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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

DOMINICAN REPUBLIC

PROJECT PAPER

VECTOR CONTROL

AID/LAC/P-337

Project Number:517-0235

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: ____

DOCUMENT CODE: 3

COUNTRY/ENTITY: Dominican Republic: University of South Carolina

3. PROJECT NUMBER: 517-0235

4. BUREAU/OFFICE: Latin America and the Caribbean — 05

5. PROJECT TITLE (maximum 40 characters): VECTOR CONTROL

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 89

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 86 B. Quarter 4 C. Final FY 88

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 87 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(734)	(–)	(734)	(1,490)	(10)	(1,500)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country	118	–	118			
Other Donor(s)					500	500
TOTALS	852	–	852	1,490	510	2,000

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) HN	510-B	542		–	–	1,000	–	1,500	–
(2)									
(3)									
(4)									
TOTALS				–	–	1,000	–	1,500	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 963

11. SECONDARY PURPOSE CODE:

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	R/H	ENV	TECH				
B. Amount	474	325	531				

13. PROJECT PURPOSE (maximum 480 characters)

To establish an institutional capacity in the Dominican Republic to research and test a limited number of ecologically sound, low cost, effective interventions in vector-borne disease control, specifically for malaria and dengue.

14. SCHEDULED EVALUATIONS: Interim MM 02 YY 88; MM ___ YY ___; Final MM 09 YY 89

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [X] Local [ ] Other (Specify) ____

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment)

Approval of Methods of Implementation and Financing: Tom Bebout

Tom G. Bebout, Controller

17. APPROVED BY

Signature: [signature]

Title: Mission Director, USAID/Dominican Republic

Date Signed: MM 12 DD 18 YY 86

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 12 DD 17 YY 86

PROJECT AUTHORIZATION

NAME OF ENTITY:	University of South Carolina
NAME OF COUNTRY:	Dominican Republic
NAME OF PROJECT:	Vector Control
NUMBER OF PROJECT:	517-0235

1. Pursuant to Section 104 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Vector Control Project for the Dominican Republic involving planned obligations of not to exceed One Million Five Hundred Thousand United States Dollars ($1,500,000) in grant funds over two years from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is three years from the date of initial obligation.

2. The project will address the problem of controlling vector-borne diseases by developing and testing ecologically sound interventions to control mosquito vectors and establishing the institutional capacity for applied research. To this end the project will provide participant training, technical and commodity assistance through the University of South Carolina to the National Malaria Eradication Service and the Universidad Católica Madre y Maestra.

3. The Project Agreement which may be negotiated and executed by the Officers to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms, covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities or services financed by A.I.D. under the Project shall have their source and origin in the United States or the Dominican Republic, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have the United States or the Dominican Republic as their place of nationality, except as A.I.D. may otherwise agree in writing.

Ocean shipping, financed by A.I.D. under the Project, shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Conditions Precedent to Disbursement

(1) First Disbursement. Prior to the disbursement of any funds under the Project, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Recipient shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.: evidence that the University of South Carolina has entered into Letters of Agreement with the National Malaria Eradication Service (SNEM) and the Universidad Católica Madre y Maestra (UCMM) that delineates the respective roles, responsibilities and contribution of SNEM and UCMM in project implementation.

(2) Subsequent Disbursement. Within ninety (90) days of the initiation of the Project activities the Recipient will, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D. an Action Plan for the period ending September 30, 1987. This plan shall cover both the dengue and malaria control activities. The plan will be updated annually.

Henry H. Bassford
Director
USAID/Dominican Republic

8/22/86
Date

DOMINICAN REPUBLIC
PROJECT PAPER

VECTOR CONTROL
(Project No. 517-0235)

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LIST OF ACRONYMS

EPA	Environmental Protection Agency
GDP	Gross Domestic Product
GODR	Government of Dominican Republic
IEE	Initial Environmental Examination
LOP	Life of Project
MDA	Mass Drug Administration
MPH	Master's Degree in Public Health
OP	Organophosporus (class of insecticide)
PAHO	Pan American Health Organization
PCD	Passive Case Detection
PHC	Primary Health Care
SESPAS	Secretaría de Estado de Salud Pública y Asistencia Social
SNEM	Servicio Nacional de Erradicación de la Malaria
SPR	Slide Positivity Rate
UCMM	Universidad Católica Madre y Maestra
ULV	Ultra Low Volume
USC	University of South Carolina
USAID/DR	U.S. Agency for International Development in the Dominican Republic
VC	Volunteer Collaborator
WDP	Water Disposable Powder
WHO	World Health Organization

I. PROJECT BACKGROUND AND RATIONALE

A. The Problem

1. Background

Several communicable diseases endemic to the Dominican Republic (D.R.) repeatedly infect large portions of the population, causing human suffering, expenditure of scarce health care resources and economic loss to employees and employers alike due to loss of wages and productive work days. These diseases include malaria, dengue, schistosomiasis and filariasis, all of which are vector-borne, so-called because their transmission depends on an intermediate host -- mosquitoes-- that carry malaria, dengue and filariasis, and snails that carry schistosomiasis. In the D.R., mosquito-borne diseases are a major concern and hence are the focus of this project. Each requires its own specialized form of diagnosis, treatment and follow up to control the future spread of the disease. Three of these diseases have the potential of becoming fatal; two, falciparum malaria and dengue (hemorrhagic form), are of major concern to the D.R. If falciparum malaria or dengue reach epidemic proportions, they could cause considerable economic damage to the country by reducing productivity and threatening the tourism industry which, as of mid-1985, provides approximately 40% of the country's foreign exchange earnings. Furthermore, the USAID-supported efforts to expand agribusiness by increasing exports of fresh and processed commodities for foreign markets and establishing new industries to meet the needs of domestic consumers all involve increased irrigation and other man-made water sources which, in turn, heighten the potential for the spread of vector-borne diseases.

2. Historical and Current Conditions of Malaria and Dengue in the Dominican Republic

a. Malaria

As in many countries, malaria control efforts in the D.R. have, for the past two decades, displayed a cycle of achievements and setbacks. Malaria control efforts in the 1960s were so successful that complete control was considered imminent; only 21 cases of malaria were reported in 1968. This early success was largely due to the intensive application of DDT and other pesticides, which at that time were new and particularly effective. These pesticides were used to reduce the population of Anopheles mosquitos, the vector involved in the transmission of malaria. The temporary success in disease control promoted a false sense of security and resulted in sharp reductions in DDT spraying and a lack of concern about conducting research into alternative methods of control. However, evidence of resistance to pesticides by disease-carrying vectors began to be reported in many countries and some areas of the D.R. As control efforts were relaxed,

the incidence of malaria and other vector-borne diseases began to rise. From a low of 21 cases in 1968, the reported incidence of malaria in the Dominican Republic rose to 4,780 cases in 1980, as shown in Table I.

Table I
Cases of Malaria Reported in Dominican Republic
1976-1985

Year	No.Cases
1976	586
1977	745
1978	1,531
1979	3,080
1980	4,780
1981	3,596
1982	4,654
1983	3,801
1984	2,370
1985	816

Source: SNEM.

Marked fluctuations characterize the incidence of malaria in the D.R. The Director of the Servicio Nacional de la Erradicación de la Malaria (SNEM) explained the malaria buildup as follows: "The higher numbers of reported cases from 1979 to 1982 can be attributed to the deficiency in logistical resources and funding, the lack of activity in vector control, the low emphasis placed on case detection and the immigration of people from regions with high prevalence of malaria." In addition, SNEM has never been equipped with the appropiate technology and trained personnel required to test and implement new vector controls in the field, which are integral parts of any comprehensive vector control program.

The reduction in reported cases from 4,780 in 1980 to 816 in 1985 was, primarily, a result of the resumption in the use of residual insecticide. The reduction in reported cases may also have partially resulted from a one-time massive distribution of a therapeutic drug combination. In any case, as a result of the reduction in cases by 1985, the malaria program is considered to have reached a case-containment mode, which is an ideal time to test the application of certain vector control measures to further reduce the number of cases. As has been shown in the exhaustive studies done in Panama from 1930 to 1940, and more recent experiences in Nicaragua and Africa, the results of mass drug administration campaigns are short-lived if they are not

followed by comprehensive vector control measures. Moreover, malaria programs that rely extensively on DDT run the risk of creating resistance in the vectors to say nothing of other forms of contamination.

Haiti shares the island of Hispaniola with the D.R. and its population has a far higher incidence of malaria than that of the D.R. The slide positivity rate for Haitians in the D.R. is about 250% of that among Dominicans. A significant source of malaria in the D.R. is Haitians who up until 1986, had been contracted to work in the D.R. during the annual sugar cane harvest. Legally contracted laborers were usually given a treatment for malaria at the time of entry into the D.R., but those who entered the country informally received no such treatment.

b. Dengue

Dengue is a viral disease transmitted by the *Aedes aegypti* mosquito. Dengue epidemics are common throughout the Caribbean and may occur in a dangerous form known as dengue hemorrhagic fever (DHF). DHF first appeared in epidemic proportions among children in the Philippines in 1954. Since then, it has spread to many other countries and has recently been reported in the Caribbean area. As of 1985, all four serotypes of dengue had been found in the D.R.

Among a sample of 2,314 households inspected in Santo Domingo in 1984, 740 were positive for *Ae. aegypti*. Recently, a team from the University of South Carolina's International Center for Public Health Research conducted a preliminary survey in Santo Domingo and found approximately 99% of the houses inspected positive for *Ae. aegypti*. Fifty-five gallon water storage drums located both inside and outside the homes were the principal source of *Ae. aegypti* breeding, and most houses maintained at least 2 of these containers. Levels of production in the drums ranged from fewer than 100 larvae to several thousand per drum, which indicated that these households had exceedingly high breeding densities. The high mosquito population levels and the abundant vector-human contact resulting from the lack of glass windows or screens create a major potential for a dengue epidemic in the D.R.

The GODR recognizes the seriousness of the spread of malaria and dengue in the country. In addition to regular control programs, the Central Bank collaborated with the Secretariat of Tourism in 1983 by contracting with SNEM to institute ultra low volume (ULV) spraying campaigns on the north coast in areas surrounding the major tourist centers. This use of ULV spraying is continuing in 1986, and has been extended to cover focal areas along the Haitian border. Additionally, in 1986, the Secretariat of Public Health and Social Assistance (SESPAS) plans to mount a program to reduce the sources of the *Ae. aegypti* in the city of Santo Domingo. Nevertheless, the institutional resources and current technology in the D.R. are insufficient to have a major impact on the control and reduction of these two harmful diseases. The Secretary of Health recognizes that the long term solution to reducing the incidence of malaria and dengue will

come from the introduction of inexpensive, cost-effective, and ecologically sound vector control methods that can be applied by existing field personnel and supported with approximately the same level of budgetary resources that are currently available.

B. Constraints to More Effective Vector Control

The constraints to a more effective vector control program in the D.R. are summarized below.

1. Lack of Appropriate Technology

The techniques that have been used thus far to reduce malaria in the D.R. are case finding, reporting, treatment with anti-malaria drugs and intradomiciliary spraying. Attention has also been paid to the control of mosquito breeding areas. Of these techniques, residual spraying with DDT or malathion has played the most important role in reducing the number of cases; however, this intervention is expensive, requires considerable logistical support to mount periodic spraying campaigns and runs the risk of creating mosquito resistance to the residual insecticide employed. While it is appropriate to apply residual insecticides under certain circumstances, alternative ecologically sound control practices that are low cost and can be applied with the existing manpower and financial resources of SNEM should be considered in addition to routine mosquito control.

Although SNEM has been operating the malaria control program in the D.R. for more than 20 years, data on vector bionomics, resistance to pesticides, vector behavior patterns, transmission potential and vector concentrations is incomplete. There is no ongoing effort in operations research, evaluation of control programs or development of alternate methods of vector control.

2. Lack of Trained Personnel

The D.R. lacks a core group of professionals who can conduct vector control operations research projects, apply their findings in small scale field trials, and then support large scale replication in order to introduce effective, low cost vector control techniques. Few Dominicans have been trained in medical entomology, vector control operations research, evaluation of the impact and effectiveness of vector control methods and implementation of vector control programs in private agriculture.

3. Lack of Physical and Institutional Infrastructure for a Comprehensive Vector Control Program

Aside from the technology and basic equipment used to apply residual insecticides, the Dominican Government and private research facilities lack the updated equipment, microscopes, and data

management capability needed to research and field test vector control methodologies for malaria and dengue. Also, despite SNEM's remarkable vehicle repair effort, funds for spare parts and tools are short, and there is no vehicle replacement policy. New and improved equipment is needed to develop the nation's capacity to carry out basic applications and evaluation of vector control techniques.

At an institutional level, there is a lack of communication between vector control specialists and personnel in agriculture, tourism and other sectors where vector-borne diseases have a negative impact. Information that is available to one sector is not shared with personnel in other sectors.

C. GODR Support for Vector Control Programs

In discussions with the Project Development Team, GODR Health officials identified the control of malaria and dengue as a priority health consideration for the country from both social and economic points of view. They support the search for alternative, cost-effective and efficient methodologies to control these diseases and consider the operational research activities of this project to be urgently required.

1. SNEM

According to its Health Strategy for 1983-1986, SESPAS supports malaria eradication through epidemiological surveillance and by controlling mosquito vectors. Although SNEM plays an important role in the implementation of the SESPAS malaria eradication strategy, it receives relatively little financial support. In each of the last five years, SNEM received an average of RD$1.4 million. However, although the SNEM budget for 1985 rose to RD$1.6 million, the unification of the official and parallel rates of foreign exchange in January 1985 reduced the value of the Dominican peso against foreign currencies. Thus, SNEM's ability to buy imported commodities is below the 1984 level.

Most of SNEM's budget goes to cover routine operating costs, including the payment of salaries and maintenance of vehicles and spraying equipment, most of which is old and overdue for replacement. The budget allocation in recent years has not permitted the purchase of pesticides that had been used in the past in large scale home-spraying programs. However, in 1984 and 1985, SNEM received RD$800,000 in PL-480 Title I local currency funds and was able to conduct a large scale home-spraying program in that year which resulted in the low number of cases reported in 1985.

2. INFRATUR

The Central Bank's Department for the Development of Tourism Infrastructure (INFRATUR) finances a mosquito control program, under which SNEM has been contracted to conduct ultra low volume spraying

around the major tourist centers on the north coast and focal areas along the Haitian border. Funding for this service is in the order of US$5,000-US$6,500 per quarter. Individual hotels also conduct various kinds of pest control activities.

D. Other AID and Donor Activities

The only other international donor that has provided assistance to vector control programs in the D.R. has been the Pan American Health Organization (PAHO). PAHO considers malaria and dengue control to be priority health activities in the D.R. Over the past five years, PAHO has financed technical assistance, local seminars and training courses, and international observational visits.

The Project Development Team held two interviews with PAHO in Santo Domingo and discussions with PAHO/Washington. Budget projections at both PAHO offices included funding support for training of Dominicans in malaria and dengue control. This has been taken into consideration in the design of this project.

Another institution involved in vector control in the D.R. is the University of South Carolina (USC). In 1984, USC conducted a workshop in the D.R. in which up-dated vector control techniques potentially applicable to the D.R. were presented. This event was followed by short-term training of key SESPAS staff at USC's International Center for Public Health Research.

Activities under the USAID's Health Systems Management Project (No. 517-0153) will complement those to be carried out under this project. The Health Systems Management Project aims to provide SESPAS with the capacity to monitor the country for increased incidence of dengue. The major implementing agencies are SNEM, the Division of Epidemiology of SESPAS and the National Laboratory.

E. Relationship to AID Policy and USAID Strategy

The activities to be undertaken under the proposed project will address the constraints outlined above and will not duplicate other vector control activities. In addition, the project is consistent with A.I.D. health policy and its specific policy on malaria. According to the Health Sector Policy Paper (May, 1984, page 4):

> "Where malaria constitutes a major public health problem, A.I.D. will assist countries in the planning and management of a locally appropriate mix of control measures including vector control, chemotherapy and chemoprophylaxis and integration of malaria control activities with other primary health care services."

In addition to A.I.D.'s role in transfering malaria control technology, the Sector Paper states that training, commodity procurement, applied field research and health education are appropriate components of a health strategy that aims to strengthen human resources and institutional capability.

This project is also in accord with A.I.D.'s Policy Guidance on Malaria Control approved in July 1984 by the Administrator. This policy urges the support of operational research for malaria control, in order to develop cost effective alternative methodologies for use in field programs.

Further, the proposed project is consistent with the USAID's overall development stategy as stated in the FY 1986-91 CDSS, which is to assist in developing sustained and equitably distributed economic growth in the Dominican Republic. More specifically, the USAID objective in the areas of health and population, as indicated in the FY-1987/88 Action Plan, is to improve access to needed health care and family planning services by reinforcing the private sector's capacity to meet these needs. The activities to be carried out to achieve the strategic objectives in the health area include the development of the nation's capacity to monitor vector-borne diseasesand the introduction of improved techniques of vector control, among others.

The proposed project helps to meet the objectives laid out in the CDSS and the activities described in the Action Plan. The introduction of improved techniques and cost effective methods of controlling malaria and dengue vectors will improve the health of people who live in areas where these diseases are endemic. Moreover, by reducing the incidence of malaria and dengue, the threat of these diseases causing damage to agriculture and tourism will be minimized. These two industries are key to the reactivation of the Dominican economy.

II. PROJECT DESCRIPTION

A. Goal and Purpose

The goal of this project is to promote a healthier living environment in the D.R. by improving the nation's ability to reduce the incidence of vector- borne diseases. The project will also support the nation's efforts to expand tourism and agribusiness, which makes it particularly timely. Tourism has recently become a significant factor in the Dominican economy and would be adversely effected by an outbreak of malaria or dengue; also the planned expansion of the nation's agricultural base will lead to an increased use of irrigation, which could result in an increased incidence of "man-made malaria" if left unchecked.

