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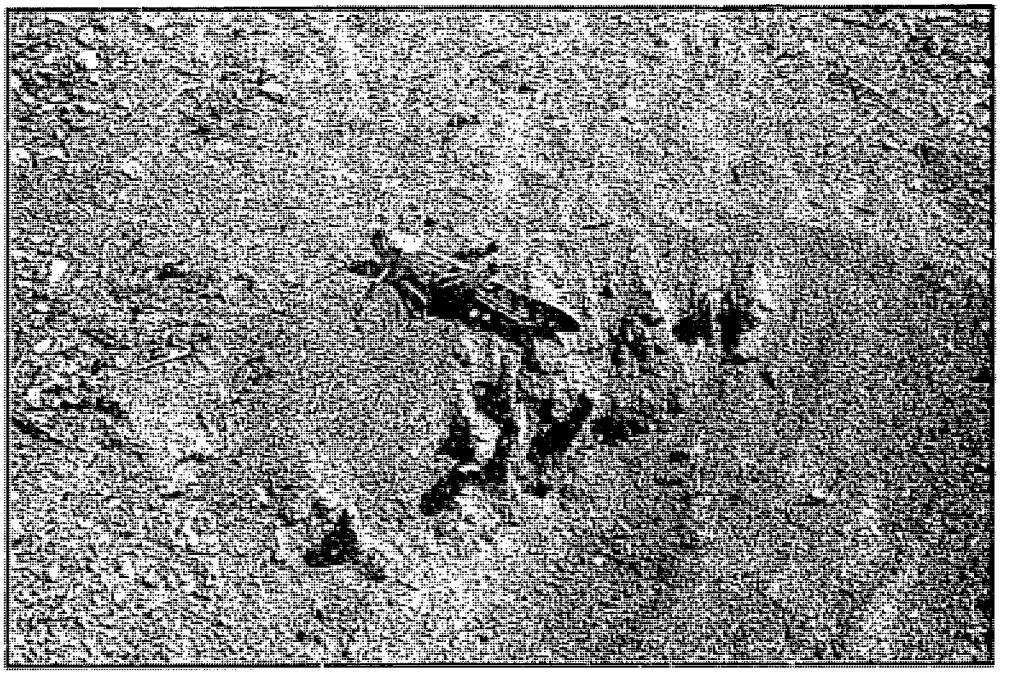
SUPPLEMENTARY ENVIRONMENTAL ASSESSMENT OF THE EMERGENCY YEMEN LOCUST CONTROL PROGRAM

United States Agency for International Development
Sana'a, Republic of Yemen



ANE/NE/DR/ENR and AFR/AA/DRCO

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AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR THE NEAR EAST
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Environment & Natural Resources Unit

SUPPLEMENTARY ENVIRONMENTAL ASSESSMENT TO THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR LOCUST/GRASSHOPPER CONTROL IN AFRICA AND ASIA

FINAL ACTION FORM

COUNTRY: **YEMEN**

DATE: JULY 1993

ACTION TAKEN BY NEAR EAST BUREAU ENVIRONMENT COORDINATOR:

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DISAPPROVED _____

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PREFACE

This Supplementary Environmental Assessment (SEA) was prepared in response to the desert locust emergency situation in Yemen. The document profits greatly from the experience gained by the Africa Bureau in the preparation of similar SEAs for Eritrea, Ethiopia, Sudan, Chad, Mali, Niger, Mauritania, Senegal, Morocco, Tunisia, Burkina Faso, and Cameroon. We wish to express our appreciation to Dr. Allan Showler (AFR/DRCO) and Ms. Vicky Dreyer (AFR/ONI/TPPI), Dr. Gary Jahn (ASIA/TR), and Ms. Janice Jensen (USEPA/OPP) for their collaboration in the planning stages of this document. We also wish to extend our gratitude to Mr. William McKinney (USAID/Yemen) for his dynamic collaboration; and to Missrs. Al Furman and Keith Cressman from FAO/Yemen for providing us with timely and complete information on the ground situation. Without their assistance and careful documentation our task would have been very difficult indeed.

LIST OF ACRONYMS AND ABBREVIATIONS

AAAS	American Association for the Advancement of Science
AChE	Acetylcholinesterase
AELGA	Africa Emergency Locust/Grasshopper Assistance Project
ANE	Asia - Near East Bureau
CFR	US Code of Federal Regulations
CICP	Consortium for International Crop Protection
DLCO-EA	Desert Locust Control Organization for East Africa
DR	Office for Development Resources
DRCO	Africa Bureau's Disaster Response and Coordination Office
EA	Environmental Assessment
EPA	US Environmental Protection Agency
ENR	Environment & Natural Resources Unit
FAO	Food and Agriculture Organization of the United Nations
GOY	Government of Yemen
GTZ	Gesellschaft fur Technische Zusammenarbeit (Germany)
ha	hectare
IPM	Integrated pest management
km	kilometer
MAWR	Ministry of Agriculture and Water Resources
mg/kg	milligrams per kilogram
mm	millimeter
NE	Near East Bureau
ODA	Overseas Development Agency (U.K.)
OP	Organophosphate insecticide
PEA	Programmatic Environmental Assessment for Locust and Grasshopper Control in Africa and Asia

SEA	Supplemental Environmental Assessment
USG	United States Government
ULV	Ultra low volume
USAID	US Agency for International Development

1.0 EXECUTIVE SUMMARY

Desert Locust Emergency and Proposed Action

The Government of Yemen has requested assistance from the International donor community to deal with their current Desert Locust (DL) outbreak emergency. The Yemeni Ministry of Agriculture and Water Resources (MAWR) has mobilized its limited capabilities but to this date has not been able to abate the locust outbreak. To remediate the situation the GOY has asked the U.S. for a donation of $275,000 in emergency assistance to procure: 10,000 liters of pesticide, 90 aircraft flying-hours, 100 sets of protective clothing, operating expenses, fuel and/or logistical support.

All crops in the region, except coffee and prickly pear cactus, are at risk. Furthermore, if the outbreak is not treated effectively, there is the risk of it leading into a plague, thus having potentially grave effects for other countries in the region. Spray operations will take place mostly on the eastern deserts bordering the Empty Quarter (Rub Al Khali) of Saudi Arabia and the Tihama, though virtually anywhere in the Yemen has the potential for being infested. This are extremely remote areas with sparse human populations and only a few areas of subsistence farming. At the same time the terrain is difficult for control operations.

USAID Regulations and Policy Consideration

USAID Environmental Procedures stipulate that 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). These procedures shall also apply, to the extent permitted by agreements entered into by USAID 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.

One of USAID concerns in DL control operations is that pesticide applicators, handlers, mixers, and the general population are adequately protected. According to complete reports from FAO representatives in Sana'a and by Dr. Allan Showler, AFR/DRCO's Technical Advisor to the African Emergency Locust/Grasshopper Assistance (AELGA) Project, existing storage facilities are in good condition. Two facilities will be used for during the campaign: Sana'a and Hodeidah. Empty pesticide containers will be disposed of after being cleaned with an appropriate solution and destroying the drums with bulldozer. MAWR pesticide application teams are equipped with a full set of protective clothing. In addition, cholinesterase testing of pesticide applicators is done periodically, and steps are being taken for a more comprehensive testing program during the locust emergency. Pesticide applicator training programs have been conducted by FAO and the MAWR. Rural health care centers and regional hospitals are available within a reasonable distance to where spray operations will be carried out. These centers and hospitals have trained doctors and other health professionals, and inventories of pesticide antidotes.

