. 1976. Some Temporal Characteristics of Desert Locust Plagues. Anti-Locust Memoir 13. Centre for Overseas Pest Research, London, England.

MacCuaig, R.D. and M.N.D.B. Yeates. 1972. Theoretical Studies on the Efficiency of Insecticidal Sprays for the Control of Flying Locust Swarms. Anti-Locust Bulletin 49. Centre for Overseas Pest Research, London, England.

Bennett, L.V. and P.M. Symons. 1972. A Review of Estimates of the Effectiveness of Certain Control Techniques and Insecticides Against the Desert Locust. Anti-Locust Bulletin 50. Centre for Overseas Pest Research, London, England.

ENVIRONMENTAL

TAMS Consultants and Consortium for International Crop Protection. 1988. Locust and Grasshopper Control in Africa/Asia - A Programmatic Environmental Assessment Draft. TAMS Consultants New York, NY/Washington, D.C. and Consortium for International Crop Protection, College Park, Maryland.

Whaley, G.R. Environmental Assessment of the Morocco Locust Control Project. USAID/Rabat, Morocco. (Draft.)

REMOTE SENSING

Pilot Project for Seasonal Vegetation Monitoring in Support of Grasshopper and Locust Control in West Africa. 1988. EROS Data Center. U.S. Geological Survey, Sioux Falls, South Dakota.

ASSESSMENTS

FAO. 1986. Assessment of the 1986 Sahel Grasshopper Control Campaign and Lessons to be Drawn for Future Campaigns. FAO, Rome, Italy.

FAO. 1987. Evaluation of the 1987 Grasshopper Campaign in the Sahel. FAO, Rome, Italy.

A.I.D./W OFDA. 1988. A Compilation of Questionnaire Responses. African Grasshopper/Locust Workshop, Harpers Ferry, West Virginia.

A.I.D. 1987. Environmental Health and Safety - Fundamental to Development. A.I.D. Special Report, Fall 1987. Washington, D.C. pp. 23-29.

Reference	Notes

REFERENCE MATERIALS

- Acronyms
- Glossary of Terms
- Key U. S. Government Contacts for Locust/Grasshopper Control

Reference	Notes

ACRONYMS

A.I.D./W	Agency for International Development - Washington, D.C.
ADI	Acceptable daily intake of pesticide
AFR/TR/ANR	Bureau for Africa, Office of Technical Resources, Agriculture and Natural Resources Division, A.I.D.
AFR/ANE	Bureau for Africa and Bureau for Asia and Near East, A.I.D.
AFR/EA	Bureau for Africa, Office of Eastern Africa Affairs, A.I.D.
AGRHYMET	Center for Application of Agrometeorology and Hydrology
ANE/MENA	Bureau for Asia and Near East, Office of Middle East, Europe and North African Affairs, A.I.D.
ANE/TR/ARD	Bureau for Asia and Near East, Office of Technical Resources, Agriculture and Rural Development Division, A.I.D.
ARTEMIS	Africa Real Time Environmental Monitoring Imaging Satellites
AV GAS	Aviation Gasoline
BHC	Benzene Hexachloride (a pesticide)
CCC	Country Coordinating Committee
CILSS	Comite Interetat pour la Lutte Contre la Secheresse au Sahel
COC	Control Operations Center
CPS	Crop Protection Service
DLCO-EA	Desert Locust Control Organization for Eastern Africa
DLTF	Desert Locust Task Force
DOD	Department of Defense (U.S.)
ECLO	Emergency Center for Locust Operations, FAO
EEC	European Economic Community
EIL	Economic Injury Level
EPA	Environmental Protection Agency (U.S.)
ETL	Economic Threshold Level
FAO	Food and Agriculture Organization, United Nations
FEWS	Famine Early Warning System
GIFAP	International Pesticide Manufacturers Association
HG	Host Government
IPM	Integrated Pest Management
IRLCO-CSA	International Red Locust Control Organization for Central and Southern Africa
ITCZ	Inter Tropical Convergence Zone
LD50	Insecticide dosage lethal to 50% of the population
NACA	National Agricultural Chemicals Association (U.S.)
NOAA-AVHRR	National Oceanic and Atmospheric Administration - Advanced Very High Resolution Radiometer
OCLALAV	Organization Commune de Lutte Antiacridienne et de Lutte Antiaviare
OECD	Organization for Economic Cooperation and Development
OFDA	Office of Foreign Disaster Assistance
OPEC	Organization of Petroleum Exporting Countries
OYB	Country Program Funds
PID	Project Identification Document, A.I.D.
PP	Project Paper, A.I.D.
PR	Public Relations
PRIFAS	Programme de Recherches Interdisciplinaire Francaise sur les Acridiens du Sahel
PSA	Public Service Announcements
SAS	Operation Sauteriaux au Sahel