The purpose of the project is to establish an institutional capacity in the D.R. to research and test a limited number of ecologically sound, low-cost, effective interventions in vector-borne disease control, specifically for malaria and dengue.

B. Project Description

1. Overview

The project will be carried out over three years. During this time, basic entomological data will be collected and evaluated and at least six interventions for mosquito vector reduction will be pilot-tested. Of the six interventions selected for pilot-testing, three will be aimed at malaria control and three at the control of the dengue vector. These will be evaluated from technical, economic, social acceptance, operational and management points of view, and applied in the field in the D.R. to determine their potential as alternatives or supplements to the control activities currently practiced by SNEM. The project will enable the nation to develop a program that utilizes the most cost-effective and ecologically sound vector control methods. In addition, the project will develop vector control interventions that can be applied in the field by existing personnel and can be sustained with existing levels of GODR budgetary support.

2. Implementing Institutions

To establish the institutional capacity in the D.R. to research and test ecologically sound, low-cost, effective interventions in vector-borne disease control, two host country institutions with some expertise in operational research and field application of vector control techniques were identified. One of these institutions, SNEM which has worked in vector control in the Dominican Republic for 22 years, is the only national institution responsible for controlling malaria. SNEM's participation in the project is important because its human resources can be trained and equipped to field test alternative vector control techniques. Also, once SNEM is able to test and apply new vector control techniques, it can apply them throughout the country. Nevertheless, SNEM does not have enough professional staff to conduct operations research. Therefore, a second host country institution, the Universidad Católica Madre y Maestra (UCMM), will also participate in this project. UCMM has the capability to conduct operations research to identify successful vector control interventions. Although SNEM and UCMM provide a basis for developing an institutional capacity in the D.R. they require strengthening and a cooperative structure that enables them to work together.

The International Center for Public Health Research (the Center) of the University of South Carolina (USC) is an ideal institution to help strengthen these institutions and coordinate their activities under the project. The Center is one of the few institutions of higher

learning in the U.S. that has a program specifically designed to provide comprehensive approaches to vector-borne disease control for practicing professionals in developing countries and to conduct research into alternative methods of vector control. While other universities such as Tulane, Yale, John Hopkins, and California provide graduate education in parasitology, medical entomology and other aspects of tropical epidemiology, they do not have the focus on comprehensive approaches, studied and taught at the practitioner level that USC offers. The university has a strong interest in the development problems of the D.R. and has conducted its own studies of vector-borne diseases and control problems in the D.R. On the basis of these capabilities, USAID/DR has selected the USC to manage the project and will enter into a Cooperative Agreement with USC for this purpose. This approach has been approved by the Latin America and the Caribbean Bureau of AID/W which concurred with Mission selection of USC as the assistance recipient (See State cable 215122 attached as Annex D.)

A Project Advisory Committee will also be established. It will be composed of representatives of USC, UCMM, and SNEM. The USAID Project Officer will serve as an Ex Oficio member. The Committee will oversee project implementation and decide on implementation issues.

USC will identify a long-term resident advisor who will be the Project Coordinator and a member of the Advisory Committee. The Coordinator will provide technical support and guidance to the Advisory Committee, and develop project guidelines, implementation plans and schedules. In addition, s/he will have the following functions:

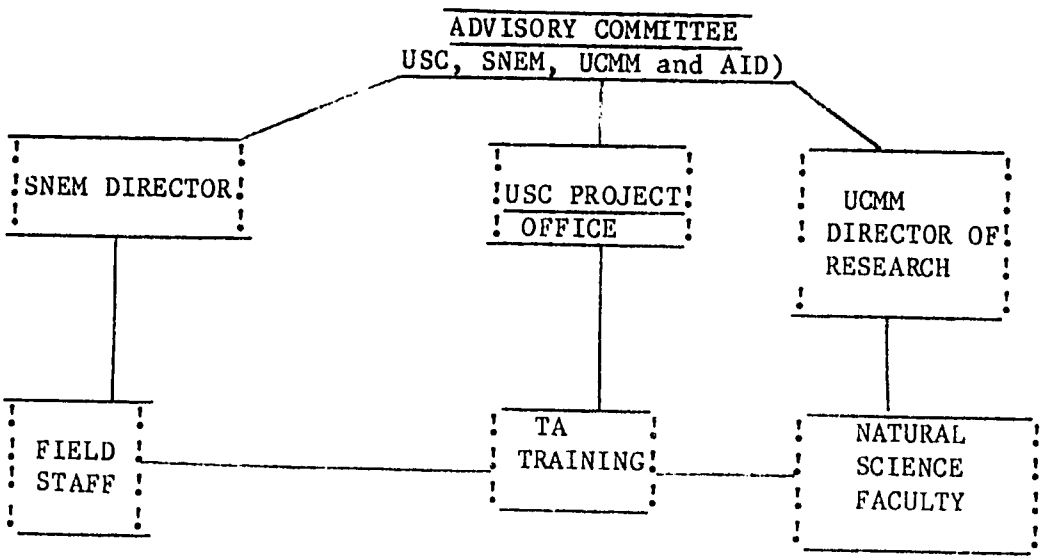
- Manage the project office, initiate and maintain communications, supervise the ordering of supplies, approve payment for authorized expenditures, establish vehicle control and ensure maintenance of project equipment;

- Provide logistical and support services to short-term consultants;

- Coordinate the implementation of all project activities; and

- Act as the primary liaison between SNEM, UCMM, PAHO, AID, and other relevant GODR agencies such as Agriculture and Tourism.

The following diagram illustrates the relationships among the institutions involved in project implementation:



To formalize the relationships and responsibilities of all the parties, USC will sign Letters of Agreement with SNEM and UCMM, which will also describe the financial arrangements and the use and ultimate destination of project property.

3. Project Components

There will be three basic components carried out under the project: the collection of baseline data; research into control techniques; and field testing of selected control techniques.

a. Baseline Data Collection

Baseline data will be collected on the mosquito vectors of dengue and malaria in preselected areas where rates of disease incidence are highest. The Project team will identify vectors, population levels, baseline levels of insecticide resistance or avoidance, transmission rates, and time and place of contact between human and vector. It will also make a preliminary assessment of breeding sources and identify areas for evaluation of new control interventions. Periodic surveys will be conducted in the same areas throughout the LOP to detect any change in the mosquito population.

b. Research in Control Techniques

A variety of vector control techniques will be selected and researched under the project. Initially, vector control interventions will be preselected at USC, based on their applicability to conditions identified in the baseline studies. The Project team will then test these methods in at least three of the regions where baseline surveys have been conducted and are continuing. Test areas will be selected based primarily on the presence of high levels of disease transmission and the diversity of

ecological conditions and mosquito producing habitats. To test the effectiveness of the interventions, after applying each control technique, mosquito populations will be compared with pre-test populations in the same area and in control areas. Examples of interventions to be tested under the project are:

- Introduction of small fish into water storage barrels. These fish eat the larvae of mosquitoes.
- Introduction of a cannibalistic mosquito that does not bite man but whose larvae consume the larvae of the *Aedes aegypti* mosquito.
- Destruction of mosquito breeding sites, by adding chemicals to ponds and irrigated fields. These chemicals kill mosquito larvae but are not harmful to man.
- Increasing the effectiveness of spraying by utilizing optimum spray sites, mix concentrations and spraying time, which will be determined through research into the biting habits of mosquitos.

Each intervention will be evaluated to determine if it could feasibly be applied on a large scale by SNEM personnel. Standard evaluation criteria to be used include effectiveness in eliminating the vector, duration of the effect, cost, ease of application, duration and effect on non-target organisms.

c. Field Testing of Selected Alternative Control Methodologies

Interventions that meet the field application criteria described above will be field tested by SNEM personnel (with guidance from USC and UCMM) to determine if it is feasible to apply them on a large scale in the malarious areas of the D.R.

4. Project Phases

a. Summary

This project will be implemented in four phases. During Phase One (Project Start-Up, Months 0-3), USC will establish the project office at UCMM in Santiago, select and bring on board the Project Coordinator and develop working relationships with UCMM and SNEM. During Phase Two (Baseline Data Collection, Months 4-9), the project team, composed of researchers from USC, faculty from UCMM and staff from SNEM, will collect baseline data. During Phase Three (Operational Research, Months 10-30) operations research will be conducted to assess a variety of vector control interventions. During Phase Four (Field Test Applications and Final Evaluation, Months 16-36), SNEM staff will be trained in the field application of the vector control interventions identified in Phase Three. This phase concludes with an evaluation of each intervention and a selection of interventions recommended for national application.

b. Start-Up Phase

During the first 3 months of the project, USC will select the long-term resident advisor (the Project Coordinator), who will establish the project office at the UCMM site in Santiago. The Coordinator, senior representatives of UCMM and the Director of SNEM will establish the project's Advisory Committee, and USC will sign the Letters of Agreement with SNEM and UCMM.

In consultation with the Advisory Committee, the Project Coordinator will prepare updated schedules for training, procurement and short-term technical assistance. The first of three major procurements to be made during the LOP will be completed. Laboratory facilities at UCMM will be prepared for the arrival of equipment. The first of seven participants will attend a six week Comprehensive Vector Control course at USC.

During this phase, test sites for malaria research will be selected. SNEM has already identified five principal malarious areas in the provinces of Elías Piña, Pedernales, La Altagracia, Dajabón and Independencia. These areas will be evaluated by a preliminary team of short-term advisors during the second and third months of the project. The advisors will be specialists in the fields of insecticidal resistance, behavior modification, sporozoite detection and mosquito bionomics. They will be assisted by project staff from UCMM and SNEM.

A variety of entomological factors will be evaluated at the potential test sites, including identification of vector population levels, baseline levels of insecticide resistance or avoidance, transmission rates, time and place of vector-human contact and preliminary assessment of breeding sources. Four test areas will be selected for malaria research, based on such factors as high incidence of malaria and corresponding high anopheline density; a representative sample of the human population; a location which presents a minimum of logistic problems and where selected interventions can be applied. Preferably, each area would also be located near a SNEM regional office.

The assessment team will spend approximately 1.5 weeks at each of the four selected problem areas to acquire this initial data. It is estimated that a least four additional weeks will be required to process the information obtained.

Studies on *Aedes aegypti*, the mosquito involved in the transmission of dengue, will be conducted at the same sites as those identified for malaria research. Also, several urban sites will be investigated to identify additional test sites for *Aedes aegypti* studies.

c. Baseline Data Collection Phase

During months 4-9 of the project, the Project Coordinator will assist SNEM in establishing a field laboratory and assist UCMM in installing a research laboratory. The second procurement will be issued and

two of the three candidates for long term training will enter the English Language Training course offered at the ICDA in Santo Domingo (the third candidate already speaks English.) One of the English language trainees will enter the course in November 1986 and the other will attend the March 1987 course. In May 1987, key UCMM and SNEM staff will attend a three-week observational study tour in the U.S. or Latin America.

On the research front, project staff will begin gathering baseline data at the four test sites identified during Phase One. Research teams will conduct biting collections using standard procedures. Also DDT resistance will be evaluated using biochemical field test kits. Inspected mosquitoes with sporozoites in salivary glands will be studied to evaluate the transmission potential of the vector population. To determine how long vectors remain in dwellings and, therefore, the potential exposure to residual insecticide, bionomic investigations will be conducted using information from the biting collections and fluorescent marking of indoor mosquito populations. Finally, the breeding habitats of vector mosquitoes will be identified and assessed.

In addition, the following studies will be conducted to gather baseline data on Aedes aegypti habitat, production and distribution:

1. Identification and typing of breeding containers in selected study areas.

2. Determination of mosquito productivity in each type of container.

3. Determination of adult mosquito populations in study area utilizing landing rate counts.

After the initial baseline data is gathered, additional data will be gathered continuously until the 35th month of the project. Since vector control interventions will be carried out at these sites, changes in data will reflect the effectiveness of the interventions.

d. Operational Research Phase

During months 10-30 of the project, the final major procurement will be issued and all three-long term training candidates will begin their studies at USC. Also, six more persons will attend the Comprehensive Vector Control course offered at USC, and fourteen short-term in-country courses, covering such topics as malariology, vector control interventions, data collection and community health education, will be offered.

In terms of operations research, project staff will focus on identifying the most effective single or combination of interventions to control the production of malaria and dengue vectors in the D.R. These interventions will enable the nation to minimize problems of pesticide contamination on the environment, vector resistance and the importation of high cost chemicals.

Major emphasis will be placed on the use of biological control agents. Effective mosquito control materials will be selected using information gained from testing that is currently underway at the Center. Materials that are selected following initial screening at the Center will be pilot-tested in the D.R. The selection of areas in which to test control methods will be based upon the presence of high levels of malaria transmission, logistical considerations and the diversity of ecological conditions or mosquito producing habitats, such as flowing or standing water and swamps or marshes. Priority areas will include irrigated agriculture lands and areas of concentrated tourist activity.

To evaluate larvicidal materials, three sites of approximately two hectares each will be treated by hand spray with each of the candidate compounds. Effectiveness of the materials will be assessed by sampling mosquito populations and comparing these to natural populations in similar untreated control areas. Cost, ease of application, duration, effectiveness, and effect on non-target organisms will be considered in the evaluation of the candidate compounds. Materials showing the greatest promise will be operationally tested in other areas by SNEM (during Phase Four-Field Application) to confirm their potential.

Special attention will be given to evaluating control methods that focus on vector life stages. One such method, source reduction and/or habitat modification, could entail the draining, filling or removal of vegetation from mosquito breeding areas. This type of control, where applicable, is effective and over the long-term more economical than the continuous use of chemicals. Also, this approach avoids the adverse effects of pesticide contamination of the environment.

Studies will also be conducted to examine how a variety of methods can be used in combination to obtain a satisfactory reduction in vector populations. When promising biological materials have been identified, they will be tested in combination with various species of herbivorous and larvivorous fish.

In addition to the activities described thus far, five areas of approximately 100 hectares each will be selected for conducting *Aedes aegypti* operations research. Baseline data will be acquired by selecting five areas at random and then counting the number and type of mosquito breeding containers.

Following the acquisition of baseline data, two mosquito eating fish will be introduced into each breeding container in the first area. After a stabilization period, correlations of productivity and mosquito adult densities will be made following the same procedures used in baseline data acquisition. Over the course of the project, exposure to dengue virus in this area will be compared to exposure rates in the control area. Population monitoring of both *Aedes aegypti* and fish will continue throughout the project and the effectiveness of this control method will be assessed.

Toxorhynchites, an African mosquito, will be introduced into the second area. The larvae of this mosquito consume those of other mosquitoes but do not develop into adults that bite humans. The introduction of these mosquitoes will be combined with the integrated use malathion applications. Two applications (12 hours apart) with malathion will be made each week, followed 12 hours later with a single introduction of 400 adult Toxorhynchites/hectare. Evaluation of adult Aedes aegypti production and dengue transmission will then be assessed.

The third area will be treated twice with abate (Temephos) 1 ppm, using Briquettes or 1% sand granules. These will be introduced into all containers in which Aedes aegypti develop. Effectiveness, duration and ease of application will be evaluated.

A fourth area will serve as the emergency treatment area. Blanket coverage of the area will be made with up to three applications per week of malathion (500g/ha). The short-term emergency control of Aedes aegypti populations will be evaluated for rapidity, effectiveness and cost.

The fifth area will serve as a non-intervention control area. Studies will be conducted on Aedes aegypti behavior, biology, and ecology, including marking and recapture for dispersal and longevity studies, and their possible influence on dengue transmission.

Criteria will be developed for evaluating the interventions, based on the following factors:

- ability of the intervention to kill the vector.
- duration of the effect.
- cost of production and application.
- ease of application with existing equipment and manpower.
- applicability to other geographical areas and terrain.
- effect on non-target animal, human and plant life.
- social acceptability and/or willingness to carry out required intervention actions.

Approximately six months into the operational research activities (February 1988) a mid-term project evaluation will be conducted. Project results will be assessed and corrections or new approaches recommended if necessary.

e. Field Application and Evaluation Phase

During months 16-36, the major activity will be the field application of the most promising interventions by SNEM personnel under the guidance of the technical assistance. As a result of this activity, new control methods can be adapted team to SNEM programs and resources. Since this activity will be carried out over a period of approximately 20 months and can begin about six months after operations research commences, the first fifteen months of Phase Four (Field Application and Evaluation) overlap with the last fifteen months of Phase Three (Operations Research).

Phase Four will also be a period during which the results of operational field tests are evaluated by comparing them with data obtained in baseline studies and control areas. Also, the practical application and cost-effectiveness of the interventions will be evaluated to determine whether these methods could feasibly be incorporated into the SNEM program.

With regard to Aedes aegypti, rates of exposure to dengue in intervention areas will be compared with control areas. This will be carried out in coordination with the Dengue Surveillance component of AID's Health Systems Management Project (517-0153).

During this phase, long-term training participants will complete their studies and the final project evaluation will be conducted.

5. Project Inputs

To enable UCMM, SNEM and USC to carry out the activities described above, the project will finance technical assistance, training, commodity procurement, operating costs, minor construction and an external project evaluation.

a. Technical Assistance ($631,000 - A.I.D.)

Long and short-term technical assistance will be provided to SNEM and UCMM in vector control research and field application. In addition to carrying out an advisory role, one of the functions of the long-term advisor will be project administration. (See Annex G for illustrative Scopes of Work for project technical assistance.)