2.0 PURPOSE AND PROCEDURES

2.1 Background

In 1989, USAID's Bureaus for Asia/Near East and Africa approved a Programmatic Environmental Assessment (PEA) for Locust and Grasshopper Control in Africa and Asia. This PEA was prepared to satisfy USAID Environmental Procedures (22 CFR 216), as well as USAID policies on the use of pesticides in development programs. This PEA was preceded by a waiver by the Administrator of USAID. The waiver, which expired in 1989, allowed USAID to provide assistance for the procurement and use of pesticides for locust control, exempting these operations from the Agency's environmental procedures. Since then, assistance for procurement and use of pesticides must follow the regulations set forth in USAID environmental procedures.

The PEA provides 38 Programmatic Recommendations to be adopted in USAID-supported locust control operations throughout the region (see Appendix C for Yemen-specific adaptation of these recommendations). USAID policy has been to follow-up each locust control program with individual Supplemental Environmental Assessments (SEA) which provide country-specific guidance for the optimal implementation of the PEA. These SEAs advise on the best ways to conduct locust control operations in an environmentally sound manner and ensuring maximum protection to human health and safety. The PEA and this SEA are designed to fulfill these goals and complete the necessary requirements which would allow USAID to provide emergency assistance to Yemen.

2.2 Current Proposal

The Government of Yemen, in response to a significant desert locust outbreak in Yemen in early 1993, has requested assistance from the International donor community, including USAID, to deal with the desert locust (DL) outbreak emergency. The Ministry of Agriculture and Water Resources (MAWR) has mobilized its limited capabilities, which to this date have not been enough to control the outbreak. Currently, MAWR ground capabilities are inadequate to successfully conduct the large scale operations required. Therefore, to mitigate and control this infestation effectively, the GOY has requested from the donor community: 50 tons of pesticide (e.g., fenitrothion ULV), safety equipment, logistical equipment, aircraft rental & flying hours, rental vehicles, aircraft fuel, and technical assistance. Specifically, the GOY has asked the U.S. for a donation of $275,000 in emergency assistance to procure: 10,000 liters of pesticide, 90 aircraft flying hours, 100 sets of lightweight protective clothing, operating expenses, fuel and logistical support.

As the outbreak has spread beyond its original areas in northern Eritrea, the Red Sea Coast of Sudan, and north-central Yemen to include countries across the Sahel, Ethiopia, Somalia, Oman, Saudi Arabia, Egypt, Pakistan and India, subsidence of the infestation in Yemen since mid-summer 1993 is likely to be a temproary respite. This SEA will allow

USAID to respond appropriately to additional requests for emergency, proactive and preventive assistance as needed in the future.

2.3 Drafting Procedure

This SEA was drafted in July 1993 by NE/DR/ENR's AAAS Fellow, Dr. Alejandro Segarra, and has been devised to maintain USAID commitment with the environmental & health procedures set forth by the PEA for Locust and Grasshopper Control in Africa and Asia completed in 1989. Data on the current situation in Yemen comes from cables, phone conversations and telefaxed information furnished by USAID/Sana'a and FAO/Yemen. In October 1993, AFR/DRCO's Technical Advisor to the AELGA Project, Dr. Allan Showler, visited Yemen to finalize this document. Analysis of documents and extensive consultations with experts, both within and outside of USAID, have allowed the preparers to reach the recommendations that are presented in this SEA.

2.4 Previous Assessments

The Programmatic Environmental Assessment for Locust and Grasshopper Control in Africa/Asia (TAMS/CICP, 1989) covers grasshopper and locust control operations in Africa and Western Asia. This SEA is a supplement to the PEA, and should be considered an integral part of the PEA on its approval which addresses country-specific environmental issues not specifically dealt with by the PEA. Other SEAs for locust control have been completed in Mauritania, Senegal, Burkina Faso, Mali, Cameroon, Niger, Chad, Sudan, Tunisia, Ethiopia, Eritrea, Morocco, Afghanistan and Kenya.

2.5 Relevent Environmental Procedures

Yemen does not have procedures equivalent to the U.S. National Environmental Policy Act (NEPA) of 1970 (42 U.S.C. 4371). Nevertheless, according to FAO representatives in Sana'a, the Government of Yemen (GOY) has adopted legislation that regulates the import, handling, use, transport, storage and disposal of pesticides. According to FAO representatives, these pesticide laws are based entirely on FAO International Code of Conduct for the Distribution and Use of Pesticides (1990) approved in Rome. FAO Code of Conduct guidelines are consistent with the USAID environmental regulations: 22 CFR Part 216, USAID Environmental Procedures; Foreign Assistance Act, Section 117, Environment and Natural Resources; and the 1991 USAID Pest and Pesticide Management Guidelines.

2.6 USAID Regulations and Policies

USAID policy is to ensure that negative environmental consequences of U.S.-development assistance actions are identified, mitigated and monitored, before, during and after program implementation. This SEA covers potential environmental consequences involved with the use of pesticides, and necessary safeguards for and

mitigation of possible adverse environmental and human health impacts associated with future control programs. When possible, alternatives to chemical control agents are recommended to use integrated pest management (IPM) tactics to the extent possible, preferably in a preventive or proactive context. Emergency situations, such as this locust emergency, make using IPM tactics difficult due to their unpredictability and great complexity and the fact that, as of late 1993, such tactics are not yet available to be applied effectively.

> *USAID's regulations require that the potential environmental consequences of USAID-financed activities are identified and considered by USAID and the host country prior to the final decision to proceed with an activity. The procedures that guide this regulation are set forth in 22 CFR Part 216. Section 117(c) of the Foreign Assistance Act and Section 533(g) of the 1991 Approbation Act require that USAID review its projects, programs, and activities in accordance with requirements of 22 CFR Part 216. USAID's policy is to approve for procurement or use only those pesticides that are critically needed and proven safe.*

USAID Environmental Procedures stipulate that 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). These procedures shall also apply, to the extent permitted by agreements entered into by USAID 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.

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 environmental assessment for the activity or 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;
(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 non-target 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 non-chemical 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.

It is also USAID policy and part of USAID's environmental regulations to conduct its assistance programs in a manner that is sensitive to the protection of endangered or threatened species and critical/fragile habitats. The 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.

U.S. pesticide contributions to Yemen will be regulated by U.S. pesticide regulations and procedures (as described in the PEA). Only those pesticides listed in the PEA (or amendments thereof) as being approved for use against locusts or grasshoppers are acceptable (see Appendix C for Yemeni-specific analysis of the 38 recommendations). USAID regulations require that all pesticides are to be used according to label instructions only. Used pesticide containers and any unwanted pesticide resulting from a U.S.-funded operation must be disposed of properly and safely. No U.S. funds shall be used to purchase, transport, or apply any pesticide that has been banned in the U.S. This includes the chlorinated hydrocarbons, such as dieldrin and lindane. A list of pesticides approved for use against locusts and grasshoppers is included in Appendix B.

3. LOCUST SITUATION AND CONTROL EFFORTS IN YEMEN

As of the first week of July 1993, one-fifth of Yemen's land mass was reported to have been infested by DL, i.e., from Sa'adah to Hadhramaut, since the beginning of the year. The last infestation of DL of this magnitude occurred in 1944, when a plague devastated the country's agriculture. The beginning of the current infestation has not been well established. It is known with certainty that DL breeding occurred on the central Tihama of Saudi Arabia and Yemen between April and June 1992. In July 1992, a locust outbreak was reported by FAO in central and southern Red Sea coastal plains of Sudan, Saudi Arabia, Yemen, Eritrea and upper Egypt. At the same time, there was widespread heavy rain over the eastern coast ot the Red Sea including the Tihama of Yemen. Thus, the latest outbreak has origninated in a manner very similar to the genesis of the last major DL plague (1986-1989).