S&T/AGR	Bureau for Science and Technology, Office of Agriculture
M/SER/OP/ COMS	Directorate for Program and Management Services, Office of Procurement, Commodity Support Division
ULV	Ultra-low-volume sprays
UNDP	United Nations Development Programme
USAID	U.S. Agency for International Development
USDA/ARS	U.S. Department of Agriculture - Agricultural Research Service
USG	United States Government
USIS	United States Information Service
WHO	World Health Organization (UN)

GLOSSARY OF TERMS

Cumuliform swarm	- Thick towering swarm
Dermal toxicity	- Absorbed through the skin
Dessication	- To dry out completely
Diapause	- A period of physiologically enforced dormancy
Ephemeral	- Short-lived
Fledging	- The final moult
Fledgling	- The young immature adult before its body hardens
Frass	- Bodily excrement
Gregarious	- The swarming phase of locusts. Behavioral, morphological, and color changes from the solitarious form are characteristic of this phase. Hoppers band and march and adults swarm and fly during the day.
Hydrated	- Formed by chemical combination with water
Hydrolysis	- A chemical reaction in which a compound reacts to water to produce a weak acid, a weak base, or both.
Incubation period	- The period of egg development
Invertebrates	- Lacking a backbone or spinal column.
Instar	- The stage of insect development between moults
Moult	- The process of casting off the old skin
Oral toxicity	- Ingested by mouth
Parasitization	- To live on or within another
Predation	- Preyed upon by other animals
Progeny	- Offspring or descendants
Savanna	- Grassland characterized by scattered trees
Solitarious phase	- The grasshopperlike form of a locust. It lives separately. Hoppers do not ground or band. Adults usually fly individually and at night. Colors usually dull, blending with their surroundings.
Steppe	- A plain having few or no trees.
Stratiform swarms	- Low-flying and stretched out
Transiens phase	- The intermediate phase between solitarious and gregarious. Color begins to change and behavior becomes more like gregarious forms.
Vertebrates	- Having a backbone or spinal column
Wadi	- A stream bed that is usually dry, except in the rainy season

THIS PAGE IS INTENTIONALLY LEFT BLANK

KEY U.S. GOVERNMENT CONTACTS FOR LOCUST/GRASSHOPPER CONTROL

AID/OFDA DESERT LOCUST TASK FORCE

Bob Huesmann	OFDA/DLTF	(202)-647-0680
Doris Barnes	OFDA/DLTF	0683
Kate Farnsworth	OFDA/DLTF	0685
Rita Hudson	OFDA/DLTF	0684
Dagnija Kreslins	OFDA/DLTF	0681
Jeff Mullis	OFDA/DLTF	0686
Ron Libby	OFDA/DLTF	0682
Shannon Wilson	OFDA/DLTF	0687
John Gelb	OFDA/DLTF	0688