A project office will be set up at UCMM facilities in Santiago. The Project Coordinator will manage the office, which will be staffed by an administrative assistant, a bilingual secretary and a driver/messenger. SNEM will also maintain an office for the project's use at its headquarters in Santo Domingo.

The project will also finance 20 person/months of short-term technical assistance in the areas of operations research, epidemiology, ULV operations, malariology and vector control (8 p/m); entomology (7 p/m); computerized data management (2 p/m); training and health education (1 p/m); and management improvement assistance (2 p/m).

b. Training ($93,000 - A.I.D.; $104,000 - H.C.)

The project will fund long and short-term participant training, observational study tours, and short-term in-country training. Most of these funds will support training of SNEM and UCMM staff. Seven senior SNEM and UCMM staff will receive short-term training in Comprehensive Vector Control at USC. Three candidates will receive Master's degree training in Public Health (MScPH). An observation tour in the U.S. or Latin America will be offered to SNEM staff and UCMM faculty, and a wide range of short-term, in-country training will be offered, particularly to SNEM field supervisors and voluntary collaborators. Also, health workers throughout the country will receive training in malaria surveillance and vector control techniques. The participating agencies, UCMM and SNEM, will continue to pay salaries for those participants while in training.

Short-term, in-country training will also be offered to community leaders and persons in tourism and agriculture to create an understanding of the contribution that adaptive research can make to their continued profitability and the nation's economic health. A detailed training plan is presented in Annex I.

c. Commodity Procurement ($270,000 - A.I.D; $15,000 H.C.)

Aside from technology used to apply residual insecticides, the Dominican Government and private research facilities lack the updated equipment, microscopes, and data management capability needed to research and field test vector control methodologies for malaria and dengue. Also, despite SNEM's remarkable vehicle repair effort, its vehicles are old, funds for spare parts and tools are short, and there is no vehicle replacement policy. New and improved equipment is needed to allow SNEM and UCMM to carry out basic applications and evaluation of vector control techniques. Therefore, project funds will be allocated to procure lab equipment, computers, microscopes, spray equipment, vehicles and insecticide. A detailed procurement plan is presented in Annex H.

d. Construction ($60,000 - H.C.)

Most of the physical facilities required to house this project are available at UCMM in Santiago. The UCMM site has adequate office space for project personnel, meeting and warehouse space, space for a medical entomology laboratory, and land for a small insectary and fish tanks. In addition to the UCMM site, SNEM will house a medical entomology laboratory and a second insectary. The cost of modifying the research laboratories at UCMM and SNEM (to receive new equipment), building two insectaries (including equipment) and constructing fish breeding tanks is estimated at $5,000 which will be counterpart funded.

The UCMM site in Santiago will house research activities during the first year of the project. However, it is quite far from the main UCMM campus, which impedes access to UCMM faculty, the UCMM-provided controller and participating members of the graduate student body. Therefore,

during the second year, the project office will be moved into on-campus facilities that are expected to be vacated by that time. The project office will remain there for the balance of the LOP. If these facilities are not vacated, UCMM will identify building space that can be remodeled or a small new building will be constructed. The cost of constructing this building is estimated at $25,000 which will be counterpart funded.

e. Support Costs ($30,000 -A.I.D.; $321,000 - H.C.)

Counterpart agencies will contribute resources both in cash and on an in-kind basis to cover the project's operating costs. These costs include staff of both SNEM and UCMM. The university will add a new faculty member to its staff to work specifically on this project. Also included in the operating costs are use of the facilities, travel and per diem during data collection and field work.

f. Evaluation ($50,000 - A.I.D.)

$50,000 in AID-provided funds is allocated to a mid-term and final external evaluation of the project.

C. Expected EOPS

At the conclusion of the project, the following EOPS should result:

1. The UCMM medical entomology laboratory will be able to perform basic operations research related to vector control for malaria and dengue.

2. The UCMM faculty will be able to design, implement, and evaluate the technical, economic, social and financial dimensions of at least three different interventions.

3. UCMM will be able to provide training sessions or seminars on vector control problems for personnel in private agriculture and tourism. These sessions are intended to lay the groundwork for possible future use of the operational research capability at UCMM by those industries, thereby providing a means for meeting the recurrent costs of research activities.

4. SNEM staff will have the capacity to apply new vector control techniques that were proven successful during the field trials.

5. SNEM will be able to conduct and apply operations research protocols.

6. A permanent national link will exist between UCMM and SNEM for conducting vector control research.

7. Recommendations for a follow-on national program will have been developed, including cost analysis of measures to be taken and identification of all resources necessary for successful sustained control of malaria vectors and *Ae. aegypti*.

III. PROJECT IMPLEMENTATION

A. Schedule of Principal Events

The following is the Project's estimated implementation schedule. Details are included in Annex G.

Phase One

1.	Project Authorized by USAID	August 15, 1986
2.	Cooperative Agreement signed	August 29, 1986
3.	First Participant begins ST Training	September 8, 1986
4.	Letters of Agreement signed	September 12, 1986
5.	Resident Advisor arrives	September 26, 1986
6.	First major procurement made	November 1986
7.	First Participant begins ELT	November 1986
8.	Test sites selected	November 1986

Phase Two

9.	Baseline data collection begins	December 1986
10.	Second Participant begins ELT	March 1987
11.	Observational study tours made	May 1987
12.	Second major procurement made	February 1987
13.	Two participants begin LT Training	June 1987
14.	In-country courses begin	June 1987

Phase Three

15.	Operations Research begins	July 1987
16.	Third participant begins LT Training	September 1987
17.	Three participants begin ST Training	September 1987

Phase Four

18.	Field Applications begin	December 1987
19.	Mid-Term evaluation done	February 1988
20.	Last major procurement made	March 1988
21.	Final Evaluation Completed	August 1989
22.	PACD	September 1989

B. Evaluation

To assure that the project is implemented as planned, two external evaluations will be performed. In February 1988, a mid-term evaluation will be conducted and at the end of the project, the final evaluation will be carried out. Personnel from the implementing institutions - USC, UCMM and SNEM - will not be members of the evaluation teams. However, they will provide information to the teams. The

evaluation teams will be composed of personnel from AID/S&T, PAHO, SESPAS and a neutral consultant.

The mid-term evaluation will examine the extent to which planned activities, including data collection, baseline investigations, research, field testing and training are proceeding according to schedule and the extent to which planned support from all sources - USC, GODR, SNEM and UCMM - is being provided.

The final evaluation will appraise the success of the project in achieving its goal and purpose, meeting output targets, and producing results that can be replicated in areas that have epidemiological patterns similar to the test areas.

C. Project Monitoring

Primary USAID monitoring responsibility will rest with the Mission's Health Advisor, who will be supervised by the Chief of the Health and Population Division. The Advisor will be assisted by a Project Implementation Team composed of representatives of the Mission's Program, Capital Development, Human Resources Development, Management, and Controller Offices. The functions of the Project Implementation Team are specified in Mission Order No. 11-3 of March 17, 1986. The Team will meet twice monthly to review the status of project implementation. Corrective steps will be taken as needed to improve project execution.

Overall project progress and disbursements will also be reviewed by the USAID Director and Deputy Director every six months. Information obtained in these reviews will be documented in the Mission's Semester Reports and sent to AID/W.

The Mission's Health Advisor will monitor the project through occasional visits to project sites, participation in the project's Advisory Committee, review and evaluation of project reports, technical monitoring by USAID or AID/W-funded consultants and informal discussions with the Project Coordinator and his/her staff. In addition, the Project Coordinator will prepare quarterly reports describing progress in executing the activities detailed in annual work plans, including activities undertaken, the extent to which intermediate targets are being met, corrective actions required, the status of training activities and fund commitments and expenditures. Annual reports will summarize achievements against targets and lay out the Work Plan for the ensuing year. Reports are due 45 days following the quarter and/or year under report.

The final report will provide a costed three-year record of achievement, an evaluation of each field-tested intervention and a detailed, costed recommendation regarding the dimensions of a prospective GODR effort to control mosquito vectors, including the roles of research organizations, implementing agencies, other SESPAS elements, and

communities. This plan will be suitable for preparing budget submissions to the GODR and international funding sources.

D. Conditions and Negotiating Status

1. Conditions

The following conditions will be included in the Project Authorization and Cooperative Agreement with USC.

(a) Initial Conditions Precedent

Initial conditions precedent to disbursement will include a requirement that USC enter into Letters of Agreement with SNEM and UCMM that delineate the respective roles, responsibilities and contribution of both SNEM and UCMM in project implementation. These Agreements should specify that adequate funding, office space and personnel will be made available to the project to carry out planned activities. In relation to training, the Agreement will specify that those employees trained under the project will continue to work in vector control activities in the Dominican Republic for at least twice the amount of time spent in training.

(b) Subsequent Conditions to Disbursement

Within 90 days of the initiation of the project USC will submit to AID an Action Plan for the period ending September 30, 1987. This plan will cover both dengue and malaria control activities and will be updated annually.

2. Negotiating Status

The Project has been jointly developed with representatives of the Government of the Dominican Republic and the Universidad Católica Madre y Maestra and the University of South Carolina. The project conditions outlined above have been discussed with and agreed to USC and on behalf of the GODR and by UCMM. Thus, USAID/DR sees no difficulty in finalizing negotiations and incorporating into the Cooperative Agreement appropriate language to cover these terms and conditions.

IV. PROJECT ANALYSES

A. Technical Analysis

1. Introduction

This project will support malaria and dengue control operational research activities that will improve the effectiveness and efficiency of SNEM and increase the vector control research capabilities

of UCMM. Over the LOP, the project will, inter alia, research and field test a number of vector control technologies. The Project Committee believes that these technologies can be feasibly employed in the Dominican Republic given the human resources, funding and materials that exist or that will be provided under the project.

2. Technologies

This project will introduce 5-6 alternative vector control methodologies which can be used by SNEM in its malaria control program. Also, the operational efficiency of methods to control *Aedes aegypti* will be investigated. The methodologies under consideration are technically sound and will provide a useful basis for an enhanced vector control program in the D. R. The discussion below deals with the technical feasibility of these activities.

a. Stratification and Surveillance

For any malaria and dengue control program to be successful, epidemiologic data must be gathered and analyzed to identify priority action areas (a process called stratification) and to monitor the incidence of disease. SNEM has already identified high priority areas in several provinces. The project's research activities will be carried out in these areas. Nevertheless, considerable additional epidemiologic study is required to better stratify the malarious areas and monitor the incidence of malaria and dengue. SNEM understands and is committed to stratification and annual re-stratification over the LOP to improve program quality and impact. This project will assist SNEM in this process by developing systems to gather and analyze the necessary entomologic, epidemiologic, ecologic, climatologic, anthropologic and sociologic information. The information that will be gathered and analyzed is technically appropriate and the methods utilized are internationally acceptable and technically feasible.

b. Chemotherapy

SNEM currently provides malaria drug therapy (in the form of chloroquine) to people with fever who go to vector control posts or health institutions. In cases where malaria has been detected, chemotherapeutic treatment is initiated. In addition, Mass Drug Administration (MDA) campaigns have been carried out by SNEM to reduce malaria transmission in geographic areas where outbreaks of disease have occurred. Chloroquine is cheap, effective and has few side effects. This project will not engage directly in treatment programs, but will be supportive of such actions if they are required in the research areas. Since SNEM has effectively carried out case-specific malaria drug treatment and MDA campaigns in the past, it is believed that SNEM can carry out the limited chemotherapy treatment interventions without assistance under the project.

c. Intradomiciliary Spraying

The D.R. has had more experience with residual intradomiciliary spraying than with any other malaria control intervention. These operations have been reasonably well planned, organized and implemented when adequate funding was available, but evaluation of results has not always been complete or performed on a timely basis. This project will selectively test residual spraying with malathion and DDT. Recent field studies in the D.R. have demonstrated that intradomiciliary spraying with these insecticides is suitable for malaria control in the country. Tests indicate that all known malaria vectors are susceptible to malathion and generally susceptible to DDT. The use of intradomiciliary spraying at study sites is considered technically sound and feasible, provided that:

- Insecticides are handled safely to prevent pesticide toxicity to program personnel and local populations; and

- There is frequent evaluation of the efficacy of spraying and the sensitivity of anopheline populations to the insecticide.

The project will require that all these factors are considered when residual spraying is tested. Baseline studies on vector behavior will be carried out, SNEM and UCMM staff will be trained in safe spraying techniques and SNEM will be assisted in monitoring mosquito populations to identify the emergence of resistance to insecticides and any significant alteration in behavior patterns.

d. Larviciding

In low income areas of the D.R., household water supply is often contained in large tanks, barrels and other temporary containers, which are ideal breeding sites for *Aedes aegypti*. One of the methods to be tested to control this vector is larviciding. This method is not presently being used by SNEM, but is considered appropriate for use in urban, suburban and other selected areas of the D.R. to reduce malaria and dengue vector populations. The proposed intervention is commonly used and is considered to be technically sound.

e. Area Spraying (Adulticides)

Ultra Low Volume (ULV) and fogging applications are used to rapidly reduce adult mosquito populations. They are cost effective under a number of conditions and technically sound if suitable insecticides are employed and application equipment is used correctly. In the past, SNEM has conducted ULV malathion applications in Santo Domingo and Dajabón. In addition, SNEM has experience in utilizing

appropriate spraying equipment. The project will provide technical assistance, two ULV truck-mounted machines, 12 backpack ULV sprayers and training in ULV spray operations to ensure that ULV technology is utilized in a technically sound manner under the project.

f. Source Reduction

The elimination of mosquito breeding sources (tin cans, metal junk, tree holes) is a technically sound way to control *Aedes aegypti*, and has been used worldwide. In the past, SNEM has carried out such work on a limited basis. The project will train personnel and encourage community participation to expand source reduction activities.

g. Biological Control

Several biological control methodologies, including the use of bacteria, viruses and nematodes, are being used world-wide. Geneticists are also studying ways to control mosquito reproduction. The only biological control method to be applied under this project is larvivorous fish, predator larvae (Toxorhynchites) and Bacillus thurigensis -H-14 (BTI).

The use of larvivorous fish appears to be an inexpensive, effective and community-based way to reduce mosquito populations in permanent breeding areas and irrigated rice fields. SNEM had some experience with this methodology when it used larvivorous fish in the Punta Cana area. Nevertheless, SNEM needs more fish breeding facilities, better methods of distribution, and field studies evaluating the effectiveness in a variety of habitats, which the project is providing.

BTI and Toxorhynchites will be used on a limited basis in the research areas. Standard methodology will be used in their application. A number of worldwide vector control programs are trying to use BTI, but to date the results have been mixed. It is technically feasible for SNEM to implement such biological control methods in their field programs if the project determines that the measures are applicable to a wide range of ecological situations in the D.R.

3. Haitian Immigration

In the D.R., the malaria control problem appears to be associated with SNEM's ability to secure funding for its insecticide requirements and the seasonal introduction of Haitian laborers into the country. This project will assist the GODR in reducing the amount of foreign exchange needed to support malaria and dengue control by utilizing other methods to control those diseases. It will not substantially address the problem of Haitian immigration. Nevertheless, SNEM has been and will continue to be involved in controlling the

importation of malaria cases via Haitian cane cutters by treating these laborers as they cross into the D.R. (if the contracting of Haitian laborers resumes), taking blood samples of legal immigrants and, if the test is positive, issuing cards for tracking purposes. This project supports these activities, but is not directly involved in them. Most importantly, information obtained under this project will be shared with USAID/Haiti and Haitian malaria authorities.

B. Institutional Analysis

1. Servicio Nacional para la Erradicación de la Malaria (SNEM)

SNEM was legally established as a semi-autonomous agency on January 3, 1964 and is the organizational successor of the SESPAS Malariology Division and the Malariology Division of the U.S.-assisted Interamerican Cooperative Public Health Service. SNEM's function is to control and ultimately eradicate malaria and dengue through case detection, treatment, elimination of mosquito breeding sites, evaluation, training, surveillance, health education and vector control through larviciding and residual spraying. Therefore, a legal base exists to justify the use of SNEM personnel in vector control operations research.

In 1985, SNEM had 494 employees stationed at its headquarters in Santo Domingo, two regional offices and sector offices. In addition to its paid staff, SNEM relies on some 4,000 Voluntary Collaborators (VC) throughout the country.

SNEM obtains malaria surveillance data through Active Case Detection (ACD) and Passive Case Detection (PCD). ACD is carried out by SNEM's staff during village visits and daily visits to health institutions. PCD is primarily carried out by Voluntary Collaborators. Some PCD slides are also obtained by GODR health institutions other than SNEM, but the relationship between SNEM and these GODR institutions should be improved so that more PCD slides are obtained. This project will help to achieve this end by providing training and health education to primary health care staff, voluntary collaborators and personnel at fixed health facilities.

With regard to dengue surveillance, accurate incidence data is practically non-existent. This capacity is being strengthened through the USAID-assisted Health Systems Management project.

SNEM has identified areas of high priority for vector control in the country and has stratified malarious regions into the following four areas: (1) areas with indigenous cases only; (2) areas with imported cases only; (3) areas with only one indigenous case; and (4) areas with only one imported case. Additional epidemiologic study is required to better stratify the malarious areas. SNEM would like to

improve its stratification system and expand and improve the collection of entomologic, ecologic, climatologic, anthropologic and sociologic data. This project will assist SNEM in this process. A great deal of data will be obtained through studies on mosquito bionomics to be conducted under the project. Also, assistance will be provided to develop SNEM's computer capabilities, to analyze up-to-date epidemiological data in a timely fashion.

The principal vector control techniques used by SNEM are residual spraying and distribution of anti-malaria drugs. New approaches must be undertaken if SNEM is to improve its malaria and dengue control programs. The project will assist SNEM to advance from its present narrow range of vector control efforts to a more flexible, integrated approach utilizing a mix of measures. SNEM has proven to be receptive to new technologies. For instance, it is now testing an alternative parasite identification methodology as part of a WHO-supported program, and has expressed interest in exploring new vector control techniques under this project.