Above average amounts of rainfall in September and October of 1992 continued providing ideal conditions for DL breeding along the Red Sea coast. Adult locusts

started breeding and two generations probably occurred before the first swarms were observed in early November when adults were found at an average density of up to 500 individuals per hectare. Regular survey and prospection operations were handled by the Ministry of Agriculture and Water Resources' (MAWR) General Department of Plant Protection. The MAWR confirmed DL breeding in the western plains of the Tihama (from North of Harad to Bait Al-Of, south of Al-Hodeidh city and in Abian and Lahj governorates). Medium size swarms were seen on December 12th and 24th north of Al-Zahrah and Thamuod respectively. The GOY initiated spraying activities in the infested areas of the Tihama on December 28 to control the hopper bands and swarms. Treatment operations continued sporadically through to June 1993, and the MAWR estimates that a total of 60,000 hectares were treated.

The current DL outbreak in the Marib governorate started when two DL swarms entered the Haareb district from the west on mid-April 1993. These swarms laid eggs in an area of about 45 km^2. In early May, seven (7) swarms entered the Shabwah governorate through the desert infesting an area estimated at 26 km^2. By late May, over 5,500 km^2 in Marib, Shabwah, and Al-Jouf have been declared infested by DL hopper bands. These hopper bands have caused extensive damage to pasture, grain farms and fruit farms in the infested regions. This latest round of infestations have occurred in the desert where difficult terrain has been making control operations hard to conduct.

Much of the survey in Yemen was conducted by military helicopter and by crop protection service ground teams. All of the control was conducted by ground, but this was hindered greatly by the rugged and remote terrain.

From early 1993, when control was initiated, until mid-summer 1993 (when the infestation dissipated largely due to movement of the swarms eastward on prevailing winds across Oman to Pakistan and India), over 100,000 ha were treated with approximately 50,000 liters of pesticide. Exact areas infested and treated, and accurate reporting on amounts of pesticide used, are not available due to the difficulty in reporting, though reports from the infested provinces were (and continue to be) communicated by radio each day to the crop protection service headquarters in Sana'a.

In Shabwah, 54,700 ha were treated using 90 vehicles (for survey and control) and 38,500 liters of pesticide (32,000 liters of which was fenitrothion, the rest was mostly propoxur and diazinon). In Marib, 39,565 ha were treated using 27 vehicles (65 persons) for survey and control, and 90,192 liters of pesticide (not ULV formulation for the most part). In Al-Jouf, 13,000 ha were treated using 12 vehicles (47 persons) and 6,475 liters of pesticide.

3.1 Crop Loss Assessment

All crops in the region, except coffee and prickly pear cacti, are at risk, including pastureland and grazing vegetation for livestock. Furthermore, if the outbreak is not treated effectively, there is the risk of it leading into a plague, thus having potentially grave effects for other countries in the region.

3.2 Locust Management Operations

Spray operations will occur mostly on the eastern and central deserts bordering the Empty Quarter of Saudi Arabia (though all of Yemen is vulnerable to infestation). This is an extremely remote area with sparse human populations and only a few areas of subsistence farming. At the same time the terrain is difficult for control operations and most will be done using vehicle mounted equipment and possibly some aircraft (preferably less expensive fixed-wing aircraft, perhaps from DLCO-EA). Ground application, mostly from 4X4 vehicles, are the backbone of the anti-locust effort, which reduces the chance of spray drift and increases the precision of applications. Farmers are not part of the campaign which is wise as they are not trained in pesticide application. Trained crop protection personnel conduct the applications.

3.3 Pesticide

The vast areas in Marib, Shabwah and Al-Jouf provinces (5,500 km^2) require treatment with non-persistent insecticides to help prevent a possible locust plague. The MAWR used fenitrothion ULV from April until June 1993 and some 8,000 liters was stored at Sana'a and Al-Hodeidah. Fenitrothion is an organophosphate pesticide effective against grasshoppers and locusts which is currently USEPA registered. This chemical is a USEPA "category III" pesticide (moderately toxic) and has an oral toxicity to rats of approximately 250 mg/kg (2500 mg/kg dermal). Fenitrothion acts as a contact insecticide and has been used frequently in locust control campaigns. Common antidotes for fenitrothion are PAM and atropine sulphate. Other names for fenitrothion are: Sumithion, Nuvanol, Folithion, and Etalene.

Fenitrothion has been chosen by the MAWR and FAO/Sana'a because it is currently recommended by FAO for DL control. In addition, MAWR is familiar with the product and its demonstrated track record of effectiveness. The pesticide will be used in its ULV formulation at a recommended application rate of 0.4-0.5 liters per hectare. This rate is half of that required by other pesticides to inflict similar DL mortality, which means transporting, handling, storing or disposing of half the number of drums. Fenitrothion is one of the USAID-approved pesticides for DL control specified in the 1989 PEA.

As of October 1993, the plant protection department has 36,000 liters of malathion, chlorpyrifos, and fenitrothion, mostly ULV formulation, for locust control. The

characteristics of these three USAID-approved insecticides are in Appendix B and in the PEA.

3.4 Pesticide Management

One of USAID's main concerns in DL control operations is that pesticide applicators, handlers, mixers, and the general population are adequately protected. Adequate protection includes: safe storage sites, adequate protective clothing, adequate training on safe pesticide use, good medical facilities and personnel to diagnose and treat pesticide poisonings, and safe disposal of pesticide containers and tank rinsates. According to FAO representatives in Sana'a the current situation is described for Yemen:

Storage Sites and Containers- According to FAO representatives existing storage facilities are in good condition. Two facilities are mainly to be used during the campaign: Sana'a, Shabwa, Lajh, and Hodeidah. The Sana'a facility was recently been completed, and both are well ventilated, with pesticides locked in concrete rooms, in guarded compounds. Fire extinguishers and other fire and safety equipment are present at each site. Because some of the storage sites are located within their cities, the department of plant protection wishes to construct new facilities farther away from densely populated areas. Finally, pesticide containers are appropriately labeled to include the name of the pesticide, manufacturer, safety instructions, date of manufacture, and lot number in English and Arabic according to FAO Code of Conduct. Lime is on hand in the storage facilities to neutralize pesticide spills.

Protective Clothing and Cholinesterase testing- MAWR pesticide application teams are equipped with a full set of protective clothing. Each set includes a respirator/mask, goggles, gloves, boots and overalls. As a matter of procedure applicators are constantly being instructed and supervised to use the equipment. In addition, pesticide applicator cholinesterase testing is done periodically, and steps are being taken for a more comprehensive testing program during the locust emergency. The plant protection department, however, has indicated that in many cases the intense heat causes workers not to wear respirators, though they will use paper face masks. This is better than in most locust-afflicted countries where protective clothing is often not worn at all. As of October 1993, the GOY has requested additional sets of protective clothing. Additional AChE test kits have also been requested.

Training- Pesticide applicator programs have been conducted by FAO and the MAWR. According to current plans, update courses will be given prior to the beginning of possible aerial applications by an FAO expert on pesticide application & safety who will be located in the target areas. Additional training has been provided and will continue to be supplied by other donors, such as

the GTZ Plant Protection project. Training of plant protection department personnel and appropriate Ministry of Health personnel in the use of AChE test kits is needed, and training on the use of micronair sprayers mounted on vehicles should also be provided upon the provision of these materials.