AID/LEGISLATIVE

Bette Cook	AID/LEG	(202)-647-8441
Susan Kakesako	AID/LEG	8440

AFRICA BUREAU

Sahel/West Africa-AFR/DP

Phyllis Dichter	AFR/SWA	(202)-647-5990
William James	AFR/SWA	5993
John Lewis, Reg. Off.	AFR/SWA	5994
Roger Simmons	AFR/SWA	5992
Louise Werlin	AFR/SWA	8125
Ron Daniel	AFR/SWA	6039
Helen Vaitaitis	AFR/PD/SWAP	7887
Willie Saulters	AFR/SWA	8124
Nancy McKay	AFR/PD/SWAP	9339

Technical Resources

Bessie Boyd	AFR/TR/ANR	(202)-647-8750
Carl Castleton	AFR/TR/ANR	9386
John Gaudet	AFR/TR/ANR	8716
Archie Hogan	AFR/TR/ANR	8767
Charles Morgan	AFR/TR/ANR	8813
Abdul Wahab	AFR/TR/ANR	8769
Brian Kline	AFR/TR	8178
Jonathan Olson	AFR/TR	9810
Keith Sherper	AFR/TR	8178
Doug Sutherland	AFR/TR/ANE	6327

Program Development

Glenn Cauvin	AFR/DP	(202)-647-2984
Sherri Grossman	AFR/DP	2975
Minnie Wright	AFR/DP	2989
Harold Marwitz	AFR/EA	9762

East Africa

Harold Marwitz	AFR/EA	(202)-647-6327
Dick Eney	AFR/EA	8145
Mary Rita Zeleke	AFR/EA	8145
Janice Weber	AFR/EA	8145

OFFICERS IN CHARGE--AID (African Countries)

Senegal/Burkina Faso	Ron Daniels	AFR/SWA	(202)-647-6039
Chad/Mauritania			
Gambia	Yvonne John	AFR/SWA	6049
Mali	Louise Werlin	AFR/SWA	8125
Niger	Helen Vaitantis	AFR/SWA	9206
Sudan	Mary R. Zeleke	AFR/EA	8145
Zimbabwe	Robert Wrin	AFR/SA	4326
S. Africa Regional	Michael Feldstein	AFR/SA	4230
Zambia/Botswana/ Lesotho	Leonard Pompa	AFR/SA	4287
Nigeria	Rudolph Thomas	AFR/CCWA	7985
Ethiopia	Dick Eney	AFR/EA	8145
Horn of Africa	Janice Weber	AFR/EA	8145

AFRICA (A.I.D.)

Charles Raley	AID/OP/OS/AFR	

EMERGENCY COORDINATION

Ross Coggins	AFR/EOO	(202)-647-3463
Hunter Farmham	AFR/EOO	3478

OFFICE OF U.S. FOREIGN DISASTER ASSISTANCE Room 1262ANS

Julia V. Taft	OFDA/DIR	(202)-647-8924
Renee Bafalis	OFFA	7539
Oliver Davidson	OFDA/OS	5916
Gudrun Huden	OFDA/AFR	7554
Bob Keesecker	OFDA/OS	5716
Bill Garvelink	OFDA/AFR	8746
Carole Siegel	OFDA/OS	7455
Bob Mutch	USDA/FS	(703) 235-1142
Art Feller	OFDA	(202)-647-5703
Tom Frey	USDA/FS	7541
Beverly Youmans	OFDA	5702
Panafax	OFDA	(202)-647-5269
Telex	OFDA	(710)-822-1975

SCIENCE AND TECHNOLOGY/AGR

Carroll Collier	S&T/AGR	SA-18 875-4024/235-2318
Christopher Potter	S&T/AGR	SA-18
Hiram Larew	S&T/AGR/AP	SA-18 875-4338
Panafax		235-3456