Despite SNEM's vector control capabilities, however, a great deal of training will be required for SNEM to be able to carry out comprehensive vector control operations research activities. Therefore, the project will finance long and short-term participant training, and observational study tours for mid level and senior SNEM staff. A wide range of short-term, in-country training will also be offered through SNEM, particularly to its field supervisors and voluntary collaborators.

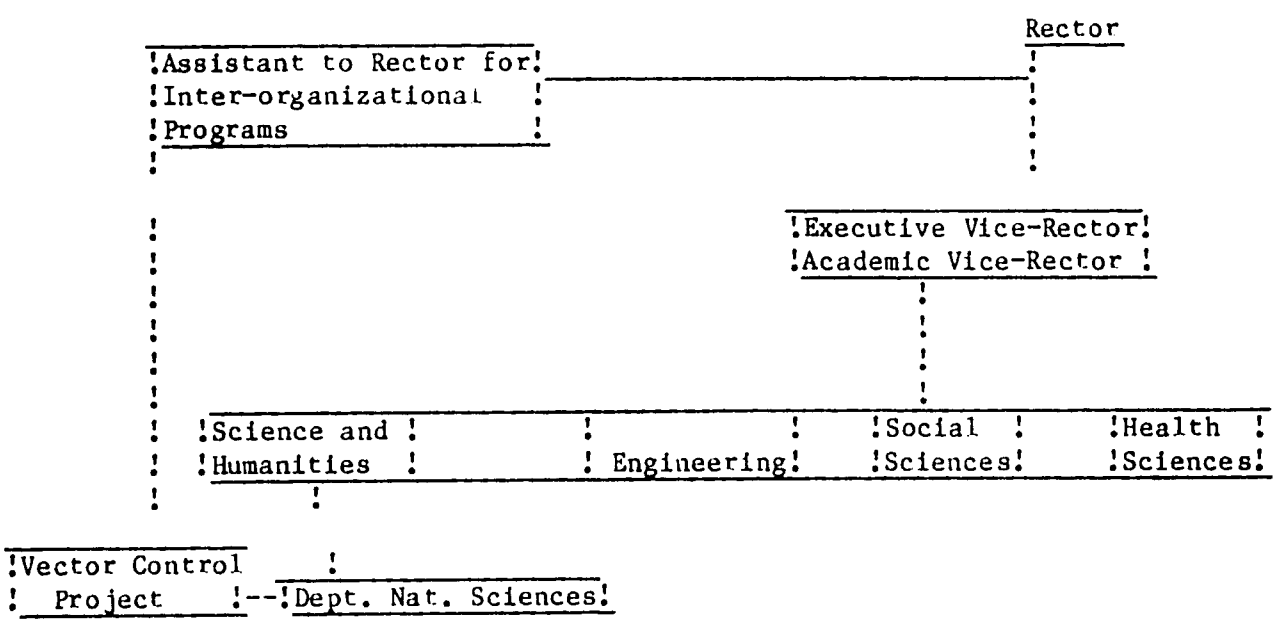
Health education to increase the understanding, cooperation, and participation of communities has been relatively neglected in SNEM's vector control program. SNEM leadership recognizes the importance of health education and is attempting to strengthen that component of their program. SNEM utilizes a variety of educational techniques such as participation in community organizations and direct contact between SNEM field workers and community members to communicate program objectives, procedures, and schedules. SNEM feels that these efforts have succeeded in creating villager acceptance, and to some extent, understanding of the program. A limited systematic effort is to be undertaken under the project to study and change villagers' attitudes and practices regarding malaria and vector control. Short-term consultation in health education will be provided to SNEM to improve in-country training, and operational research will be conducted to study community knowledge, attitudes and practices in relation to malaria and dengue. This health education activity will result in considerable improvement in the management of SNEM's health education function, and will increase awareness of the program in the communities where research is being conducted.

In summary, SNEM possesses the institutional capacity to support project activities, which in many ways are an extension of SNEM's historical pattern of working on scientific enterprises in communities

throughout the country. Nevertheless, SNEM needs to move substantially forward in its transition from a program emphasizing total coverage house-spraying and active case detection surveillance methods to an integrated program utilizing a selective mix of vector control measures and a better balance between active and passive case detection for malaria and other vector-borne diseases. There is strong support in SNEM to make these improvements in its program, and the organizational and administrative structure of the institution is adequate to support its participation in this project and to contribute substantially to its success.

2. Universidad Católica Madre y Maestra (UCMM)

Since the major thrust of this project is research and training, a university base is essential. UCMM is a respected institution of higher learning in the D.R. with a Department of Natural Sciences that has a proven track record in research. Its organizational structure (with this project included) is as follows:



UCMM has two faculty members who are trained in entomology. One will serve as a full-time member of the Project Team. The other will work part-time to assist in gathering and analyzing baseline data on vector bionomics. All project activities involving UCMM faculty, facilities and students will be carried out under the direction of the Director of the Office of Inter-Organizational Programs. UCMM will also furnish the services of a Project Controller who will be responsible for reporting on the use of project funds.

Some training in such areas as data gathering, pesticide resistance, biological control methodologies and community health education will be required for UCMM to be able to carry out comprehensive vector control operations research activities. Therefore, the project will finance long and short-term participant training and observational study tours for UCMM faculty. UCMM's two entomology faculty will attend the six-week Comprehensive Vector Control course offered at USC in 1987. Also, the project will offer Master's degree training in vector-borne disease control with a specialty in medical entomology to the Director of the Office of Inter-Organizational Programs. An observation tour in the U.S. or Latin America will be offered to senior UCMM faculty. Furthermore, the project provides TA which will work closely with UCMM faculty, thereby providing it with in-depth, hands-on field experience in vector control operations research.

UCMM is located close to the field research sites, and has excellent laboratory and library facilities and faculty from a wide range of academic disciplines. It has office, laboratory and warehouse space and land for the construction of a small insectary/research center. Nevertheless, if UCMM is to be capable of conducting vector control operations research, it will need additional laboratory and computer equipment and an insectary, which will be provided under the project.

In summary, UCMM possesses the basic institutional capacity to support vector control operations research. Nevertheless, its faculty requires more training, better facilities and technical assistance to be able to provide the country with an academic base for conducting vector control operations research. There is strong support in UCMM to develop this capacity and the organizational and administrative structure of the institution is adequate to support its participation in this project and to contribute substantially to its success.

C. Economic Analysis

The objective of this project is to provide technical assistance, commodities and training inputs towards the goal of reducing the incidence of malaria and dengue in the Dominican Republic. This project will address the problem of controlling vector-borne diseases by developing and testing ecologically sound interventions to control mosquito vectors, and establishing the institutional capacity for applied research.

The "benefits" to this project depend upon utilization of project results. While costs are immediate and real, the benefits are not immediately quantifiable, moreover not any single form of intervention will be uniformly applicable to meet the different epidemiological patterns of malaria and dengue vector concentrations in the Dominican Republic. Appropriate technologies will be tested and adapted to local environment to produce a near term beneficial impact on the quality of life. To be economically viable, these interventions should make optimum use of the resources available and SNEM must be able to successfully conduct field applications for adoption within the country's national malaria and dengue control programs. A cost/benefit ratio of the project will be determined as part of research and testing of each intervention.

Although this first experiment to introduce appropriate vector control technologies represents a heavy investment in external technical experts and equipment, the non-reimbursable nature of this AID assistance makes this design cost-effective for the Dominican Republic. Additional benefit to the economy represents also the increased access to more efficient disease control methods and increased productivity because of skills upgrading of local technicians. Furthermore, through the use of more cost effective methods, future application of disease control methods will be less susceptive to large cost swings, and will contribute to reduce loss in agriculture, health and tourism.

Tourism is one of the most important sources of foreign exchange earnings for the Dominican Republic. It is expected to continue to grow in importance during the next decade. Currently, a heavy investment is being made to develop this sector. During the last 3 years, construction on the North Coast has been in the order of $635 million bringing the total rooms available in that area close to 2000. Government initiatives through INFRATUR and the private sector have contributed to this effort. The World Bank is also financing the construction of hotels and necessary infrastructure. This investment has resulted in foreign exchange earnings to the Dominican economy of $430 million in 1985 and has averaged at least $300 million over the past four years. These earnings represented 40% of the country's foreign exchange for the year 1985.

A serious outbreak of any type of vector disease, especially malaria or dengue, will seriously affect tourism in the Dominican Republic. This concern is being demonstrated by INFRATUR through its campaign of fumigating twice a week all the north coast, especially near the hotel sites. Furthermore, if an outbreak occured which resulted in a reduction in tourist landings of 50% during a given year this would result in $200 million reduction in the foreign exchange earnings of the country. This loss of foreign exchange would have a damaging impact on the nation's balance of payments. It would also seriously impair the future growth of the tourism industry.

E. Financial Analysis

1. Introduction

This project provides assistance to support the establishment (or possibly the confirmation) of bionomic baseline data on the vector(s) of malaria and dengue; a program of operational research to identify vector control methodologies which are alternative to, less expensive than, superior to and/or less demanding in terms of foreign exchange than SNEM's current array of vector control techniques; and a program of field trials of methodologies identified by the research effort to ascertain their effectiveness under Dominican conditions. In the process of conducting these activities, the project will increase the research capacity of a major Dominican University (UCMM), establish a link between the university and the element within SESPAS (SNEM) which is charged with the conduct of all

vector-borne disease control activities in the D.R., and provide the tested information on which improved programs of vector-borne disease control may be developed.

The PL-480-derived counterpart contribution will be a net addition to the present budgets of both SNEM and UCMM. The activities to be conducted under the project do not duplicate current functions of either SNEM or UCMM; rather, they will result in an improved product in both institutions, together with an established relationship between these institutions which does not now exist and which will benefit both. Thus, while Tables 2, 3, and 4 are restricted to the specific project costs for the activities described in this Project Paper, the ultimate benefits will extend to SNEM's total operations; to the entire Department of Biology in UCMM; to the synergistic relationship between the two Dominican participating entities; and to their long-term relationship with USC.

2. Financial Plan

The basic financial plan of the project is illustrated in Tables 2, 3, and 4. The project will cost an estimated $2,000,000 over a three-year period. Funds will come from an AID grant to USC of $1,500,000, a counterpart contribution, in RD pesos, (PL 480 funds) equivalent to approximately $320,000 from the GODR, and in-kind contributions, in RD pesos, from both UCMM and SNEM amounting to an equivalent of about $180,000. These contributions, and their related percentages, are illustrated below.

Input	Total Amount (000s of $)	% of Total	% Provided By AID	% Provided By GODR
Technical Assistance	631	31%	31%	-
Training	197	10	5	5
Commodities	285	14	13	1
Support Costs	351	18	2	16
Construction/Land	60	3	-	3
Evaluation/Contingencies/ USC overhead	476	24	24	-
TOTALS	2,000	100%	75%	25%

In Table 3 it is evident that project inputs will be divided fairly evenly among the three project components with the exception that most of the training will be applied to the Operations Research component and that the bulk of the commodities procurement will be for Baseline Data Collection.

With respect to timing of project inputs, it can be determined from Table 4 shows that almost 50% of AID's share will be provided in year one while GODR contributions will be only 24% in year one. By the end of year two, however, AID will have contributed 77% of its share and the GODR about 68%. The bulk of commodities procurements

will take place in the first year as well as the larger portion of training expenditures. Technical Assistance and Support Costs will take place more evenly across the entire LOP.

In summary, the financial plan appears reasonable, adequate to accomplish project objectives and each participating entity should be able to meet its contributory obligations on a timely basis. It is recommended, however, that separate specific letter agreements be signed by UCMM, and the GODR (SNEM) to indicate the specific nature and timing of contributions committed to the project by each party.

TABLE 2
SUMMARY FINANCIAL PLAN
By Source and Use (Input) of Funds

Use (Input) of Funds	Source of Funds				
	AID				
	L/C	FX	TOTAL	HC*	TOTAL
			(in 000's US$)		
Technical Assistance	-0-	631	631	-0-	631
Training	-0-	93	93	104	197
Commodities	-0-	270	270	15	285
Support Costs	-0-	30	30	321	351
Construction/Land	-0-	-0-	-0-	60	60
Evaluation	10	40	50	-0-	50
USC Overhead	-0-	349	349	-0-	349
Contingencies	-0-	77	77	-0-	77
TOTALS	10	1,490	1,500	500	2,000

* = Based upon RD$2.80 = US$1.00

TABLE 3
SUMMARY FINANCIAL PLAN
By Source and Use (Component) of Funds

Use (Component) of Funds	Source of Funds					
	AID					% of
	L/C	FX	TOTAL	HC	TOTAL	TOTAL
	(in 000's US$)					
Baseline Data Collection						
Technical Assistance	-0-	177	177	-0-	177	
Training	-0-	25	25	10	35	
Commodities	-0-	242	242	3	245	
Support Costs	-0-	2	2	74	76	
Construction/Land	-0-	-0-	-0-	5	5	
Subtotals	-0-	446	446	92	538	27%
Operational Research						
Technical Assistance	-0-	233	233	-0-	233	
Training	-0-	64	64	49	113	
Commodities	-0-	14	14	7	21	
Support Costs	-0-	12	12	122	134	
Construction/Land	-0-	-0-	-0-	55	55	
Subtotals	-0-	323	323	233	556	28%
Field Application						
Technical Assistance	-0-	221	221	-0-	221	
Training	-0-	4	4	45	49	
Commodities	-0-	14	14	5	19	
Support Costs	-0-	16	16	125	141	
Construction/Land	-0-	-0-	-0-	-0-	-0-	
Subtotals	-0-	255	255	175	430	22%
Evaluation	10	40	50	-0-	50	2%
Overhead/USC	-0-	349	349	-0-	349	17%
Contingencies	-0-	77	77	-0-	77	4%
TOTALS	10	1,490	1,500	500	2,000	100%

TABLE 4
PROJECTED DISBURSEMENTS, BY YEAR

	YEAR ONE		YEAR TWO		YEAR THREE		TOTAL	
	AID	HC	AID	HC	AID	HC	AID	HC
	(in 000's US$)							
Technical Assistance	304	-0-	256	-0-	255	-0-	815	-0-
Training	148	15	47	56	20	33	215	104
Commodities	232	15	34	-0-	4	-0-	270	15
Support Costs	10	93	10	112	10	116	30	321
Construction/Land	-0-	5	-0-	55	-0-	-0-	-0-	60
Evaluation	-0-	-0-	25	-0-	25	-0-	50	-0-
Contingencies	40	-0-	4-	-0-	40	-0-	120	-0-
TOTALS	734	118	412	223	354	149	1,500	500

3. Methods of Implementation and Financing

USC, under a Cooperative Agreement, will be responsible for all procurement actions except evaluation, which will be implemented directly by AID. As a registered educational institution with an existing Letter of Credit on the Treasury Financial Communications System, USC is qualified and has the capability to manage its implementation actions. On-site continuous management of procurement and implementation actions will be the responsibility of the full-time USC resident advisor and his/her project office staff. The evaluation related actions will be implemented directly by the Mission through AID-direct contracts.

Table 5 illustrates the methods of implementation and financing for the AID-funded portion of the project. The methods of financing are preferred methods of financing under the Administrator's Payment Verification Policy Guidance and represent no deviation from the Mission's general assessment of financing policy and procedures. Therefore, no further justification of the methods of financing is required.

TABLE 5
METHODS OF IMPLEMENTATION AND FINANCING

METHOD OF IMPLEMENTATION	METHOD OF FINANCING	AMOUNT (000's US$)
Tech. Assistance, Training, Commodities, Support Costs		
Cooperative Agreement, University	LOC - TFCS	$1,373
Evaluation		
Direct Contract, Profit or Non-Profit Making	Direct Pay	50
Contingencies		77
TOTAL		$1,500

4. Internal Control Vulnerability and Audit Coverage

Since all AID funds provided for the project will be handled only by USC and AID, internal control vulnerability is considered low. AID's standard post audit coverage of university contractors and USAID's internal operations is considered adequate.

The resident USC advisor will monitor contributions by UCMM and SNEM and, working in cooperation with the USAID project manager, should be able to insure their complete and timely arrival into project implementation.

USAID/DR exercises considerable management and influence over the disbursement of PL 480 local currency contributions and no problems are anticipated in the prompt contribution of these resources by the GODR.

No additional audit coverage is required for this project.

D. Summary Social Soundness Analysis

The social soundness analysis presented in Annex K provides details on the relationship and impact of this project on society and culture. Three factors are analyzed (1) the distribution of benefits under the project; (2) problems relating to Haitian immigration; and (3) social acceptance of the techniques to be used in the project for the control of malaria and dengue. Equitable distribution of benefits is assured as any person at risk to malaria or dengue will benefit from the results of this project.

The problem of importation of malaria by Haitian workers is basically an operational one and methods used to control the disease by anti-malaria drugs are socially acceptable and provide benefit to the Dominican and Haitian populations. The control techniques being researched in this project are considered socially acceptable, but care will be taken at each test site to insure that the community is informed of the work to be carried out and to seek support and participation.

In summary, the project is socially sound. It takes into account the cultural considerations of the people and its ultimate benefits will be equitably distributed throughout the D.R.