Poisoning Treatment- Rural health care centers and regional hospitals are available within a reasonable distance to where spray operations will be carried out. These centers and hospitals have trained doctors and other health professionals, and inventories of pesticide antidotes. In addition, limited quantities of atropine are available from the GTZ/Plant Protection Project in Sana'a. As a third back-up alternative FAO is in contact with Hunt Oil Co., which operates in remote areas of Yemen, and which has made available its emergency health facilities and services in case of need.

Disposal of Pesticide Containers- Spray equipment and storage drums are being rinsed with an appropriate solvent after the completion of spray operations. The rinseates are disposed of according to FAO Code of Conduct in conjunction with the stringent requirements of current FAO/GTZ projects on pesticide disposal in Yemen. Furthermore two FAO experts are in Yemen and ODA will be providing a third expert to assist in monitoring this activity during the operations. Empty pesticide containers will be disposed of after being cleaned with an appropriate solution and destroying the drums with bulldozer.

Protection of Rural Population- The GOY has taken the following precautions to protect the rural population of impending pesticide treatment in their area: (1) a massive public awareness/alerting campaign aimed at the general population, as well as farmers and beekeepers involving Arabic language newsprint, radio and TV programs; (2) Personal contacts with nomads and farmers and beekeepers in rural areas, providing advanced warning of impending spraying for the protection of livestock inside target areas.

4. ENVIRONMENT

4.1 Yemen - Environmental Profile

Yemen is characterized by a variety of environmental zones, from an arid coastal strip on the Red Sea to a rugged north-south mountain chain with the highest point on the Arabian Peninsula (i.e., Jabal an Nabi Shu'ayb). Information on the various environmental zones is available from many sources but no uniform classification of zones has been adopted by the GOY. In simple terms, from west to east, the country could be divided into the following four zones:

The Coastal Plain and the Tihama Foothills: These range from sea level to 500m. This zone stretches inland 65 km and covers around 16% of the land area. The zone includes several major wadi systems with alluvial sediments. The average temperature is 30°C and ranges from 16°-41°C. Rain is sparse, ranging from 14-400mm/year. The coastal area is influenced by the oceanographic structure of the Red Sea and is dominated by the influence of monsoons. The major surface circulation are southerly winds driven from the Indian Ocean for most of the year. Prevailing winds reverse shortly during the summer becoming northerly. The landscape of the Tihama foothills is characterized by contrasts between the dry, brown hills and the green fertile valleys. An evergreen environment with mixtures of microphyllous and sclerophyllous plant species are the most important flora of these seasonal lowland forests.

The Western Escarpment: The range of elevation is between 1000-1600m and consists primarily of basement rocks underlying Mesozoic sediments and covers around 30% of the land area. The average annual temperature is 25°C and precipitation ranges in the 600mm. Humidity in this zone tends to be more moderate that in the Tihama. This zone has been subject to deforestation due to the high demand for fuel wood. Terrace cultivation is extensive and livestock grazing active. In the higher elevations of this zone temperature averages 20°C and precipitation is 1000mm/year. This is prime agricultural land due to the high moisture availability. This is also the most highly populated region of the country. The flora in this zone is characterized by a drought-deciduous submontaine woodland mixed with a few evergreen trees and shrubs.

The Central Highlands: This series of basins with varying elevations covers about 40% of the county and contains the major cities. The Central Highlands have a temperate climate with declining rainfall on a south-north transect. While annual rainfall way be 1,800mm/year in Taiz and Ibb, it could be as little as 200mm/yr in the north near Sa'da. Plains in this zone are heavily cultivated and primary land for agriculture. Frost is a common feature of this zone. The main plant formation is drought-deciduous mountain woodland, but very few of these woodland relics are still to be found due to the history of intensive cultivation during thousands of years.

The Eastern Plateau: The eastern part of Yemen becomes progressively drier and inhospitable to agriculture toward the east and the Empty Quarter. This is the zone currently affected by the DL outbreak. Rocky slopes descend from about 2,200m to 1,300m. The mean temperature is 25°C with a winter frost potential, and few and irregular rains amount only to an average of less that 200mm/yr. There are slopes, semi-desert dwarf shrubland, dune systems, and a few wadis. The most important wadi now has a modern dam constructed at Ma'rib. The eastern mountain slopes and the desert plateau are too dry for any

tree cover. Therefore the most important plant formation on rocky and stony sites is a semidesert drought-deciduous open dwarf shrubland with few evergreen plants and succulents. The shifting dunes only bear some very isolated plants.

4.2 Restricted Habitats

Under current Yemeni law there are no protected areas, though the Kumran Islands are being considered. The World Conservation Center and the United Nations has recommended that an additional 24 sites be declared protected areas in Yemen (See Appendix B). It is important to point out that each one of these proposed critical areas are several hundred kilometers away from the area currently affected by the DL outbreak in the eastern desert and the Empty Quarter. At the moment, and in view of the current locust forecast, it is not expected that any of these areas of ecological interest will be treated. However, fragile habitats, especially wadis, oases, and oueds should not be treated if at all possible, and a spray-free buffer of 2.5 km should be observed around such fragile habitats.

5.0 Yemen SEA Recommendations & Conclusions

1. Locust control operations for this emergency program are not expected to occur near nationally or internationally recognized critical or otherwise fragile (e.g., aquatic systems such as oases and wadis) environmental areas. However, it is recommended that in the unforeseen event that DL control operations change location due to swarm movements, that no pesticides be applied within 2.5 km of these areas. Large portions of Yemen remain unexplored by biologists. Future scientific expeditions may identify additional critical habitats.

2. This SEA recommends that any U.S.-funded assistance concerning locust management should promote the development of integrated pest management (IPM) tactics for locust control. An IPM program reduces pesticides usage by relying on a variety of locust control methods; using insecticides only when necessary. The SEA recommends that FAO continue to take the lead in this area, with guidance from USAID locust specialists, as this organization has had considerable experience in Africa and the Near East with such efforts.

3. This SEA suggests that FAO should encourage and assist the GOY to monitor the environmental fate of pesticides and their residues.

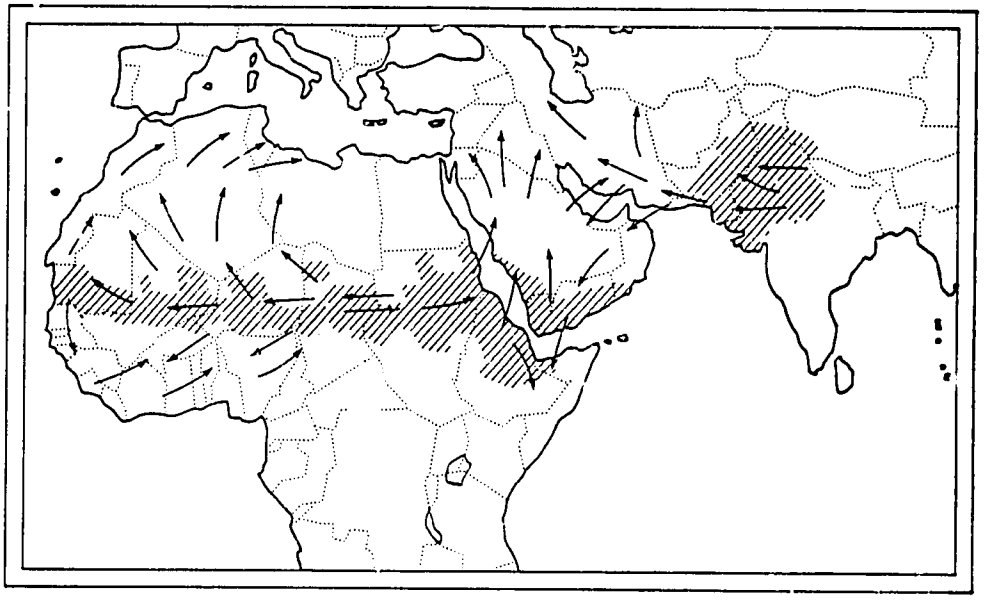
4. Frequent analysis of blood acetylcholinesterase levels in pesticide handlers and applicators has been a common practice for other USAID-sponsored DL control projects, and this accepted practice is recommended here as well.