LATIN AMERICAN AND CARIBBEAN BUREAU

Jerry Bowers	LAC/DR	(202)-647-9145
Ingrid Peters	LAC/CAR	3446
Winston McPhie	LAC/DR/CP	5648
TomKing	LAC/DR/RD	5689
Rafael Resario	LAC/DR/RD	5688
Jeff Brokaw	LAC/DR/EST	5972
Jim Hester	LAC/DR/EST	7921
Peter Violar	LAC/CAR	9106
Meg Symington	LAC/DR/EST	8048
Jon 0. Wilson	LAC/PR/EST	8046

ASIA AND NEAR EAST BUREAU

Robert Armstrong	ANE/TR/ARD	(202)-647-7217
Gregg Baker	ANE/TR/ARD	6982
Paul Novick	ANE/TR/ARD	7217
Peter Deinken (Yemen)	ANE/MENA	9001
Dick Delaney (Tunisia)	ANE/MENA	9001
Marx Sterne (Morocco)	ANE/MENA	9001
Kathy Satterson	ANE/PD/ENV	8226
Glenn Whaley	ANE/PD/ENV	6995
Jon Lindborg	ANE/PD	9639
Richard Cobb	ANE/TR	9134
Pánafax		4958

OFFICE OF THE GENERAL COUNSEL

Annette Adams	GC/AFR	(202)-647-9218
TimRiedler	GC/CP	6381
Stephen R. Tisa	GC/CP	8416

SPECIAL COUNSELOR ON THE ENVIRONMENT

Norm Cohen	C/AID

OFFICE OF PROGRAM AND POLICY COORDINATION

Hal Gray	PPC/PB	(202)-647-6484
George Hill	PPC/PB	6484
Pat Kahil	PPC/PDPR	7059
Charlotte Suggs	PPC/DC/UN	2483

OFFICE OF PUBLIC AFFAIRS

Bart Kull	AID/XA/PR	(202)-647-4274

STATE DEPARTMENT

Peggy Colvin	State/IO/D	(202)-647-2607
Rob Merrigan	State/AF/EPS	3503
Gordan Powers	State/AF/EPS	3503
Ralph Winstanley	State/NEA/AFN	4675
William Strawn	State/IO/D/AGR	1017
John Cook	State/IO/D/AGR	1017
John Riddle	State/NEA/ARP	7550

DESK OFFICERS (STATE)

Central Afr. Affairs	Anthony Dalsimer	AF/C	(202)-647-2080
East African Affairs	John Davison	AF/E	9742
S. African Affairs	Gibson Lanpher	AF/S	9836
W. African Affairs	Frances Cook	AF/W	4567
	Rob Proctor	AF/W	3406
Ethiopia	John Berntsen	AF/E	8852
W. African Affairs	Frankie Calhoun	AF/W	2865
Mali, Niger, Burkina Faso			

SCOPES OF WORK

- Junior Entomologist
- Senior Entomologist
- Environmental Specialist
- Aerial Operations Specialist

Reference	Notes

JUNIOR ENTOMOLOGIST

I. General

This specialist will work as part of a team, typically comprised of a senior entomologist and an aerial operations specialist to assist the Crop Protection Service to plan for and implement ground and aerial control operations against the desert locust.

II. Specific

A. Assist in population surveys, survey design, and identification of the phases or developmental stages of the desert locust.

B. Work with the Crop Protection Service to prepare timely locust sighting reports in the field which are relayed to the center for analysis and program planning.

C. Work with senior entomologist and aerial operations specialist to train crop protection specialists on technical aspects of aerial control operations, including delineation of treatment areas, and post spraying evaluation.

D. The specialist also will undertake some initial environmental monitoring activities to include the following (monitoring could be done by an environmental specialist):

1. Monitor the general conditions under which pesticides are being stored, transported, applied, and the containers disposed.

2. Incorporate pre-and post-treatment surveys to determine what impact the pesticides have on human inhabitants, their livestock and the non-target flora and fauna in treated areas.

3. Identify critical habitats of endangered species, wildlife preserves, including aquatic areas which need to be protected by buffer zones.