E. Environmental Concerns

The Initial Environment Examination (IEE) has been prepared for this project with a negative determination. The IEE is attached as Annex F. The project being proposed is basically an operational research program with training and technical assistance components. Alternative mosquito control methodologies will be tested on a small scale at 3-5 field sites, and long-term studies of mosquito bionomic will be conducted. All research activities will be governed by well developed, scientifically sound protocols approved by a committee consisting of scientists from the National Malaria Control Service (SNEM), A.I.D., the University of South Carolina (USC) and the Universidad Católica Madre y Maestra (UCMM). All research protocols will consider environmental implications and approval will be granted only if environmental concerns are met. All personnel involved in the field research will be carefully trained and supervised in order to carry out the research study in a scientific manner. Only ecologically acceptable, EPA approved insecticides will be utilized in test sites covering a limited area of approximately 100-200 acres. The actual test sites in rural areas will be limited to approximately 50 premises. The emphasis will be on predator and other biological controls, source reduction and other alternative mosquito control methodologies in these limited test sites. Only indigenous larvivorous fish will be employed at the test sites. A review has been made with the Comision de Bio-Conservación de la Secretaría de Agricultura for possible adverse interactions of

agricultural applications of pesticides; the conclusion was that the research activities of this project would not be adversely influenced by present agricultural practices in the Dominican Republic. Over the course of its long involvement in malaria and dengue control spray operations, the D.R. has experienced no past or present spray-related health problems. This is a tribute to the safeguards built into the program supervision, regular and refresher training, proper storage and application of acceptable insecticides and/or other methodology. In view of this outstanding record of performance and the limited nature of the research activities under this project, the PP Team has concluded, and the Mission concurs, that no further environmental analysis is required and recommends a negative determination. Additional environmental studies or assessments will be carried out as necessary if new chemical, biological or physical malaria control methods which transcend standard approved compounds or practices used within the United States for mosquito control are introduced into the test sites.

GLOSSARY OF TERMS

Active Case Detection (ACD) is a part of surveillance activities in which malaria personnel actively search for malaria cases through the collection of blood slides and epidemiological investigations.

Annual Parasite Incidence (API) is the proportion of cases of malaria detected on an annual basis in relation to the unit of population in which malaria occurs.

Biological Control is a method of controlling mosquitoes using living vertebrate or invertebrate predators, genetic control, or parasites.

Chemoprophylaxis is the use of drugs before infection with the aim of preventing disease.

DDT is the common abbreviation of the name Dichlorodiphenyl Trichloroethane, a chlorinated hydrocarbon type of residual insecticide.

Endemicity is a term applied to malaria when there is a constant measurable incidence in an area over a succession of years.

Epidemic is a term applied to malaria when the incidence of cases in an area rises rapidly and markedly above its usual level.

Epidemiology in a broad sense is the study of the environmental, personal, and other factors that determine the incidence of disease.

Focal Spraying is residual insecticide house spraying around a malaria focus.

Incidence is the number of cases of disease occurring during a given time period in relation to the unit of population in which they occur.

Larvicide is a substance used to kill the aquatic larval stage of the malaria mosquito by ingestion, contact, or respiratory blockage.

Malaria Control is an operation aimed at reducing the prevalence of malaria to a level at which it is no longer a major public health problem.

Malaria Control Service (MCS) refers to the national malaria control effort of the Government of the Dominican Republic.

Malaria Eradication is the ending of the transmission of malaria and the elimination of the reservoir of infected persons in a time-limited campaign, to the degree that when the effort comes to an end there is no resumption of transmission.

Malaria Focus is a defined and circumscribed locality situated in a currently or formerly malarious area and containing continuous or intermittent malaria transmission.

Malariogenic Potential is the degree to which an area is conductive to malaria, based on cumulative epidemiological data collected from each area regarding the parasite load, vector density, water-logging, climatic conditions, population movement, and other factors.

Malathion is an organophosporus residual insecticide.

Malaria Parasite is a colloqial term for any of the protozoan organisms causing malaria infections.

Parasite Rate is the percentage of persons showing malaria parasite by blood smear examination.

Passive Case Detection (PCD) is a part of the surveillance activity in which the public health and medical services other than the regularly constituted malaria service assist surveillance activities by the collection of blood slides from persons requesting treatment.

P. Falciparum Malaria is a severe type of malaria caused by Plasmodium falciparum, a species of malaria parasite.

Presumptive Treatment is initial drug treatment given to an expected malaria case at the time when a blood sample is taken for examination.

Residual Insecticide is an insecticide which when suitably applied on a surface, maintains for a considerable period of time its insecticidal activity by either contact or fumigative action.

Stratification or a malaria control activity represents a process by which an ara is divided into epidemilogical components in an effort to prioritize for operational purposes those areas which need a given level or type of control intervention.

Surveillance is that part of a malaria program aimed at discovery, investigation, and elimination of continuing transmission and the prevention and cure of infections.

Total Spray Coverage is the application of residual insecticide during one spraying cycle to all sprayable surfaces in all sprayable houses within a given operational area.

Ultra Low Volume (ULV) Spraying is a method of insecticide dispersion by special air or ground equipment using very small amounts of finely dispersed particles of insecticide.

Vector is an infected non-vertebrate host which serves as a vehicle for transmission of a disease from infected man to uninfected man. A biological vector is one in which cyclic development of the disease organism within the host is required before the host can transmit to man the infective form of the agent of disease.

Vector in malaria is any species of Anopheline mosquito in which the malaria parasite completes its sexual cycle within the host mosquito and which is thus able to transmist the disease.

Vector Density (in the context of malaria) is the number of female Anopheline mosquitoes in relation to the number of specified shelters or hosts or to a given time period, specifying the method of collection.

Vector Susceptibility represents the resistance status of a species of mosquito to the effects of insecticides.

Water Management as it relates to malaria control involves the reduction or elimination of sources of mosquito breeding through filling, draining, digging, changing water levels, flushing, canal trimming, and other engineering methods.

ANNEX B

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Project Title and Number: Vector Control, 517-0235

Life of Project: FY 1987-1989
PACD Date : September 1989
Date Prepared : July 8, 1986.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Program or Sector Goal: This project will contribute to a healthier environment in the DR by improving the nation's ability to control vector-borne diseases. It will also support the nation's efforts to expand tourism (by helping to prevent malaria and dengue outbreaks) and agribusiness (by preventing increases in vector populations in irrigated areas).	Measure of goal achievement: - Measurable reduction in incidence of malaria and dengue fever. - Increased case finding and follow up on confirmed cases by SNEM. (Note that both indicators will become valid after end of project.)	- Evaluation of statistics provided by SNEM, SESPAS (MOH) and the dengue surveillance program.	- Sustained economic growth and GODR financial support to health services and SNEM. - Continued support by PAHO. - Stability in the public sector to allow implementation of project activities.
Project Purpose: Develop and test ecologically sound, low cost and effective interventions in vector control to reduce the incidence of malaria and dengue, and establish institutional capacity for further applied research.	End of Project Status (EOPS): - The UCMM medical entomology laboratory will be able to perform basic vector control operations research for malaria and dengue. - UCMM faculty will be able to design, implement, and evaluate the technical, economic, social and financial dimensions of at least three vector control interventions.	- AID mid-term and EOP evaluation. - Grantee reports covering project activities. - Mission monitoring and site visits.	- USC will be able to introduce vector control technologies th have been applied in other countries. - Staff of UCMM and SNEM will be able to fulfill their commitment for duration of the project.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	EOPS (continued):		
	- UCMM will be able to provide training on vector control problems to personnel in private agriculture and tourism.		
	- SNEM staff will have the capacity to apply new vector control techniques that were proven successful during field trials.		
	- SNEM will be able to conduct and apply operations research protocols.		
	- A permanent national link will exist between UCMM and SNEM for conducting vector control research.		
	- Recommendations for a follow-on national program will have been developed, including cost analysis of measures to be taken and identification of all resources necessary for successful sustained control of malaria and dengue vectors.		

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Outputs:			
1. UCMM will have participated in Operations Research (OR) programs to control malaria and dengue vectors and will be able to apply OR to the control of other diseases.	- An entomological laboratory will be established at UCMM. - UCMM faculty and laboratory staff will be trained in OR techniques.	- Same as above.	- USC, UCMM and SNEM working relationships are productive and mutually beneficial during LOP. - USC, UCMM and SNEM find it mutually beneficial to continue their relationship after LOP.
2. SNEM will have conducted field applications and evaluated alternative interventions to determine if they should be incorp-ated into national malaria and dengue control programs.	- Three UCMM faculty members will receive training, participate in the design, implementation and evaluation of at least six vector control interventions, and be able to perform OR for other such interventions.		
3. A permanent link will have been established between a research-oriented American university, USC, a Dominican research institution, UCMM, and a Dominican vector control institution, SNEM.	- One faculty member trained under the project will direct future activities of the UCMM research center. - Three senior SNEM staff will be trained in the design, management, data collection and evaluation of field trials in vector control and will train field staff to apply control techniques. - SNEM will be able to adapt OR protocols to operational applications of tested vector control interventions. - SNEM will use a microcomputer system for data analysis and will select the best mix of interventions to be used in control programs.		

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Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Inputs			
1. SNEM Provide adequate staff and facilities to carry out project activities. 2. UCMM Provide necessary space, controller of project peso costs, and adequate professional personnel to carry out assigned research tasks. 3. USC Provide general project coordination, technical assistance, training and procurement services. 4. GODR Provide $320,000 equiv. for peso costs not provided by SNEM and UCMM personnel as in-kind inputs.	- SNEM and UCMM together will fund $180,000 equiv. in in-kind contributions to the project and $320,000 (equiv. in pesos) will be made available by GODR from PL-480 Title I account. - Project Budget (US$000) AID / GODR,SNEM UCMM TA 631 / - Training 93 / 104 Commodities 270 / 15 Support Costs 30 / 321 Constr./Land 0 / 60 Evaluation 50 / 0 USC Overhead 349 / 0 Contingencies 77 / 0 Total 1,500 / 500 - TA, training, commodities and other inputs provided as scheduled.	- Review institutional budgets and space allocation for project activities. - Field visits. - Review of SNEM and UCMM program budgets. - Review of USC work plans; debriefings with short-term advisors; monthly meetings with Chief-of-Party; admin. review of vouchers - Trained UCMM and SNEM staff performing assigned duties. - Commodities needed to implement project arrive in the DR (receiving reports). - Evaluation report received.	- GODR budget support for SNEM remain at least at 1985-86 levels. - Requested funds are available.

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5(C) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE?	Yes
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?	Yes

A. GENERAL CRITERIA FOR PROJECT

1. FY 1986 Continuing Resolution Sec. 525; FAA Sec. 634A.

   A Congressional Notification was submitted on 06/05/86 per SD 07376 CN expires on 07/28/86

   Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project.

   Yes

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   Yes

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

   N/A

4. FAA Sec. 611(b); FY 1985 Continuing Resolution Sec. 501. If for water or water-related land resource construction, has project met the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See AID Handbook 3 for new guidelines.)	N/A
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N/A
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No, project is not susceptible to execution as part of a regional or multilateral project.
7. FAA Sec. 601(a). Information and conclusions whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strenghten free labor unions.	Agriculture, agro-industry and tourism industry will be strengthened through the applications of new vector control methods.

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8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprises).	A U.S. university will be the main participant in the program; all commodities will be procured in the U.S.
9. FAA Sec. 612(b), 636(h); FY 1985 Continuing Resolution Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The country is contributing 25% of total project costs.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	No, use of a non competitive cooperative Agreement was approved by the AA/LAC
12. FY 1985 Continuing Resolution Sec. 522. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A

13. FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests?	Yes
14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N/A
15. FY 1985 Continuing Resolution Sec. 536. Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral institution?	No
16. ISDCA of 1985 Sec. 310. For development assistance projects, how much of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?	Short-term technical assistance to be provided under the project may be from historically black colleges and universities.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance project Criteria

a. FAA Sec. 102(a), 111, 113, 281(a). Extent to which activity will (a)

	effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; (e) utilize and encourage regional cooperation by developing countries?	The Community will be encouraged to participate in the various vector control activities. The poor will be the main beneficiaries as they often live in rural areas of the country where malaria and dengue are endemic
b.	FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	Yes. Section 105
c.	FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving,	Project is directed at the development, testing and application of technologically appropriate mechanisms for vector control.

	labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	
d.	FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a relatively least developed country)?	Yes
e.	FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes, indirectly
f.	FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?	Yes
g.	FAA Sec. 381(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people	Only host country nationals

of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	will be trained in exchange for a committment to work for the sponsoring enterprise for a specified period of time. The two host country institutions participating will develop the institutional capacity to continue the work started under the project.
2. Development Assistance Project Criteria (Loans Only)	
a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.	N/A
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	
3. Economic Support Fund Project Criteria	
a. FAA Sec. 531(a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of part I of the FAA?	N/A
b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?	

c. ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction of, or the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such country is a party to the Treaty on the Non-Proliferation of Nuclear Weapons or the Treaty for the Prohibiton of Nuclear Weapons in Latin America (in the "Treaty of Tlatelolco"), cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States?

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

ANNEX D

(10) ACTION: AID-8
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E.O. 12356: N/A
TAGS: N/A
SUBJECT: VECTOR CONTROL-PROJ (5-0)

1. LAC CONCURS WITH PROCEEDING WITH THE PROJECT.

2. MISSION DIRECTOR IS AUTHORIZED TO APPROVE PID AND PP, AND AUTHORIZE THE PROJECT.

3. SELECTION OF THE UNIVERSITY OF SOUTH CAROLINA AS THE ASSISTANCE RECIPIENT IS APPROVED. SHULTZ
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República Dominicana

Secretaría de Estado de Salud Pública y Asistencia Social

"AÑO INTERNACIONAL DE LA JUVENTUD"

DSE 05032

Santo Domingo, D.N.

2 ABR. 1985

Sr. Henry Bassford
Director,
Agencia Internacional para
el Desarrollo -AID-
Ciudad

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Estimado señor Bassford:

La República Dominicana está enfrentando en la actualidad el reto del desarrollo económico y social y de mejorar las condiciones de salud de la población. Dentro de este último campo, tiene que enfrentar, con carácter prioritario, varias de las enfermedades transmitidas por vectores. La malaria amenaza recobrar, como lo ha hecho en Haití, la categoría de primer problema nacional de Salud Pública. El dengue hemorrágico epidémico y el síndrome de shock, ya ha afectado a Cuba y puede predecirse que alcanzarán al país en corto tiempo. El desarrollo de proyectos turísticos en zonas costeras próximas a áreas tocadas por las aves migratorias que transportan diversos arbovirus, demandan la adopción de medidas efectivas de control, que podrían afectar la ecología y engendrar resistencia a insecticidas en los artrópodos locales.

De igual modo, el incremento del regadío y de las represas para fines hidroeléctricos o agrícolas y la acuacultura, incrementará la población de vectores. Es natural pues el interés de la Secretaría de Estado de Salud Pública en el desarrollo de capacidad residente de un efectivo control de vectores que preserve los recursos productivos, presentes y potenciales, tanto los turísticos como en la producción de ostras, peces y crustáceos, en nuestras costas manglares.

Por las razones antes expuestas, solicitamos a la Agencia Internacional para el Desarrollo que evalúe cuidadosamente los proyectos que está desarrollando el Gobierno Dominicano, a través de las Secretarías de Estado de Agricultura y Salud Pública, conjuntamente con las Universidades Católica Madre y Maestra y de Carolina del Sur.

5022

Sr. Henry Bassford
Agencia Internacional para
el Desarrollo -AID-

ABR. 1985

El apoyo económico de la AID a estos proyectos, tiene en nuestra opinión, gran potencial de contribuir positivamente al desarrollo de empleos y mejorar la balanza de pagos del país, en tanto que mejora l condiciones de salud y de prevención de enfermedades.

Atentamente,

DR. AMIRO PEREZ MERA
Secretario de Estado de Salud Pública
y Asistencia Social

APM/mv

cc: Monseñor Agripino Núñez Collado
Dr. Andrés Peralta

54

UNIVERSITY OF SOUTH CAROLINA
COLUMBIA, S. C. 29208

April 2, 1984

PRESIDENT

lf DUE: 4-12-84
ACTION: AA/LAC coordinate w/AA/S&T fc McPherson signature
INFO: McPherson logs, AA/S&T, AA/PPC

The Honorable M. Peter McPherson
Director
Agency for International Development
Room 5942
Department of State Building
320 Twenty-First Street, N. W.
Washington, D. C. 20523

Dear Mr. McPherson:

The Dominican Republic and Haiti have the last remaining malarial problem among the Caribbean islands. To address this problem, a proposal was developed jointly by the University of South Carolina and the Universidad Catolica Madre y Maestra in consultation and with the full support of the Secretary of Health, Dr. Amiro Perez Mera. The proposed study entitled "Unsolicited Proposal for the Development of Programs for Control of Malaria, Vector-borne Disease and Technical Self-Sufficiency in the Dominican Republic" is a field of research study designed to reduce the incidence of malaria through a combination of chemotherapy and vector control. The proposal has been reviewed and approved by a panel of internationally known experts on malaria and vector control and a copy of their report is now annexed to the original unsolicited proposal. This proposed study can provide the field research component to the much larger proposal under consideration encompassing both the Dominican Republic and Haiti. It would also make it possible to begin almost immediately to control the expotential growth of the disease while the total island comprehensive project is under development.

Three weeks ago the Secretary of Health of the Dominican Republic, submitted the joint University of South Carolina - Universidad Catolica Madre y Maestra proposal to A.I.D. in the Dominican Republic. I would very much appreciate any assistance you could give us in determining the status of this proposal.

Sincerely yours,

James B Holderman

James B. Holderman
President

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S. Hougen 03/11/86
P.M.