5. This SEA recommends continued support to FAO leadership in assisting Yemen to continue the development of their national pesticide regulations, specially as a result of this locust outbreak.

6. Since Yemen has no national parks and forests, or otherwise protected or reserve areas, there are no official restrictions on where pesticides can be applied. This SEA recommends that the GOY identify fragile habitats that should be protected from pesticide use as described in recommendation #1 above.

7. This SEA recommends that additional logistical support be given to establish, train, and equip medical crews to identify and treat cases of accidental pesticide poisoning occurring during locust control operations, including the provision and utilization of adequate protective clothing and equipment, and ample supplies of atropine or other suitable antidotes.

8. This SEA recommends the GOY and FAO continue to take every precaution to ensure that populated areas and livestock are protected from pesticide applications. All spraying operations must follow PEA guidelines which limit how close pesticides applications can occur to populated areas to no less than 2.5 km.



Summer mating areas (August-September)
and major swarm movements.

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APPENDIX A. LIST OF PREPARERS/CONTACTS

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APPENDIX B. RELEVANT DOCUMENTATION

I- Copy of questionnaire sent to FAO/Yemen to obtain information for the completion of this SEA. Faxed to FAO/Yemen June 29, 1993. (Prepared by A.Segarra).

Information needed from FAO-Yemen:

A-Insecticide Use: Fenitrothion

1- Fenitrothion (ULV) at 0.5 lb/ha is on the list of USAID-approved pesticides for locust control, and its use as part of USAID-funded operations is acceptable. However, fenitrothion is highly toxic to birds and wildlife. USAID does not recommend its use near wildlife reserves and other sensitive habitats. Please justify the use of this chemical, especially in light of other possible less toxic alternatives that can be used instead, such as: malathion, carbaryl, etc.

2- Briefly describe the locations where the pesticide is to be used; also sketch the likely application methods that will be used to threat hopper bands and swarms.

B-Insecticide Management: Storage and Inventory.

1- Describe the current inventory of pesticides for locust control in Yemen, in particular, please determine the following:

-The quantity of existing pesticide stocks (by pesticide and storage site).

-The condition of existing storage facilities- Please describe the safety precautions at each major site, and how do facilities ensure optimum storage conditions.

-The disposal procedures to be used with tank rinseates, spills and excess pesticide (if any) at the end of the campaign.

-Describe briefly the applicable pesticide laws in Yemen. In particular a brief assessment of Yemen's ability to regulate or control the distribution, storage, use and disposal of the procured pesticides.

2- Describe how pesticide containers are appropriately labeled to include: name of pesticide, manufacturer, safety instructions, date of manufacture, and lot number; in Arabic and English.

OFFICE OF THE FAO REPRESENTATIVE
Sana'a, Republic of Yemen
Facsimile No. (967) 1-208852

FACSIMILE TRANSMISSION
No. YEM/93/ 286

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Sent by: A. Furman, K. Cressman
Posn/Project: FAOR, ECLO expert
Date: 30.06.93

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copied to USAID, Sanaa and A. Hafraoui, FAO/ECLO, Rome (for info)

SEA FOR EMERGENCY LOCUST ASSISTANCE TO YEMEN

Reference is made to your fax of 29 June 1993 regarding Locust Control Questionnaire for the USAID Supplementary Environmental Assessment (SEA). The following answers to the questionnaire are based on information from the Ministry of Agriculture and Water Resources (MAWR). Please refer to the original fax for the text of each question.

Following the answers, the current priorities of needs to meet the emergency are listed to better assist USAID in meeting emergency locust needs in Yemen.. These have been compiled in collaboration with FAO and the MAWR.

SEA ANSWERS

A1. Fenitrothion ULV is used in Yemen because (1) it is one of the FAO recommended pesticides for Desert Locust control, (2) familiarity with the chemical, its behaviour and toxic effects, (3) it is sprayed in remote areas away from wildlife, natural parks, water sources, and human settlements, (4) the recommended application rate is 0.4 - 0.5 litres/ha which is more advantageous than other pesticides that are applied at higher rates (i.e. 1.0 l/ha) in that it involves a smaller number of drums that must be handled, transported, stored, and disposed of.

A2. Spray operations will take place mostly in the eastern deserts bordering the Empty Quarter of Saudi Arabia. This is an extremely remote area with no sizeable villages and only a few areas of mostly subsistance agriculture; however, it is an area preferred by the Desert Locust. Pesticide will be applied using the FAO recommended incremental and drift spraying of ULV formulated pesticide by FAO approved ground and aerial equipment.

B1. Presently there are about 8,000 litres of ULV pesticide (4,000 l in Hodeidah and 4,000 l in Sanaa/Marib).

Existing storage facilities are in good condition: the Sanaa facility was recently completed. Storage facilities consist of a well-ventilated, locked cement room(s) in a guarded compound. Water, fire extinguishers and other safety equipment are present at each site.

Spray equipment and storage drums are rinsed with an appropriate liquid after completion of spray operations. The rinseates are disposed of according to the FAO Code of Conduct in conjunction with the stringent requirements of current projects by FAO and GTZ on pesticide disposal. Furthermore, two FAO experts are in country and ODA will be providing a third expert to assist in monitoring this activity during the operations.

The Government of Yemen has laws regulating the import, handling, use, transport, storage, and disposal of pesticides. A registration system, based on the FAO Code of Conduct, will be implemented upon completion of a pesticide testing laboratory. At present, residue analysis are sent to Germany for processing. Disposal procedures are under the control of the FAO and GTZ pesticide disposal projects.

B2. Pesticide containers are appropriately labeled to include name of pesticide, manufacturer, safety instructions, date of manufacture, and lot number in English and Arabic according to FAO Code of Conduct.

C1. Every application team is given a full set of protective clothes that includes mask/respirator, goggles, gloves, boots, and overalls. Applicators are continually being instructed and reminded to use this equipment. Training has been recently provided by FAO as well as the MAWR. FAO is continuing to supply protective clothing under emergency locust control funds.

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C2. Rural health care centres and regional hospitals are available within a reasonable distance to where spray operations will be carried out. These centres and hospitals have trained doctors and inventories of antidotes for pesticides used in Desert Locust control. Limited quantities of the antidote Atropine are available in the GTZ/Plant Protection Project in Sanaa. FAO is in contact with Yemen Hunt Oil Company which operates in remote areas and has offered to make available emergency health facilities and services.

C3. Training programmes have been undertaken and continue for locust applicators and, as mentioned above, medical staff are available in health centres and hospitals. Guidelines have also been produced by the Government. Since the onset of the locust emergency, the national TV and radio have been broadcasting programmes and bulletins regarding the emergency and protective measures to take.

C4. Testing is done periodically for applicators, and steps are being taken for more frequent testing during the locust emergency.