4. Survey areas to search for phototoxicity, absence of known animal residents, or death of non-target insect.

5. Examine local livestock for any evidence of toxicity to pesticides.

6. Interview human population for evidence of sickness or other symptoms.

Junior Entomologist (Cont)

II. Qualifications and Experience

The Junior Entomologist position is recommended for candidates with a sound background in biological sciences and entomology. Preferred candidate should have at least a B.S. in biological science or equivalent and 3 years practical experience.

Candidate should also have a working capability in aerial and ground application of pesticides. Some familiarity with pesticides used for locust control is desirable. Experience in Africa, familiarity with field conditions, and knowledge of French and/or Arabic strongly advised. Language ability may be substituted for Africa experience.

III. Administrative and Reporting Responsibilities

The specialist will work under the general supervision of the team leader (senior entomologist or aerial operations specialist). The specialist is encouraged to maintain close contacts with the backstop for the locust program and to consult the OFDA/DLTF Desert Locust Task Force, as needed.

There will be a debriefing in Washington(OFDA) at the conclusion of the assignment. A written report must be submitted, which should contain observations and recommendations concerning the locust control operations as well as a proposed scope of work for a more complete environmental assessment.

SENIOR ENTOMOLOGIST

I. General

Senior entomologist and team leader will assist the Ministry of Agriculture and the USAID Mission in preparing for, and implementing locust control operations.

II. Specific

A. Review locust program work plans and identify areas of weakness, as well as assess plan of action against available resources. Work plan elements should include evaluation of population assessment, control methodologies, and capabilities, program monitoring, and identification of resources available as well as shortfalls.

B. Identify locust program training needs and sources.

C. Support day-to-day plant protection actions in the capital and in the field:

1. Prioritize survey areas
2. Delineate population concentrations
3. Identify developmental stages of locust populations
4. Project movement of hopper bands and adults.

D. Entomologist will work closely with logistics expert to plan control operations, and to select most effective control method given the level of infestation.

III. Administrative and Reporting requirements.

Entomologist will serve as team leader and will coordinate team activities with the Director of Crop Protection at the Ministry of Agriculture and the USAID Mission. Entomologist will be required to prepare periodic reports on the situation for forwarding to OFDA/DLTF in Washington. There will be a two day briefing in AID/W before the team's departure and a day of briefings upon the team's return. A final report outlining the team's activities and making recommendations for future interventions and technical assistance is required.

IV. Qualifications and Experience

Qualifications should include a minimum of 7 years of program operations management and field experience on grasshoppers or locusts. Experience in conducting population assessments is required. Background in coordinating multi Agency/cooperative plant protection programs is necessary. Knowledge of pesticides and pesticide safety strongly advised. Academic background should include a minimum of B.A. or B.S. in biological science. Prior experience in Africa and knowledge of French language highly desirable. Ability to work independently without continuous Embassy/MinAg headquarters contact important, as much of the work will be done in the field.

Reference	Notes

ENVIRONMENTAL SPECIALIST

I. General

Monitors the general conditions under which pesticides are being stored, transported applied and the containers disposed. Specialist would carry out surveys to ascertain impacts on the local human population, livestock, and non target aquatic and terrestrial flora and fauna. Make recommendations for mitigating or eliminating unsafe conditions.

II. Specific

A. Participate in an in-country briefing with representatives of the country and missions for background information. Develop a workplan based upon the results of this meeting. The environmental specialist would visit several pesticide storage areas to review the inventory system (e.g. first in-first out), condition of the buildings, drainage, leakage, clean up procedures, first aid facilities, condition of the containers, labeling etc. Observe loading, transportation, and unloading procedures for pesticides. Consider the safety equipment required and the protective measures in force in warehouses. Inspect workers, mixer/loaders, applicators and others handling pesticides. Review mixing/loading procedures including handling, spillage, drainage, and cleanup methods. For ground and aerial applicators, consider appropriate safety equipment in relation to how applicators are actually dressed.