REPUBLICA DOMINICANA

SECRETARIA DE ESTADO DE SALUD PUBLICA Y ASISTENCIA SOCIAL
SERVICIO NACIONAL DE ERRADICACION DE LA MALARIA
(SNEM)

TELEFONOS
2-2689 — 9-6770

DIRECCION CABLEGRAFICA SNEM
APARTADO POSTAL Nº 1303

Nº 246-86

Santo Domingo, D. N.
10 de julio, 1986

JUL 11 10 35 AM '86

Sr.
Lee R. Hougen, Dr. P.H.
Jefe de la División de Salud
y Población
Agencia para el Desarrollo
Internacional (AID),
Embajada Americana.

Distinguido doctor:

Atendiendo a sus requerimientos y en mi condición de Director del Servicio Nacional de Erradicación de la Malaria, me permito certificar que ésta institución se compromete a participar activamente en los puntos que figuran anexos; los mismos están formulados en el Proyecto de Control de Vectores que ha de ser realizado en el país bajo estrecha coordinación de las Universidades Madre y Maestra, South Carolina y el SNEM.

Creemos oportuno señalar que todo lo concerniente a viáticos y horas extras en el trabajo de campo deberán ser cubiertos por el citado proyecto.

Le saluda a usted, muy atentamente,

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Secretaría de Estado de Salud y Asistencia Social
Servicio Nacional de Erradicación de la Malaria
SNEM
República Dominicana

Dr. Delmin Cury S.
Director Gral. del Servicio
de Erradicación de Malaria y
Enf. Transmitidas por Vectores.

DCS/ebs.

56

c. Plan and carry out the procurement of commodities, and training of key UCMM and SNEM staff. Training will be a combination of in-country, in-service courses or activities, short courses in the US or other LAC countries, and two MS degrees at USC or other appropriate US universities.

2. UCMM Responsibilities

a. Provide the needed faculty and develop faculty expertise to conduct operations research.

b. Develop expertise of technicians and laboratory personnel needed to implement operations research under faculty guidance.

c. Establish a laboratory for operations research in vector-borne disease control.

d. Establish an insectary and other facilities needed to prepare, conduct and evaluate alternative methods of control.

e. Develop standard protocols for the technical social, economic and financial evaluation of selected control methods.

f. Conduct courses or other training events to assist trainers at SNEM to develop the necessary expertise in applied research, vector control, alternative methods of vector control and program evaluation.

3. SNEM Responsibilities.

a. Help to identify operational research areas needing special attention, e.g., mosquito resistance to insecticides, or effectiveness of control methods, and evaluate control programs in light of these findings.

b. Together with UCMM, develop alternative control methods that are effective and practical for application under conditions in the Dominican Republic.

c. Institute field trials of alternative control methods and evaluate their effectiveness and practicality for implementation in SNEM programs.

d. Develop the capability of SNEM staff to provide training in operational methods.

e. In earlier stages, establish guidelines or mechanisms for continued interchange and collaboration with UCMM, INFRATUR, the Secretariats of Health, Tourism and Agriculture, PAHO and other relevant agencies for the ongoing development of vector control strategies.

UNIVERSIDAD CATOLICA MADRE Y MAESTRA
VICERRECTORIA ACADEMICA
Santiago de los Caballeros
República Dominicana

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Agosto 27, 1986
VA-042-1-86/87

Sr. Henry Bassford, Director
Agencia Internacional para el
Desarrollo (AID)
Embajada de los Estados Unidos
de América
Santo Domingo, D. N.

Estimado señor Bassford:

Desde hace algún tiempo y ante la prevalencia en nuestro país de la malaria y de otras enfermedades transmitidas por vectores, la Universidad Católica Madre y Maestra, conjuntamente con la Universidad de Carolina del Sur y la Secretaría de Estado de Salud Pública y Asistencia Social, a través del Servicio Nacional de Erradicación de la Malaria (SNEM), ha venido elaborando un proyecto de investigación operativa, de adiestramiento y de tratamiento para someterlo a esa Agencia con fines de obtener financiamiento.

En interés de contribuir a la realización del Proyecto de Control de Enfermedades Transmitidas por Vectores, nuestra Universidad ha decidido aportar lo siguiente:

1. Proveer espacio físico en el complejo de laboratorios de la Facultad de Ciencias de las Ingenierías, en el campus de Santiago, para la instalación provisional de los laboratorios, insectario y oficinas del proyecto. Este espacio incluye un área de 15 x 15 metros (225 M^2) para los laboratorios; dos oficinas de 2.5 x 15 metros cada una y un depósito de 2.5 x 6 metros adecuado para el insectario. Toda el área dispone de servicios de agua, electricidad y teléfono y tiene, además, fácil acceso a la Biblioteca y a otras áreas de servicio de la Universidad. Dispone también de área de parqueo.

El espacio asignado estaría disponible sin costo alguno para el proyecto durante todo el tiempo de ejecución y mientras se construyan las facilidades definitivas del mismo.

Sr. Henry Bassford
Agosto 27, 1986
Página 2

2. Proveer espacio para el almacenaje de insecticidas y de equipos a utilizarse en el proyecto.

3. En su campus de Santiago, los servicios de contabilidad y de auditoría necesarios para el proyecto. Estos servicios incluirán el establecimiento de una cuenta bancaria separada con los fondos del proyecto, el establecimiento de un sistema de comprobantes de pagos del proyecto y la elaboración de cheques para gastos del mismo debidamente autorizados.

4. Los miembros del personal del proyecto tendrán acceso a las facilidades y al uso de la Biblioteca de la Universidad, sin costo alguno para el proyecto.

5. Al concluir el tercer año de ejecución del proyecto, la Universidad se compromete a asumir el pago de salario por un período de tres años de uno de los miembros calificados. Aceptamos en principio para esta posición al Lic. Andrés Zaglul, pendiente de la evaluación de sus credenciales por las autoridades académicas de la Universidad. Asumimos también el compromiso de reanudar el pago del salario de la profesora Rosario Granados de Veras al concluir el tercer año del proyecto. Una de estas dos personas asumirá en ese momento la posición de Director del Programa de Control de Vectores en la UCMM. El candidato deberá poseer el grado de maestría en Ciencias y haber realizado, además, una labor satisfactoria durante la ejecución del proyecto.

6. La Universidad, en su campus de Santiago, aportará el terreno para la construcción del edificio para alojar las oficinas, laboratorios y el insectario del proyecto.

Estas facilidades deberán ser construidas con fondos del proyecto. La Universidad cubrirá los costos de los servicios de agua y de electricidad.

Queda entendido que el proyecto cubrirá con sus fondos los compromisos siguientes:

a. El pago, durante los tres años de ejecución del proyecto, del salario de la profesora Rosario Granados de Veras y de los aumentos a los cuales sea acreedora de acuerdo con el Reglamento de Profesores y de Carrera Docente de la Universidad.

Sr. Henry Bassford
Agosto 27, 1986
Página 3

b. El pago de los salarios de los técnicos de laboratorio, estudiantes graduados y de cualquier otro personal asignado al proyecto durante los tres años de ejecución del mismo.

c. El pago de la construcción de un insectario y de cualquier facilidad necesaria a los propósitos del proyecto.

d. Esforzarse, dentro de las posibilidades del proyecto, para fortalecer las facilidades de la Biblioteca de la UCMM, mediante la adquisición de libros, revistas y de cualquier otro material bibliográfico o de equipo relacionados con el control de enfermedades transmitidas por vectores y otros tópicos relacionados al proyecto.

Esperamos contar con la confianza de ustedes en la capacidad de nuestra Institución para participar en la ejecución de este importante proyecto. Nos es grato saludarlo.

Muy atentamente,

Ing. Renato Núñez Gil
Vicerrector Académico

/mga

cc: Mons. Agripino Núñez Collado
Rector

Universidad Católica Madre y Maestra
Vicerrectoría Académica
Santiago, R. D.

INITIAL ENVIRONMENTAL EXAMINATION

I. Project Location: Dominican Republic

Project Title and Number: Vector Control (517-0235)

Estimated Funding - LOP ($000): A.I.D. $1,500 (Grant)
G.O.D.R. $ 500

Life of Project: Three Years (FY 86-88)

Project Assistance Completion Date: September 30, 1989

IEE Prepared By: Lawrence T. Cowper, AID/W, S&T Health, Chief, Vector Borne Diseases;
Dr. Mac Tidwell, Director, Public Health Research, USC;
Lee Hougen, Chief, Health and Population Div., USAID/DR.

Date Prepared: July 3, 1986

Threshold Decision: Pursuant to the authority delegated to the USAID Director and based on an Initial Environmental Examination for the proposed use of A.I.D. project funds to support a targeted anti-malaria and dengue operational research program involving U.L.V. spraying, larviciding, source reduction and natural biological controls and assistance to the Dominican Republic's Vector Control activities as described herein, I recommend the following negative determination:

The proposed action is not an action which will have a significant effect on the human environment over and above that described below and is, therefore, not an action for which a more detailed Environmental Impact Statement or Assessment will be required under this project.

Mission Director's Concurrence:

Henry H. Bassford
AID Director

Date

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

I. Project Description

This project will provide technical assistance, support for applied research in malaria and dengue control, training, and limited commodities to assist the Government of the Dominican Republic to improve through increased operational research activities its nationwide malaria and dengue control programs. The project will provide funding to be used to help create a body of trained personnel capable of conducting operational research, and to test under Dominican conditions a range of environmentally neutral interventions in controlling mosquito-borne diseases, especially malaria and dengue fever. These efforts will enable the GODR to mount a more effective program of malaria and dengue control, focusing primarily on the rural population of the Dominican Republic, thus enhancing economic and social development in the fields of health and agriculture. The project will enhance the quality of the environment in those areas where source reduction and other environmentally desirable interventions replace insecticides in the conduct of the vector control program. Insecticides may continue to be used in the malaria and dengue programs, but these chemicals which have been used in Dominican Republic with no adverse effects in the past will be applied in a manner which is not detrimental to the environment. Health safeguards are presently in place in the field program for application of DDT and limited ULV spraying of malathion, and careful attention will be paid to training and supervision in the handling of additional insecticides which may be tested over the life of the project. The National Service for Malaria Control (SNEM) has applied limited organophosphorous (O.P.) insecticides previously without serious cases of insecticide intoxication.

All research carried out under this project will be governed by a research protocol approved by a Technical Committee. Environmental considerations will be an element in the approval process.

The proposed project relates primarily to limited applied field research, technical assistance and training and is categorically excluded from an EA or EIS.

II. Evaluation of Environmental Impact

A. General

The A.I.D. Environmental Impact Statement (EIS) included an in-depth review of the impact of malaria programs on the environment. The conclusions of the EIS were that the major insecticides used in world-wide malaria control programs such as DDT, malathion, and Abate have a favorable risk-benefit impact on the environment due to their method of application in public health programs, i.e. within the house structure. This project will apply standard application and dosage techniques for organophosphorous (O.P.) and chlorinated hydrocarbons insecticides only in limited, well-defined research areas. No new insecticides will be tested which do not have full Environmental Protection Agency (EPA) approval for the usage practice under study. One of the purposes of the comprehensive EIS submitted by A.I.D. and accepted by the Environmental Protection Agency (EPA) was to avoid duplicating

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environmental review efforts for projects of a similar nature in countries with comparable conditions. In addition, this project confines its activities of environmental importance to limited field research sites and no widespread application of any insecticide is proposed. All research will be carefully monitored by trained personnel. In the first year, the project will focus on collection of baseline entomological activities and vectoral capacity. After appropriate baselines have been established, approximately, 2-3 test sites covering up to 500 houses or less will be used to test standard mosquito control methodologies.

It has been concluded that the project will not have any significant impact regarding the change of the character or the use of the land or causing irreversible inefficient commitments of natural resources. The project interventions are limited to field research and should improve the ecological balance. As a result of this project, positive impacts will be made on health, sociocultural and economic sectors of Dominican Republic.

B. Insecticides Used in the National Malaria Control Program (SNEM)

1. Chlorinated Hydrocarbons (DDT)

The major insecticide procured by the GODR for its anti-malaria activities is DDT. While the A.I.D. project will not be procuring DDT for this program a summary review of its environmental implications is presented in this IEE.

The effectiveness of DDT as an insecticide was discovered in 1939 but it was first synthesized in 1874. Initially it was used to protect military areas and personnel against vector borne disease such as malaria and typhus. In 1945, DDT was released for commercial use. Use in the U.S. increased until 1959 and then declined gradually. Concern developed in the late 1960's that DDT might have adverse environmental effects not previously expected. However, in developing countries of the world where malaria was a serious problem, the continued use of DDT was necessary.

In January of 1971 a statement entitled "The Place of DDT in Operations Against Malaria and Other Vector-borne Diseases" was presented at the forty-seventh session of the executive board of the World Health Organization (WHO). The statement points out that DDT is being replaced for control of many vector-borne disease by other insecticides and the use of DDT is declining. However, for the present, no economic alternative to DDT is available and the epidemiological, operational, and financial consequences of the withdrawal of DDT would be very grave. The statement reviews the effects of DDT on man and wildlife and discusses environmental contamination from its use in anti-malarial campaign. It concludes that:

a. "Indoor spraying of DDT in routine anti-malarialoperations does not involve a significant risk to man or to wildlife. The withdrawal of DDT from the malaria programmes would be fraught with great danger and is

unjustifiable in the light of present knowledge. The Organization should do everything in its power to ensure that DDT remains available for this purpose.

b. Outdoor use of DDT should be avoided as far as possible.

c. Further research is needed on substitute insecticides."

The use of DDT in the Dominican Republic anti-malaria program is confined to spraying the inside of houses and other buildings at the rate of 2gm. per sq. meter. In this situation it appears that only insignificant amounts will get into the environment utilized by wildlife and the relevant consideration must be the possible effects on humans.

The environmental impact of using DDT in malaria control programs has been thoroughly considered by AID, the Pan American Health Organization (PAHO), and the U.S. Public Health Service as well as by the GODR. These agencies are all in agreement that DDT is the safest and most effective insecticide for use in malaria control and does not threaten the environment when it is applied by the standardized methods recommended by PAHO and A.I.D.

a. The DDT is sprayed only on surfaces where it will not wash away, i.e. on the inside walls of houses and on sheltered areas of adjacent buildings. Thus, it is unlikely that any appreciable amounts of DDT can escape into the soil and subsequently into groundwater or streams. In the Dominican Republic, the existing GODR malaria control effort (funded by GODR) calls for two applications of DDT applied each year at a rate of two (2) grams per square meter which is the standard dosage in malaria control program.

b. DDT is characterized by low volatility and none of it escapes into the atmosphere.

c. Regional and Washington-based PAHO advisors are available to ensure proper spraying and storing of the DDT.

d. DDT will only be used as a residual spray and it is not to be applied in any other manner.

In a WHO publication entitled, "The Place of DDT in Operations Against Malaria and Other Vector-Borne Diseases," an assesment of

environmental contamination from the use of DDT in antimalarial operations is given as follows:

> "Whereas damage to wildlife has sometimes followed the application of DDT in agricultural and forestry practice, the same risks do not now accompany the use of DDT in anti-malaria operations. Since the vast majority of the DDT used in the control of malaria is applied as a residual spray indoors, only a small fraction of the insecticide is likely to involve any direct contamination of the environment. This, however, may take place during the process of spraying the houses with DDT, when a certain amount of contamination of the floor and immediately surrounding soil outside does take place. Some measurements have indicated that about 6% of the spray is deposited on the floor inside and some 2% on the outside soil around the houses. The deposit outside houses, if calculated for rural areas with an average of 100 inhabitants per square km., as in parts of tropical Africa, would amount to a DDT input of 10 gm per hectare, it will be seen that this is 200 times less than a standard DDT application of 2 kg. per hectare as employed on cotton crops. Moreover, whereas only one or two applications are made to houses per year, multiple applications are made to cotton during its growing season. The DDT sprayed on the inside walls and falling to the floor is held by those surfaces. Hence, provided the insecticide is used indoors as in the case of anti-malaria operations, it would appear that there is little possibility of the insecticide contaminating the surrounding local vegetation and water sources that would endanger wildlife."

Since the use of the DDT in the Dominican Republic's malaria control program is exclusively used as a residual on the inside of buildings and it is not used as a larvicide, the amount getting into the outside environment is minimal. Nevertheless, since DDT has aroused considerable controversy and emotion, a brief review of some environmental effects is presented. DDT tends to persist in the environment for relatively long periods of time and does accumulate in the tissues of animals and concentrations tend to magnify in some organisms over a period of time. DDT in soil has an average half life of three (3) years (Edwards, 1973). In Maryland occasionally cropped soil had 40% of the DDT applied after 17 years (Nash and Woolson, 1967).

At the present time vast amounts of literature exist on the effects of DDT on the environment. A review of the total literature is not practical here but the following presents the essential elements of it. There is widespread disagreement over the use of DDT and it has been banned in a

number of developed countries even though scientists favor continuation of its essential uses. In the United States DDT is banned but is allowed when necessary to protect human health. It was used in California in 1976 for control of plague (R.F. Peters, Pers. Com.).

Because of the overriding necessity for DDT in malaria control it is still used in the Dominican Republic for that purpose. However, because of reported serious adverse effects on some forms of wildlife, notably fish and some birds, the use of DDT in the Dominican Republic for malaria control is restricted to indoor residual spraying where the risk of exposing wildlife is extremely limited. There has been limited DDT resistance reported (Dajabon) in 1984, but to date this insecticide is still considered the insecticide of choice.

2. Organophosphorous Insecticides (Malathion, Abate)

In addition to DDT, the GODR malaria program will be applying limited amounts of organophosphorous (O.P.) insecticides, malathion and Abate, in its field operations program in very limited areas of the country. At present, O.P. insecticides are only applied as ULV spray (malathion) in limited urban areas of three towns (Elias Pina, Dajabon, and Puerto Plata) as well as Santo Domingo and on occasion as a larvicide (Abate) in the Dengue Control Program.