D1. Current procedures consist of cleaning empty pesticide drums with the appropriate solution and destroying the drums by bulldozer.

E1. Locust applicators recently received an FAO sponsored training course on safety measures for ground application. According to current plans, an update course will be given prior to start of aerial operations by an FAO expert on pesticide application and safety who will be located in the target areas. Additional training has been provided and will continue to be provided under the GTZ/Plant Protection project.

F1. All listed sites are on or near the Red Sea coast several hundred kilometres from the Empty Quarter and eastern deserts where spray operations will occur. At the moment, in view of the current locust situation and forecast, it is not expected that any of the listed sites will be treated.

F2. The Government has taken the following precautions: (1) a massive public awareness campaign aimed at the general population as well as farmers and beekeepers involving Arabic language TV and radio programmes and announcements three times per day, (2) regular information in the daily newspapers and magazines, (3) personal contact with nomads and farmers in rural areas, (4) advance warning to farmers and nomads to move animals away from target sites.

F3. The Government is undertaking daily surveys in all affected areas with the use of maps and Geographical Satellite Positioning systems to accurately identify and mark target areas for control. In addition, FAO has supplied one application specialist to train applicators on environmentally safe, efficient and effective control.

PRIORITIES FOR EMERGENCY CONTROL OPERATIONS

1. vehicle-mounted ULV spray equipment (Micronair AU8110)
   vehicles (Toyota 4wd LandCruiser pickup)
   protective clothing (lightweight for use in desert; small and medium size only)

2. mobile radios (ICOM 735 HF)
   training (pesticide safety, application)
   geographical positioning systems / GPS (Magellan 5000)
   general operating expenses (dsa, fuel, etc.)

3. pesticide
   first choice: fenitrothion 96 ULV
   second choice: carbaryl ULV
   third choice: malathion ULV

ANNEX 9

UNITED NATIONS LIST OF NATIONAL PARKS AND PROTECTED AREAS FOR YEMEN

Proposed site(s)

Kumran Islands R.

Recommended site(s)

Al Kadan, Dobera Parkland, Tihama
Al Khawkha
Al Mahwit woods
Al Mocha
Al Qutay'-Jabal Bura', Tihama
Dhubab
Hidhran marshes
Humar Island
Jabal Bura' valley forest
Jabal Sabir-Wadi Thabad wadis
Wadi Al Dhabab
Jabal an Nabi Shu'ayb
Ras Katanib Island
Ras 'Isa MP
Shibam/Kawkaban escarpment
Taiz woods
Uqban (Ukban) Islands
Wadi Duba forest
Wadi Mawr, Tihama
Wadi Rima' estuary
Wadi Siham
Wadi Suq 'Abs, Tihama
Zubayr Islands
Zuqur Islands MNP

Shortcomings of list:

1. No sources on who proposed
2. Difficult to identify because of transliteration system used
3. Some areas far too large

List sent to MAF and passed to EPC. No action taken. This highlights fundamental problems with lack of institutional focus for conservation and thus need for IUCN affiliation.

To Allan Showers

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AIDAC NAIROBI FOR REDSO/ESA; ABIDJAN FOR REDSO/WCA, N/ENA
E.O. 12356: N/A
TAGS:
SUBJECT: UPDATE ON A.I.D.-APPROVED LIST OF PESTICIDES FOR LOCUST/GRASSHOPPER CONTROL

1. SUMMARY: AID/AFR/ONI IS IN THE PROCESS OF REFINING THE LIST OF PREFERRED PESTICIDES PRESENTED IN THE 1989 PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) FOR LOCUST AND GRASSHOPPER CONTROL IN AFRICA AND ASIA. THE INFORMATION IN THIS CABLE UPDATES SIMILAR TABULAR DATA IN THE PEA, AND SUPERCEDES SIMILAR DATA IN A.I.D.'S 'REVIEW OF ENVIRONMENTAL CONCERNS IN A.I.D. PROGRAMS FOR LOCUST AND GRASSHOPPER CONTROL, PUBL. SERIES NO. 81-7'. THE INFORMATION ON PESTICIDES IN THIS CABLE SHOULD BE CONSIDERED TO BE AN AMENDMENT TO THE PEA. THE TABLE LISTING PESTICIDES IN THE ENVIRONMENTAL CONCERNS DOCUMENT WAS ONLY MEANT TO INDICATE PESTICIDES THAT CAN BE PURCHASED WITH A.I.D. FUNDS, BUT IT SHOULD NOT BE CONSIDERED AS GUIDANCE FOR PESTICIDE SELECTION, END SUMMARY.

2. WITH MORE AND MORE INFORMATION ON PESTICIDES BEING GENERATED, AID/AFR FINDS IT NECESSARY TO REFINE ITS LIST OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES. THE FOLLOWING IS AN ALPHABETICAL LISTING OF THE PESTICIDES APPROVED IN THE PEA. THE LIST INCLUDES RELEVANT INFORMATION ON TOXICITY, BIO-ACCUMULATION AND SIGNAL WORDS (TO INDICATE THE RELATIVE TOXICITY OF EACH INSECTICIDE). THIS INFORMATION PROVIDES A SKETCH OF PROPERTIES OF THE A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES. ALL OF THE CHEMICALS LISTED BELOW ARE CURRENTLY REGISTERED EITHER BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) OR ITS EQUIVALENT IN OTHER COUNTRIES FOR LOCUST AND GRASSHOPPER CONTROL.

	TOXICITY TO						
	FISH	INVER	BIRD	MAMML	BIOAC	PERS	SIGNW
1. ACEPHATE	L	L	L	M	L	L	C
2. BENDIOCARB	M	M	M	M	M	M	W
3. CARBARYL	L	L	L	L	L-M	L	C
4. CHLORPYRIFOS	M	M	M	M	M	L	C-W
5. DIAZINON	M	M	M-H	L	M	M	C-W
6. FENITROTHION	L	M	M	L	M	L	W
7. LAMBDA-CYHALOTHRIN	M	M	L	M	M	M	D
8. MALATHION	L	L	M	L-M	L	L	C
9. TRALOMETHRIN	M	M	L	L	M	M	D

LEGEND:

NON-TARGET ORGANISMS: FISH, INVERTEBRATES (INCLUDING HONEYBEES), BIRDS, MAMMALS

BIOAC = BIO-ACCUMULATION, PERS = PERSISTENCE,

L = LOW; M = MODERATE; H = HIGH (APPLY TO TOXICITY LEVELS TO NON-TARGET ORGANISMS, BIO-ACCUMULATION AND PERSISTENCE; RELATIVE TOXICITY IS ALSO A FUNCTION OF FORMULATION AND ACTIVE INGREDIENT CONCENTRATION)

SIGNW = SIGNAL WORD: C = CAUTION; W = WARNING; D = DANGER (POISON); (APPLIES TO THE RELATIVE TOXICITY OF PESTICIDES IN ASCENDING ORDER; RELATIVE TOXICITY IS ALSO A FUNCTION OF FORMULATION AND ACTIVE INGREDIENT CONCENTRATION)

SPECIFIC DOSAGES MUST BE WORKED OUT BY HIGHLY EXPERIENCED PERSONNEL FAMILIAR WITH THE APPLICATION EQUIPMENT, PESTICIDE FORMULATION, ETC., TO BE USED. FOR ELABORATION ON THE PROPERTIES OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES, CONSULT THE PEA AND COUNTRY-SPECIFIC SUPPLEMENTARY ENVIRONMENTAL ASSESSMENTS (SEAS).