B. Review actual conditions under which pesticides are applied (e.g. wind, temperature). Check calibration of equipment, frequency, etc. Monitor target areas for dosage, droplet size, and peripheral areas for drift. Following application, consider the disposition of unused pesticides and disposal and cleanup procedures for empty containers and any spillage.

C. The environmental specialist should incorporate pre-and post-treatment surveys to determine what impact the pesticides have on human inhabitants, their livestock and the non-target flora and fauna in treated areas. Identify critical habitats of endangered species, wildlife preserves including aquatic areas which need to be protected by buffer zones. Similar untreated habitats that are adjacent should also be surveyed, time permitting. Counts on transects through the areas should be made looking for phytotoxicity, absence of known animal residents, and collecting any dead or dying animals (e.g. birds, mammals, amphibians, reptiles, fish) for testing. Invertebrate surveys would require extra support, but would be very useful, particularly for terrestrial predators and parasites and aquatic forms. Local livestock should be checked for any evidence of toxicity to pesticides. The human population should be interviewed for evidence of sickness or other symptoms. With the local medical personnel, cholenesterase tests should be undertaken.

D. Prior to leaving for this assignment the specialist must be briefed by relevant members of the Desert Locust Task Force (DLTF) and the appropriate bureau. Also, the specialist will be familiar with the Draft AFR/ANE Programmatic Environmental Assessment for Grasshoppers and Locust Control (copies available from DLTF). Upon completion of the assignment specialist must travel through AID/W for debriefings and to submit a draft report to be completed within one month.

III. Qualifications

A. Academic background in crop protection and/or pest control and/or pesticides.

B. Field experience in appropriate application, site inspection and survey techniques.

C. Language skills desirable (esp. French level 2 + 2/ 2 + 0.)

D. Experience overseas in LDC'S.

E. Good health.

AERIAL OPERATIONS SPECIALIST FOR LOCUST CONTROL PROJECT

I. General

The aerial operations specialist supports the aircraft spray operations by identifying and communicating daily aircraft operational needs to the host Government. The specialist also monitors the aircraft contract, if appropriate, on behalf of USAID and ensures that obligations of the contract are fulfilled. In this context the specialist will work within the context of a command post specially organized for locust control operations and will be assigned to an operational base in the field. The specialist will be required to communicate with both civilian and/or military personnel where aircraft are based.

II. Specific

A. Establish daily schedules in concert with pilots, authorities, and ground support crews that identify and provide for timely operational requirements to aircraft, principally for refueling, pesticide delivery and loading, and maintenance for aircraft.

B. Develop working relationship with authorities and ground crews that assures appropriate logistical support in coordination with other donor aircraft requirements.

C. Participate in daily briefings for pilots in order to determine safe conditions for treatment, as well as fuel and pesticide requirements.

D. Monitor obligations of aircraft contract with A.I.D., and report on performance and constraints.

E. Assist as needed with field spray operations and monitor spraying effectiveness.

F. Other similar duties as assigned

III. Qualifications and Experience

A minimum of 7 years aerial operations management. Working knowledge of A/C types, classes and categories, including work rates, capacities, operational requirements and capabilities. Knowledge of dispersal systems including conventional low vOLUME, ULV, dry and granular applications. A working knowledge of manual and electronic guidance systems for agricultural purposes such as Loran C and Omega with agricultural software. A minimum of 5 years aerial operations planning and supervisory advisor experience on large scale plant protection programs.

Aerial Operations Specialist (Cont)

A minimum of commercial pilots license with Class II medical certification, and single engine, multiengine and instrument rating. Aerial certification for agricultural application. Federal or state certification for pest control operator.

IV. Administrative and Reporting Responsibilities

The specialist is encouraged to maintain close contacts with local government representatives and consult the OFDA/DLTF (Desert Locust Task Force), as needed. There will be a debriefing in Washington, DC (OFDA) at the conclusion of the assignment. A written report must be submitted, which should contain observations and recommendations concerning the locust control operations