Malathion has undergone several environmental examinations in connection with its use in A.I.D.-assisted malaria control efforts in Sri Lanka, Pakistan, India, Nepal, and Zanzibar. All of these environmental examinations have concluded that malathion as applied as a residual spray in malaria control programs does not adversely affect the environment provided that (1) strict compliance to A.I.D. specifications for malathion is enforced; (2) proper training and supervision of spray personnel is carried out; (3) adequate protective equipment is provided to spray personnel and (4) periodic cholinesterase testing is done on spray operation personnel. In this project, malathion may be used in residual or ULV applications only in limited test sites under strict research standards to test its usefulness under Dominican Republic conditions. There is no proposal to carry out any large scale applications of this insecticide as DDT is reported to be effective. Malathion is to be applied as a ULV application in the program over the project period in limited urban areas in an environmentally acceptable manner. Susceptibility tests carried out by SNEM and PAHO indicated that the mosquito vectors of malaria and dengue fever in the Dominican Republic are completely susceptible to malathion.

The larvicide, Abate, an organophosphate, is to be used occasionally on an ad-hoc basis as a control measure in the Dengue Control Program during the life of the project. This compound has been shown in studies to be low in toxicity if taken orally and applied dermally. Normal application concentrations of Abate in water under field conditions is about 0.5 ppm. Even if an adult were to drink the water treated directly and if 2

liters were consumed, the maximum amount of Abate imbibed daily would be about 1 mg. This compares with a dosage of 256 mg/man/day fed to human volunteers for 5 days and 64 mg/man/day for four weeks without clinical symptoms or side effects. Through the dermal route, Abate was found to be even less toxic. Abate has a short half-life, is not stored in the body, and produces no known chronic or residue effect. Abate offers little potential for harm to human health (Pg. 224, AID, EIS). This insecticide is widely used in Latin America for treatment of domestic waters in the control of Aedes mosquitoes and has proven very effective and safe.

It is planned to use Abate only in urban situations in domestic water containers at the test sites using several alternative approaches to control Aedes aegypti. It is proposed that the test sites be represented by approximately 50 houses where Abate will be applied under strict supervision. The test site is to be located in Santo domingo and careful entomological surveillance and evaluation will be done during the test period.

In addition to the safeguards for insecticides use already existing and being used in the malaria control service, the A.I.D. project is planned to provide experienced short term project funded consultants who will pay particular attention to matters concerning the specifications, storage, dosage rates and application of insecticides within the 3-5 test sites.

3. Biological Control

The project foresees the continued and expanded use of larvivorous fish in the project as a supplemental biological control measure in mosquito control in selected areas. At present, SNEM does use larvivorous fish, Poecilia elegans, in its limited activity in the Altagracia area on the East coast. It is planned to increase the use of larvivorous fish for this purpose in the operation. There are no plans to import non-indigenous larvivorous fish, but to use fish already established in the Dominican Republic in their malaria and mosquito control programs. The larvivorous fish, Gambusia affinis, will also be used in the project at the research sites. This species is already present in the Dominican Republic and can now be considered indigenous.

It is also possible that a biological larvicide, BTI, may be experimentally used in specific locations. There are no known adverse environmental implications to this compound and it rapidly bio-degrades in the environment. As a research project, BTI will be carefully evaluated if it is tried in the program and its use will be supervised by trained personnel.

Other biological controls are under consideration but all methods tested will be those methods used and proven effective elsewhere. There are no proposals to use experimental viruses, parasites or nematodes at any test site.

III. Discussion of Impacts

A. Land Use

The only proposed project activity which will effect land use is the draining and filling of mosquito breeding sites in selected research sites covering up to 2-4 villages under a program of community participation. Existing irrigation canals will be improved by cleaning to allow more rapid flow of water which will reduce mosquito breeding. No major changes in land areas are proposed and large mechanical equipment is not to be used in the drain and fill operations under this project.

1.c. Land Clearing: There will be no significant land clearing.

1.d. Changing Soil Character: The nature of the soils will not be affected.

2. Alteration of Natural Resources: No relevant impact.

3. Foreclosing Important Uses: The project will not introduce changes in the present use of the land except for improvements in canals.

4. Danger to Man or His Works: Project research sites will be evaluated to insure that they will not be subjected to landslides, floods, erosion, etc.

B. Water Quality

1. Physical State of Water: The project will only include research projects in areas where there is no danger of irreversible depletion or contamination of scarce water resources.

2. Chemical and Biological States: Groundwater sources and reservoirs will be protected from contamination during any of the research activities.

3 Ecological Balance: The ecological balance will not be significantly affected as the limited research sites will be carefully supervised by trained scientists under approved protocols.

C. Atmosphere Impacts

The traffic associated with this project will not significantly increase the noise level or air pollutants in the research areas.

D. Natural Resources

Due to the limited size of the proposed research areas, natural resources will be affected. There will be no adverse impact on wildlife or marine resources.

E. Cultural and Socio-Economic Impacts

The project will create the conditions for the establishment and growth of community development activities. Improved living conditions in the rural communities will assist in stemming the migration of rural inhabitants to urban areas. Community involvement and education is proposed at each research site.

F. Health Impacts

The provision of alternative and more cost effective disease control technologies will create an environment conducive to improving health conditions. The incidence of malaria and dengue will be reduced.

G. Other Impacts

No other environmental impacts or controversial environmental issues are foreseseen in relation to the proposed project research activities.

IV. Recommendation

In view of the above examination of the environmental issues of this project, a threshold decision for a Negative Determination is made for this project.

TECHNICAL ASSISTANCE PLAN

USC will provide long and short term technical assistance to SNEM and UCMM in vector control research and field application. The total cost of technical assistance is estimated at $631,000.

There will be one long-term advisor, who will serve as Project Coordinator, provide technical assistance to UCMM and SNEM in vector control research and field application, and administer project resources. The Project Coordinator will report to the Director of the USC International Center for Public Health Research or (in his absence) the Dean of the School of Public Health. Specific duties of the Project Coordinator will include:

- Providing technical and management support to the project to meet its stated objectives.

- With guidance from the advisory counsel, develop project guidelines, implementation plans and schedules.

- Act as a liaison between SNEM, UCMM, PAHO, AID and other relevant GODR agencies.

- Manage the project office, initiate and maintain communications, supervise office personnel and order supplies, approve payment for authorized expenditures, establish vehicle control and ensure maintenance of project equipment.

- Provide logistical and support services of short-term consultants as authorized by contract arrangements.

- Undertake field travel to work sites to ensure that baseline studies, control interventions and evaluations are progressing on schedule. Take necessary action to correct problems in project implementation.

The Project Coordinator must be bilingual in Spanish and English, physically able to undertake frequent and difficult field travel, have a minimum of seven years overseas experience in malaria and/or dengue vector control and a degree in Entomology, Biology or Parasitology. A Master's level degree or PhD in these areas or in health sciences will be given preference.

In addition to long term technical assistance, the project will finance 20 person/months of short-term technical assistance. Most of the short-term assistance will be provided in the first year of the project, and will cover the following areas:

1. Entomological Surveys at Specifc Test Sites

- Determination of natural infection rate with the ELISA technique for the detection of sporozoites in field-caught specimens.

- Determination of pesticide resistance levels in vector population.
- Determination of avoidance behavior to residual insecticides by vector populations.
- Determination of time and place of disease transmission.
- Determination of seasonal vector population densities.
- Determination of larval habitat and other bionomic information for vector species.

2. Control Interventions

- Determination of evaluation techniques to assess the effectiveness of control methods.
- Determination of the effectiveness of new biological and vector control agents, combinations of fish species, chemical consequences, source reduction and personnel protection.

3. Data Management

- Development of data processing systems for vector control.
- Development of data analysis and evaluation systems.
- Development of statistical analysis of vector control data.
- The development and application of computer models which use bionomic vector data to make manpower needs and cost projections for control interventions.

4. Epidemiology

- Develop entomological surveillance gathering systems for epidemiological information.
- Develop epidemiological evaluation systems.

5. Health Education

- Develop new health education approaches that would be compatible with the DR culture and social patterns.
- Develop evaluation systems to test effectiveness of health education programs.

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Qualifications and scopes of work for short term advisors are as follows:

1. Epidemiologist

- Will participate in the direction of the malariology course at UCMM along with personnel from SNEM and UCMM. Will present participants with new methodologies for the analysis of epidemiological data in vector-borne diseases. Will also participate in operations research activities.

2. Health Education Specialist

- Will assist in planning and developing training program for promoters and community leaders. This person will have had extensive experience in working with target groups in rural communities.

3. Toxicologist

- Will conduct laboratory and field testing for insecticidal resistance. The expertise of this person will include capability to conduct biochemical analysis of enzymes associated with physiological resistance. Will provide training in this area.

4. Mosquito Bionomics Specialist

- Will be responsible for analyzing basic vector behavior including behavior avoidance to insecticides. This person will determine transmission potential of vector species through studies involving daily and seasonal vector activity patterns and host/vector contact. Will identify vectors, identify breeding habitat and participate in training programs.

5. Vector-borne Disease Transmission Specialist

- Will evaluate vector's capability to transmit malaria utilizing the enzyme-linked immunosorbent assay (ELISA) technique for sporozite detection in mosquito collectors. Will demonstrate techniques to project staff.

6. Entomologist/Population Modeling Specialist

- Will develop an interactive predictive computer model and analysis system to evaluate control interventions for *Aedes aegypti*. Will demonstrate and teach these techniques in seminars and courses.

7. Vector Surveillance Specialist

- Will evaluate surveillance systems for population monitoring of vector species, and employ mark and recapture techniques and methods for detection or dispersal and longevity studies.

8. Entomological/Toxorhynchites Specialist

- Will develop a successful low cost system for the production of Toxorhynchites and establish techniques for field release of biological material under Dominican conditions. Will perform demonstrations for operational staff.

9. Biostatistician

- Will work with other scientists at the beginning of the project to ensure that the work is statistically sound. The biostatistician will return prior to the mid-project evaluation to aid in data analysis, and again near the end of the project to help in the final data analysis. The person should have had extensive experience in the analysis of field trials with Bti or other biologicals as well as experience with chemical field trials and evaluations.

10. Data Manager

- Health Administrator with knowledge of management of data. Person will instruct staff from SNEM and UCMM in the development of operational programs, analysis of data, and in methods to determine cost-effectiveness. Will participate during all three years of the project.

PROCUREMENT PLAN

Aside from technology used to apply residual insecticides, the Dominican Government and private research facilities lack the updated equipment, microscopes, and data management capability needed to research and field test vector control methodologies for malaria and dengue. Also, despite SNEM's remarkable vehicle repair effort, its vehicles are 1950's models, funds for spare parts and tools are short, and there is no vehicle replacement policy.

New and improved equipment is needed to allow SNEM and UCMM to carry out basic applications and evaluation of vector control techniques. Therefore, $285,000 of project funds will be allocated for commodity procurement ($270,000 in AID funds and $15,000 in counterpart funds).

Major procurements will be made three times during the LOP. During the first three months of the project (Phase One - Start Up), the first major procurement will be made, totalling $227,900 in commodities and shipping costs. Items to be purchased include vehicles, microscopes, spray equipment, insecticides and laboratory and office equipment and supplies. Also, in an effort to improve data management capability at SNEM and UCMM, uninterrupted power supply (UPS)-protected computer equipment will be purchased for both institutions.

In January-February 1987 (during Phase Two of the project), the second major procurement will be made, totalling $31,400. The major items to be procured at this time include laboratory equipment and supplies, insecticides, training equipment and office supplies.

During Phase Three of the project (Operational Research), the final major procurement will be issued, totalling $25,700. The major items to be procured at this time include laboratory equipment and supplies, insecticides, training equipment and office supplies.

Procurement List

		FY-1	FY-2	FY-3
1.	Vehicles	56,000		
2.	Microscopes	13,300		
3.	Spray equipment	25,600		
4.	Computer equipment	15,000		
5.	Lab. equipment & supplies	54,700	14,000	14,000
6.	Office equipment	20,000		
7.	Office supplies	4,500	3,500	3,700
8.	Training equipment	2,800	3,000	3,000
9.	Insecticides	2,000	7,900	2,000
10.	Shipping	34,000	3,000	3,000
	T O T A L	227,900	31,400	25,700

Detailed Listing		TOTAL
1.	Vehicles 3 vans and 5 motorcycles for sprayers	56,000
2.	Microscopes	
	a) 7 Compound w oil immersion	6,300
	b) 7 Dissecting w light	7,000
3.	Spray equipment 2 ULV Spray machines Leco, 12 ULV Lecon model PI, 7 Portable Swing fog (Curts or equiv.), 6 Hudson Compression Sprayers, replacement parts.	25,600
4.	Computer equipment 2 IBM PC or equiv., surge protector, printer, etc.	15,000
5.	Laboratory equipment and supplies Refrigerator, air conditioners, glassware, mosquito cages, collecting equipment, traps, test kits, misc.	82,700
6.	Office equipment Typewriter, furniture, file cabinets.	20,000
7.	Office supplies	11,700
8.	Training equipment	8,800
9.	Insecticides	11,900
10.	Shipping	40,000
	T O T A L	285,000

EQUIPMENT SUPPLIERS 1/
(In addition to those listed in Waivers)

Light Traps and Surveillance Equipment

John W. Hock Co.
P.O. Box 12852
Gainesville, Fla.
(or equal)

Entomological and Laboratory Supplies

Fisher Scientific
P.O. Box 4829
Norcorss, Ga.
(or equal)

Control Materials

Adapco, Inc.
P.O. Box 7218
Orlando, Florida
32854
(or equal)

1/ These suppliers have already been identified as low bidders in the competetive bidding process employed by the Center in its equipment procurements.

TRAINING PLAN

This project will provide US$197,000 ($93,000 in AID funds and $104,000 in counterpart funds) to finance long and short-term participant training, observational study tours, and short-term in-country training. Most of these funds will support training of SNEM and UCMM staff. Seven senior SNEM and UCMM staff will receive short-term training in Comprehensive Vector Control at USC. Three candidates will receive Master's degree training in Public Health (MScPH). An observation tour in the U.S. or Latin America will be offered to SNEM and UCMM staff, and a wide range of short-term, in-country training will be offered vertically through SNEM, particularly to its field supervisors and voluntary collaborators. Also, health workers throughout the country will receive training in malaria surveillance and vector control techniques.

Short-term, in-country training will also be offered to community leaders and persons in tourism and agriculture, to create within the business community an understanding of the contribution that adaptive research can make to their continued profitability and the nation's economic health.

1. Participant Training

This project will finance long and short-term overseas training and an observational study tour. All overseas training in comprehensive vector control provided to GODR personnel by PAHO will be taken into account and, when possible, taken advantage of. All PIO/Ps will be prepared by the USAID/DR Training Office.

a. Long-term participant training

Masters of Science in Public Health (MScPH) degrees in medical entomology and epidemiology will be provided to three professional-level personnel from SNEM (1) and UCMM (2). Training will take place at the University of South Carolina. USC offers a two-year MScPH degree with a concentration in vector-borne disease control. After the project ends, one of the trained people will direct the UCMM vector control operational research center.

Two of the graduate degree candidates will start their studies in June 1987. One of them, Andrés Peralta from UCMM, speaks English and, therefore, will not have to undergo intensive English language training prior to his enrollment in the USC program. The second participant, (Carlos Peña, a mosquito taxonomist working for the National Museum) does not speak English adequately and, therefore, will attend the intensive English course offered at the ICDA in Santo Domingo in November 1986. This five-month course will require Mr. Peña's full time attendance (8 hours/day). Also, his employer must agree to pay his full salary while in training. Alternatively, Mr. Peña may elect to be trained in Panama or Mexico instead of USC.

During the training period, the participants will spend six months of each year at USC and six months in the D.R., enabling them to play a major role in the project and prepare their theses in the D.R. At the end of their two years in training, they will return to USC for five days to defend their theses. Their schedule is as follows:

DATES	ACTIVITY
Nov. 1986 - Mar. 1987:	English language training for Carlos Peña at the ICDA in Santo Domingo.
June - Nov. 1987:	Begin Master's study at USC.
Dec. 1987 - May 1988:	Return to Dominican Republic to work with project and continue studies.
June 1988 - Nov. 1988:	Return to USC.
Dec. - May 1989:	Return to Dominican Republic.
June 1989:	Return to USC to defend theses.

The third participant, a biologist who will be hired by SNEM, will begin his/her studies at USC in September 1987. Since this participant has not yet been identified, it is not known whether s/he speaks English adequately. If s/he does not have adequate language capability, s/he may attend the ICDA course offered in Santo Domingo in March 1987 or, alternatively, may elect to be trained in Panama or Mexico instead of USC. The training schedule for this participant is as follows:

DATES	ACTIVITY
Mar. - July 1987:	English language training at the ICDA in Santo Domingo.
Sept. 1987 - Feb. 1988:	Begin studies at USC.
Mar. - Aug. 1988:	Return to Dominican Republic to work with project and continue studies.
Sept. 1988 - Feb. 1989:	Return to USC.
Mar. - Aug. 1989:	Return to Dominican Republic to complete studies.
Sept. 1989:	Return to USC to defend thesis.

b. Short-term participant training

Seven professionals from SNEM and UCMM will attend the six-week Comprehensive Vector Control (CVC) course offered once a year in Spanish at the USC International Center for Public Health Research. Two participants will attend the CVC course in September-October 1986, three more will attend the course in September-October 1987, and the last two will attend the September-October 1988 session.

c. Observational study tour

During April-May 1987, the Director of SNEM, one or more members of his senior staff and a UCMM faculty member will attend a three week observational tour of three Mosquito Abatement Districts (MADs) in the U.S., to exchange technical information and observe program activities. If visits to the U.S. cannot be arranged, the project may finance an observational trip to Latin American countries instead.