3. IT IS IMPORTANT THAT ALL PRECAUTIONS INDICATED ON THE PESTICIDE LABELS, E.G., APPLICATION DOSAGES, SAFETY MEASURES, INSTRUCTIONS ON HANDLING AND STORAGE PROCEDURES, DISPOSAL OPTIONS, ENTRY BY UNPROTECTED PERSONS INTO TREATED AREAS, EMERGENCY GUIDELINES, ETC., BE CAREFULLY OBSERVED, AS OUTLINED IN THE COUNTRY-SPECIFIC SEAS.

4. AID/W WILL KEEP MISSIONS INFORMED OF FUTURE UPDATES ON THE LIST OF A.I.D.-APPROVED ANTI-LOCUST/GRASSHOPPER PESTICIDES.
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C-Protective Measures:

1- Describe, in as much detail as possible, how are pesticide applicators being protected (i.e., protective clothing available for personnel working in pesticide operations). Is the equipment such as respirators, masks, gloves, boots and 'coverall' clothing widely used in present operations? How does the operation ensure (encourage) its use?

2- Determine if health care centers or dispensaries are located in areas where poisonings are likely to occur. Describe their current inventory of supplies of appropriate antidotes (2-PAM, pralidoxime or Atropine Sulfate, etc.).

3- Training and public safety awareness programs should be in place to allow medical personnel to recognize the symptoms of pesticide poisoning, first aid, prevention. Describe, as best as possible, the level of training of available medical personnel in the recognition of pesticide poisonings, and the application of proper treatment. Describe steps being taken to insure that medical personnel are properly trained.

4- Determine if cholinesterase testing or screening programs will be used to monitor pesticide exposure levels in people working in pesticide operations. Describe the steps that will be taken to screen out workers at higher risk of pesticide poisoning.

D-Disposal of Containers

1- Describe current procedures that will ensure the destruction and safe disposal of US-procured empty pesticide containers.

E-Training of Applicators/Users in Safe Use of Pesticides

1- Describe the current safety training program for pesticide applicators. If no program is available, please describe program plans to provide the appropriate pesticide safety training as part of the overall operation.

F-Assessment and Minimization of Exposure

USAID policy is not to allow pesticide application in environmentally fragile areas and human settlements.USAID recommends that buffer zones of 2.5 km should be established around water bodies, human settlements, and areas with endangered species or in critical habitats.

1- Based on an inventory of environmentally fragile areas in Yemen (see

attached illustrative list):

a- Determine the areas likely to be affected by current or future spray operations;

b- Describe in detail what steps are being taken to avoid damage to each of the areas at risk from pesticide applications.

2- Describe the precautionary steps used to ensure that pesticide application on populated areas, and grazing areas containing livestock are completely avoided.

3- Describe the steps being taken by the program to ensure minimum impact on non-target species and to minimize overall treated area, such as adequate prospection and surveillance.

APPENDIX C. ANALYSIS OF PEA RECOMMENDATIONS

BASIC PRE-CONDITION OF PROGRAM

1. USAID should continue its involvement in locust control. Operationally, the approach to be adopted should evolve toward Integrated Pest Management (IPM).

This recommendation should be applied in the context of the specific needs of Yemen. USAID/Yemen and FAO support use of IPM tactics in the management of locusts, as well as other insect pests. However, at the time, this SEA was being completed in November 1993, feasible IPM tactics were not sufficiently developed for use in Yemen or any other locust-afflicted country.

INVENTORY AND MAPPING PROCEDURES

2. An inventory and mapping program should be started to determine the extent and boundaries of environmentally fragile areas in Yemen.

FAO and USAID/Yemen should encourage the Government of Yemen to establish areas where pesticide use is banned or limited, and to designate such areas on official maps.

3. A system for dynamic inventory of pesticide chemical stocks should be developed.

In the past, poor pesticide management in Yemen has resulted in an accumulation of banned and degraded pesticides. Pesticides were often transported, applied, and disposed of carelessly. For the past four years GTZ and FAO have been implementing an aggressive Plant Protection project that has resulted in improvements in the system for managing pesticide. FAO and GTZ are encouraged to continue to implement this pesticide safety program and its goal of protecting human health and the environment. The establishment of a pesticide bank by EEC or FAO should be done to avoid accumulation of pesticide stocks. The GOY currently is well aware of the problem of overstocks and the GOY has even refused donations of pesticides when their stocks were adequate for relatively short-term needs.

4. USAID should take an active role in assisting host countries in identifying alternate use or disposal of pesticide stocks.

A plan for disposal of obsolete pesticide stocks is being implemented by FAO/GTZ to assist the MAWR. Additional activities should include the periodic testing of stored pesticides stocks to insure that the material is usable. The future accumulation of unwanted pesticides should be minimized. FAO should promote the establishment of a pesticide bank.

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5. FAO should be requested to establish a system for the inventory of manpower, procedures and equipment.

USAID/Yemen and USAID/W support this recommendation.

MITIGATION OF NON-TARGET PESTICIDE EFFECTS

6. There should be no pesticide applications in environmentally fragile areas and in human settlements.

Pesticides should only be procured for Yemen with the understanding that pesticides cannot be used in certain areas, such as designated wetlands, national parks, national forests, and fragile areas.

7. Pesticides should be those with the minimum impact on non-target species.

Pesticide recommendations in the PEA should be followed until research indicates that safer pesticides and nonchemical alternatives are available. The list of USAID-approved pesticides is in Appendix B. The GOY has only USAID-approved pesticides in its arsenal for locust control as of October 1993 (e.g., malathion, fenitrothion, chlorpyrifos).

8. Pre- and post-treatment monitoring and sampling of sentinel organisms,water, and soils should be carried out as an integral part of each control campaign.

This recommendation should be implemented to the extent that it is possible in Yemen. The expense of sampling and the lack of supportive infrastructure will make it difficult to implement this recommendation in Yemen. A program of research monitoring is important both as a basis for design of operational monitoring and as a means of establishing statistically verifiable base line data. In addition, periodic sampling of target and non-target mortality, population numbers, and behavior is encouraged at locations where pesticides are used. Such studies have and are being conducted, most of which are supported by USAID in Sudan, Mali, Senegal and Morocco. Many of the findings from these studies can be extrapolated to Yemen.

APPLICATION OF INSECTICIDES

9. The minimum area should be sprayed.

To minimize the area to be sprayed:

1) Emphasis should be placed on an early and vigorous surveillance program.

This allows early treatment applications and reduces the amount of pesticide used.

2) Establish economic thresholds.

3) Identify non-treatment areas and minimum treatment areas.

4) Training of decision makers should emphasize restraint in pesticide use and when it is possible, nonchemical IPM tactics.

5) Include farmers, nomads and villagers in pesticide safety training, locust survey and prospection.

10. Helicopters should be used primarily for survey to support ground and air control units.

In the flat eastern desert of Yemen, airplanes are sufficient for surveying and spraying. But in the rugged highlands it may be necessary to use helicopters. The Yemeni military frequently provides helicopters for both survey and control. Ground control is, in Yemen, the backbone of the anti-locust efforts.

11. Whenever possible, small planes should be favored over medium to large two- of four-engine transport types (for application of pesticides). In all cases, experienced contractors will be used.

This SEA supports this recommendation.

12. Any USG-funded locust control actions which provide pesticides and other commodities, or aerial or ground application services, should include technical assistance and environmental assessment expertise as an integral component of the assistance package.

This SEA agrees with this recommendation. Training should be a part of USAID assistance.

13. All pesticide containers should be appropriately labeled.

This SEA agrees with this recommendation. Pesticides for locust control in Yemen are labeled in English and, in some cases, Arabic.

DISPOSAL OF PESTICIDES

14. USAID should provide assistance to host governments in disposing of empty pesticide containers and pesticides that are obsolete or no longer useable for the

purpose intended.

USAID and FAO have developed guidelines on disposal programs for unwanted pesticides and empty containers. Several pilot disposal projects have been implemented. The GOY should follow such disposal guidance. Disposing of empty pesticide barrels properly is especially important. The GOY has issued its own guidelines for pesticide management, including the proper method for destruction of pesticide drums.

PUBLIC HEALTH AWARENESS

15. USAID should support the design,reproduction, and presentation of public education materials on pesticide safety.

USAID supports this recommendation and encourages FAO/GTZ to continue their cooperative effort with MAWR to develop public and applicator education materials on pesticide safety, pesticide poisoning recognition, avoidance, and treatment. These materials could be used in "Train the Trainer" programs, and in village training courses.

16. Training courses should be designed and developed for health personnel in areas where pesticides are used frequently.

This SEA supports this recommendation and advocates collaboration between concerned ministries in health and safety training programs. The Department of Plant Protection has devised a manual for pesticide poisoning diagnosis and treatment and has distributed it to health offices. Antidotes in Yemen are also available and stocks thereof should be maintained.

17. Each health center should be provided with posters describing diagnosis and treatment of pesticide poisonings, as well as medicines and antidotes required for treatment of poisoning cases.

This SEA supports this recommendation.

18. Presently available tests for monitoring human exposure to pesticides should be implemented in the field.

This SEA supports the need to monitor the health of pesticide applicators and handlers during control operations, especially the use of cholinesterase testing which is presently practiced in Yemen.

PESTICIDE FORMULATION AND MANAGEMENT

19. Specifications for USAID purchase of locust insecticides should be adapted for all insecticides.

This is an USAID/W activity that should be implemented through a revision of USAID's Pest Management Guidelines. No Yemen-specific recommendation is included in this SEA.

20. Pesticide container specifications should be developed.

This is an USAID/W activity that has been implemented by the development of USAID's Pest and Pesticide Management Guidelines.

BIOLOGICAL CONTROL

21. Beauvaria and other biological control agents such as plant extracts should be field tested under African and Asian conditions in priority countries.

USAID currently supports research on biological control in Africa. FAO is encouraged to continue its support of local research on parasites, pathogens, and predators of locusts. USAID's AELGA Project has also supported research on NEEM extract and is currently looking into the potential use of sesame extract in Eritrea.

TRAINING

22. A comprehensive training program should be developed for USAID Mission personnel who have responsibility for control operations.

USAID supports this PEA recommendation.

23. Local programs of training should be instituted for pesticide storage, management, environmental monitoring and public health (see Recommendation 16).

This SEA support this recommendation, and recommends that high priority be given by donor agencies to provide Yemen with training on safe use of pesticides.

24. When technical assistance teams are provided, they should be given short-term intensive technical training (including language if necessary) and some background in the use and availability of training aids.

This SEA supports this recommendation as an USAID/W activity.

ECONOMICS

25. Field research should be carried out to generate badly needed economic data on a country-by-country by basis.

This SEA supports this recommendation. Implementation in Yemen should begin with agricultural productivity analysis.

26. No pesticides should be applied unless the provisional economic threshold of locusts is exceeded.

Research should be conducted in Yemen and other countries in the region to establish an economic threshold for the desert locust. No such threshold has been developed for locusts. In the case of swarms of locusts descending on croplands, the concept of an economic threshold is likely to be irrelevent.

27. USAID should provide assistance to host countries in drawing up regulations on registration and management of pesticides and in drafting environmental policy.

This SEA supports this recommendation. USAID, USEPA and FAO have developed programs to assist developing countries with drafting pesticide regulations and policies. The Ministry of Agriculture in Yemen has developed guidelines and regulations on pesticide use, pesticide importation and sale of pesticides.

PESTICIDE USE POLICY

28. A pesticide use inventory covering all treatments in both agricultural and health programs should be developed, on a country-by-country basis.

This SEA supports this recommendation and considers this to be a topic appropriate for GOY action. In addition, MAWR should continue keeping an up-to-date, accurate inventory of all of their pesticides. This inventory should be made available to any donor agencies upon request.

PESTICIDE HANDBOOK

29. USAID should produce a regularly updated pesticide handbook for use by its staff.

USAID/W has produced two such handbooks, which are regularly up-dated: *Integrated Pest Management and Pesticide Management* and *Pest Management Guidelines of the Agency for International Development*. This SEA supports the continued up-dating of these handbooks.

SUPPORT AND TRAINING

30. Technical assistance, education and training, and equipment should be provided to crop protection services of host countries with a view to making the services eventually self-sustaining.

This SEA supports this recommendation, but the actual needs of MAWR should be thoroughly assessed by FAO before providing assistance. "Train the Trainer" programs for farmers, medical personnel, and livestock herders are a potentially valuable contribution that FAO can make in Yemen.

STORAGE

31. More pesticide storage facilities should be built. Until that occurs, emergency supplies should be stored in the United States.

Establish a pesticide bank run by the United Nations to reduce the need for on-site storage and disposal of pesticides. The Department of Plant Protecion is requesting the construction of pesticide storage facilities located away from populated areas.

FORECASTING

32. USAID should make the decision whether to continue funding forecasting and remote sensing or to use FAO's early warning program.

This SEA is in favor of continuing and improving forecasting as an FAO activity. Donor agencies should support, thorough field research programs, studies of the ecology of outbreak areas in northeastern Africa and Arabia, so that plagues can be predicted with greater accuracy.

28

PUBLIC HEALTH MONITORING AND STUDY

33. A series of epidemiological case-control studies, within the countries involved in locust control, should be implemented in areas of heavy human exposure to pesticides.

While this is an appropriate activity for FAO or the World Health Organization, the current activity lacks the necessary funds and expertise to implement this recommendation.

RESEARCH

34. Applied research should be carried out on the efficacy of various pesticides and insect growth retardants, as well as pesticide application.

USAID supports this recommendation.

35. Applied research should be carried out on the use of plant extracts as anti-feedants.

USAID supports this recommendation and has and will continue to explore the potential of plant extracts for locust control.

36. Research should be carried out to determine the best techniques for assessing the environmental impact of organophosphates used for locust control.

This research is an appropriate activity for donor agency funding. USAID has funded and continues to fund such research in Mali, Sudan, Morocco and Senegal.

ENHANCING AND ACCELERATING IMPLEMENTATION

37. USAID/W should provide guidance in locust control to missions in the field.

This SEA supports this recommendation and considers that the current *Locust/Grasshopper Management: Operations Manual* is a useful guidance tool USAID/Yemen. The AELGA Project is also expressly designed for this purpose.

38. Detailed guidelines should be developed for USAID to promote common approaches to locust control and safe pesticide use among UN agencies and donor nations. Coordination of efforts is becoming increasingly important because of the increasing number and magnitude of multilateral agreements and follow up efforts in subsequent years by various donors.

This SEA supports this recommendation. The guidelines should include information on forming and training crop protection brigades. International cooperation must continue and should be strengthened. Suggestions that each country should only be concerned with their own locust problems are short-sighted. Nations that host breeding areas should not be expected to bear the entire burden of plague prevention. It is in the best interest of all nations effected by plagues to pool their resources in the campaign against locusts as an insurance policy. It is also in the best interest of donor agencies to coordinate their efforts so that assistance is used as effectively as possible.