2. In-country training

A great deal of the training that will take place under this project will be done on-the-job, through the association of project personnel with specialists who will provide technical assistance (some 20 person-months in all) throughout the LOP. Nevertheless, to increase the skills and knowledge of SNEM personnel throughout the country (including field supervisors), SNEM's 4,000 community-level voluntary collaborators, thousands of health promoters (who at present play no role in the malaria control effort), other health workers, and personnel in tourism and agriculture, the training staffs of SNEM and other SESPAS agencies will be trained to conduct a series of short-term, in-country courses, covering such topics as vector control techniques, malaria surveillance and approaches to community education. Short-term courses that will be conducted in-country include:

a. Data Collection and Management in Vector Control. This four week course, provided by USC, will be given to 10 UCMM faculty and SNEM staff during the first year of project implementation.

b. Malariology. This two to three day seminar in malariology and the economic impact of malaria, will be offered by USC, UCMM and SNEM to forty physicians, other medical personnel and health educators (in conjunction with scheduled conventions attended by these professionals.)

c. Surveillance and Control of Malaria and Dengue. USC, SNEM, and UCMM project staff will offer this five-day course in surveillance and control of malaria and dengue three times during the LOP. Approximately 55 mid-level SNEM staff responsible for training and field supervision, will take this course (15 per class).

d. Malaria Control Interventions. This four-day course in vector control techniques will be offered three times during the LOP by SNEM staff who have been trained by a USC-UCMM-SNEM team. They will offer the course to 90 members of SNEM's field staff (30 per class).

e. Community Health Education. This two-day course will "train trainers" in community education. It will be offered three times during the LOP by USC-SNEM-UCMM project staff to SESPAS training personnel, who will then train rural health workers. The course is designed to create an understanding of vector control problems and methods of eliciting community participation.

f. Regional Seminars on Vector-Borne Diseases. USC, UCMM, and SNEM will offer three 1-2 day regional seminars throughout the D.R. to about 100 persons who work in tourism, agriculture and public health. Topics will include the epidemiology of dengue and malaria, control methods, and economic and social impacts of these diseases. These seminars will provide a means of meeting the recurrent costs of the research activities, by encouraging industries to use the operational research capability at UCMM and SNEM in the future.

PARTICIPANT TRAINING SCHEDULE

ACTIVITY	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1. Masters Degree Study:																																		
Andrés Peralta:																																		
- studies at USC										X	X	X	X	X	X							X	X	X	X	X	X							
- practice in DR																X	X	X	X	X	X							X	X	X	X	X	X	
- thesis defense																																		X
Carlos Peña:																																		
- ELT at ICDA			X	X	X	X	X																											
- studies at USC										X	X	X	X	X	X							X	X	X	X	X	X							
- practice in DR																X	X	X	X	X	X							X	X	X	X	X	X	
- thesis defense																																		X
SNEM candidate:																																		
- ELT at ICDA							X	X	X	X	X																							
- studies at USC													X	X	X	X	X	X							X	X	X	X	X	X				
- practice in DR																			X	X	X	X	X	X							X	X	X	X
- thesis defense																																		
2. Short-term overseas training (CVC)																																		
2 participants	X	X																																
3 participants													X	X																				
2 participants																									X	X								
3. Observational Study Trip								X	X																									

IN-COUNTRY TRAINING SCHEDULE

ACTIVITY	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
Data Collection (4 weeks)										X																									
Malariology (2-3 days)													X						X																
Surveillance and Control (5 days)											X					X						X													
Vector Control Interventions (4 days)												X					X							X											
Community Health Education (2 days)					X									X						X															
Regional Conferences (1-2 days)											X							X							X										

PROJECT ANALYSES

I. Technical Feasibility

1.1 Background

This project is designed to support a wide variety of malaria and dengue control operational research measures which will enhance the operational impact and efficiency of the Servicio Nacional de Erradicación de la Malaria (SNEM) and increase the vector control research capabilities of the Universidad Católica Madre y Maestra (UCMM). While malaria control is far more technically complex than malaria eradication, the basic methodologies of malaria control are similar to those used in eradication programs. The difference is in how these methods are used to direct and evaluate operations. This project emphasizes increased field operation research and analysis to guide malaria and dengue control operational decisions on the part of the SNEM Director and his senior staff and to provide to SNEM and UCMM staff operational research experience and support which will provide the basis for implementation of alternative control measures and future research activities. Program operations rely on (1) continual stratification of the malaria program, using a range of epidemiologic, entomologic and other data; and (2) the application of a variety of control measures, as dictated by the stratification, results of the operational research and the resources available to control malaria and dengue.

The discussion below describes the technical and operational feasibility of applying the project's various operational research activities and their specific impact on the Dominican Republic's malaria and dengue programs.

1.2 Stratification of Operational Areas

A critical epidemiologic issue for malaria and dengue control is the setting of priorities for operations. The important factors determining priority are data on locations where transmission is occurring, the intensity and seasonality of transmission, measurements of mosquito vector density and inoculation rates, and estimates of the potential for intervention (e.g., insecticide and drug resistance, human population variables such as migration and accessibility), and measurements of the public health impact of malaria and dengue (e.g., estimates of morbidity and mortality). An epidemiologic data base is required for accurate stratification, and sufficient data are not presently available in the Dominican Republic. This project is specifically designed to provide accurate baseline data on mosquito bionomics to insure operational activitities are based on efficient and cost-effective interventions.

Using available malaria case reports, the SNEM program has identified areas of high priority based upon 1985 malaria incidence. The program is presently stratified into: (1) areas with indigenous cases only; (2) areas with imported cases only; (3) areas with only one indigenous case; and (4) areas with only one imported case. SNEM operational activities are varied based on this stratification but the principle control techniques are on use of residual spray and distribution of anti-malaria drugs.

The areas of highest priority to SNEM are those with indigenous cases reported within the malarious areas of the Dominican Republic (DR), yet these problem areas identified are in several provinces and considerable additional epidemiologic study is required to better stratify the malarious areas. However, the major malaria problem areas which have been identified are to be found in the provinces of Elias Piña, Pedernales, Dajabón (Haitian border) and La Altagracia (East coast). The project will specifically focus on these areas in carrying out its research activity. Efforts will be made to insure that the research methodologies are technically sound and will accomplish their purpose of obtaining baseline entomological data useful to SNEM.

The Dominican Republic malaria control organization (SNEM) understands and endorses the stratification concept and has demonstrated this understanding in preparing its Plan of Operations. SNEM is committed to stratification and to annual re-stratification over LOP to improve program quality and impact with expanded and improved data collection on entomologic, ecologic, climatologic, anthropologic and sociologic factors. This project will assist the SNEM in this complex process by providing accurate data, especially in entomology which can be used to develop appropriate interventions. Using the project's technical assistance component, SNEM personnel will be strengthened in epidemiology, field research, conduct of operational procedures and capacity to upgrade their in-house training. The project will make possible technically feasible and cost-effective malaria and dengue control assistance to SNEM and the GODR.

In order to insure progress in the program's development, an evaluation is planned in early FY 1988, approximately eighteen months after the initiation of the project.

This evaluation will provide additional guidance for operational research directions and planning which will assist the project in the future development of its research activities.

II. Technical Analyses of Relationship of Project Activities to Specific SNEM Operational Components

2.1 Surveillance System

Surveillance of malaria and dengue should be based on the

specific objectives of the national program: control of these diseases to a level where they are not major public health problems. Multiple, complementary data bases which include both entomological and parasitological information are required. Considering the acute need to define and deal with epidemic situations especially with dengue, accurate data and spot surveys will be required to set priorities. Existing surveillance and data available outside the SNEM network should be actively sought within the general public health structure. For long-term stratification and program assessment of malaria and dengue, a thorough and continual method for evaluation of epidemiologic activities is necessary. This project will provide scientific data through studies on mosquito bionomics to properly evaluate the present epidemiological situation and to plan for the future. This project also provides assistance in developing computer capabilities at both SNEM and UCMM which will improve the decision-making process by providing up-to-date epidemiological data in a timely fashion.

SNEM has basically two sources of malaria surveillance data--Active Case Detection (ACD) and Passive Case Detection (PCD). The collection mechanism includes not only the SNEM staff but also some 4,000 Voluntary Collaborators (VC). In addition, slides taken during epidemiological investigations also assist in defining the malaria problem. Accurate incidence data for dengue is practically non-existant, although data collection capacity is being strengthened through a recently approved USAID-assisted project which is specifically focused on dengue surveillance. The project here described interlinks directly with the dengue surveillannce project and complements its activities. Specific data on dengue is included at the conclusion of this analysis to present latest available data.

ACD accounts for approximately 80% of all slides collected by SNEM. In the DR, the classification of ACD slides includes not only slides collected by SNEM during village visits but also those collected by some SNEM personnel at health institutions during their 2-3 hours visits each day.

Actual Passive Case Detection (PCD) carried out by GODR health institutions outside SNEM is limited and SNEM derives the majority of slides classified as PCD from Volunteer Collaborators. It is estimated that less than 5% of the total slides collected are actually obtained through efforts of the personnel at PCD institutions.

Efforts are required to improve the relationships between the SNEM and these PCD institutions. This project will provide limited training and health education activities to integrate malaria and vector-borne disease control more closely into the general health structure through the presentation of annual workshops, seminars and conferences. Project plans are satisfactory and will increase general health service knowledge and participation in vector-borne diseases.

The Voluntary Collaborator (VC) network is a major asset to malaria surveillance and therapy activities in Dominican Republic, and it is one of the principal health services which has been extended to the community level. The VC network depends on close supervision, a reliable system of providing supplies of materials and medications, and prompt collection of blood slides and return of laboratory results. The VC network provides approximately 15% of all blood slides for SNEM. This project will investigate the possibility of using VC personnel in modest vector control activities at the village level. This objective is sound; such use of VC personnel is employed in a number of countries as a supplementary control measure. The results of this operational research are important for SNEM in developing possible future alternative control strategies which could make more effective use of community participation.

For long-term development of surveillance activities, emphasis must be placed on utilization of data derived from sources both from within and outside of SNEM. During this project, Primary Health Care staff, including village collaborators and personnel at fixed health facilities, will be strengthened through training and participation as appropriate in the operational research activities. The training plan includes a schedule and costs for such activities and is considered a sound approach.

2.2 Chemotherapy

There are three situations in which malaria drug therapy is indicated and will be provided by SNEM. The first and most important in terms of both generating local data on malaria cases and treating suspected cases is presumptive drug chemotherapy provided by SNEM personnel, the approximately 4,000 VCs attached to the SNEM organization and cooperating public health facilities. Treatment with chloroquine is provided to all fever cases arriving at VC post or health institution. Since all fevers are presumed to be malaria, the drug treatment is termed a presumptive treatment. Because of the special malaria risk to children under five and pregnant women, they may be provided with an additional appropriate dosage of chloroquine adequate to ensure a rapid reduction or elimination of the malaria parasites. In cases where malaria has been detected a course of full treatment is initiated. This more comprehensive drug regime is termed radical treatment. In addition to these two specific drug regimes, SNEM with SESPAS has organized Mass Drug Administration (MDA) campaigns to reduce malaria transmission in a number of areas. In MDA all, or as nearly as possible all, residents of an area are provided with drugs. This project does not plan to engage in SNEM programs of presumptive, radical or MDA treatament, but will be supportive of such actions as they occur in the research areas.

The distribution and use of anti-malaria drugs in the VC system is technically sound and feasible. Chloroquine, the drug of choice, is cheap, effective and has few side effects. Chloroquine is used to suppress symptoms; primaquine reduces the possibility of

transmission as it acts on the gametocyte forms of the malaria parasite. The single dose treatment of Haitian laborers as they cross into the Dominican Republic has been carried out by SNEM using 600 mgs. of chloroquine and 45 mgs. of primaquine as a single dose treatment. In 1986, this procedure is not being used as the officially contracted Haitian labor force is being at least temporarily terminated. Haitian laborers who choose to cross the border "informally" do not and have not in the past received the single dose treatment.

2.3 Evaluation of P. falciparum Drug Sensitivity

The project will not be engaged in operational research activities in chemotherapy and drug treatment.

2.4 Intradomiciliary Spraying

The DR has had more experience with residual intradomiciliary spraying than with any other malaria control intervention. Such operations have, in the past, been reasonably well planned, organized and implemented when adequate funding was available. While evaluation of results has not always been complete or performed on a timely basis, good evaluation is within the capabilities of the program. Residual spraying is to be tested selectively within the project with malathion and DDT as the insecticides of choice. Recent field studies in the DR have demonstrated that intradomiciliary spraying with these insecticides is suitable for malaria control in the country. The susceptibility tests for malathion indicate all known malaria vectors are susceptible. The vectors have also been determined to be generally susceptible to DDT, with some exceptions in the Dajabón area. The use of these control measures within the operational research study sites are considered technically sound and feasible, provided that:

a. The baseline studies indicate that the behavior pattern of the vector will be such that the testing of intradomiciliary insecticide residues will interfere to a significant degree with the transmission of malaria.

b. Safe application and handling practices are employed with the insecticide so that there are no significant problems of pesticide toxicity to program personnel nor to local populations, as determined by carefully organized and effective monitoring; and

c. There is frequent--preferably quarterly--entomologic evaluation of the efficacy of the study and spraying and of the sensitivity of anopheline populations to the insecticide.

The determination and assurance of these qualifications are within the technical and administrative capabilities of the project with the assistance of the SNEM organization. The project is

designed to train SNEM and UCMM in a number of interventions that will result in a continually improved and epidemiologically sound control operation. The project will assist SNEM to monitor mosquito populations carefully in order to identify the emergence of resistance to insecticides and any significant alteration in its behavior patterns. The project's mechanism for this monitoring is considered technically sound and will improve SNEM capabilities to detect early changes in vector behavior or response to insecticides. This SNEM activity is being strengthened by the addition of both technical assistance and training.

One of the priority operational research efforts the project will support is a series of trials of alternative insecticides and their usefulness for acceptable control. Demonstration of the efficacy of insecticides not presently used in the DR for malaria control would permit SNEM to develop future operational alternatives. Such research can be conducted on a limited basis by the project, with the assistance of SNEM and UCMM, and short-term technical assistance. The project has also specifically scheduled both training and technical assistance in mosquito resistance evaluation to both SNEM and UCMM personnel. Such experiences strengthen both institutions technically and provides direction for future vector control research planning and implementation.

2.5 Larviciding

This method is considered appropriate for use in the DR in urban, sub-urban and other selected situations to achieve reduction in malaria and dengue vector mosquito populations, but is not a SNEM program activity at present. Household water supply is often contained in large tanks, barrels and other temporary holding units and this makes ideal breeding sites for *Aedes aegypti*. Several methods of controlling this vector will be tested including larviciding. The project will provide data on the effectiveness of larviciding and its cost implications in a pilot study area. The proposed research is technically sound and can be carried out with the resources provided by the project within the 3-year time frame. The studies will also demonstrate to both SNEM and UCMM the proper protocols and field work required in testing such methodology.

2.6 Area Spraying (Adulticides)

The use of Ultra Low Volume (ULV) and fogging applications for control of adult vector mosquitoes is technically sound provided suitable insecticides are used, and if the application equipment used is correctly adjusted and operated. ULV Malathion applications have been carried out by SNEM in Santo Domingo and Dajabón in the past. However, entomological evaluations have been minimal and much more needs to be done in ULV evaluation. The SNEM program has six Leco or London Fog ULV machines of which three are reported as not

functioning. ULV technique is used for rapid reduction of vector densities and is cost effective under a number of conditions. The project includes technical assistance provision of two ULV truck-mounted machines, 12 backpack ULV sprayers and training in ULV spray operations. Conducted as planned, malaria and dengue control research activity using ULV technology selectively applied is technically sound. It is important to SNEM and UCMM to receive training and experience in scientifically evaluating the usefulness of this technique under field conditions.

2.7 Source Reduction

Source reduction (environmental modification) methods are considered technically sound contributors to malaria and dengue control, particularly as they provide for a permanent reduction in mosquito breeding sources. The environmental control through elimination of breeding sites (tin cans, metal junk, tree holes) is a standard method of *Aedes aegypti* control worldwide. Inclusion of these measures in a vector control program demands specific efforts by the program to identify, assess and correct situations which are suitable for this type of intervention. SNEM has in the past carried out such work with municipalities, but activity has been limited. With increased training and retraining of personnel as planned during the project, it may be feasible to expand source reduction activities. The project plans to encourage community participation in minor source reduction actions. Source reduction is technically sound provided that SNEM or project personnel guide and give supervision to such efforts. Such interventions using community assistance can be maintained beyond the LOP if guidance is provided by SNEM.

2.8 Biological Control

A number of biological control methodologies are being tested world-wide; they include the use of bacteria, viruses, and nematodes. Geneticists are also attempting to discover mechanisms for the control of mosquito reproduction. However, this project has no present plans to make operational application of any biological control except larvivorous fish, predator larvae (Toxorhynchites) and Bacillus thurigenesis -H-14 (BTI). The use of larvivorous fish appears to be an inexpensive, effective, and potentially community-based measure for reduction of mosquito populations in permanent breeding areas and irrigated rice fields. It is a sound, time-tested measure and further exploitation of the method is feasible for SNEM. SNEM has had experience with this methodology using *Poecilia elegans* in the past in the Punta Cana area. Additional fish breeding facilities, methods of distribution, and field studies evaluating the effectiveness in a variety of habitats are needed and are included in this project. The use of BTI and Toxorhynchites will be very limited at the research areas and standard methodology will be used in their application. A number of

worldwide vector control programs are trying to use BTI, but to date the results have been very mixed. It is technically feasible for SNEM to implement such biological control methods in their field programs if the project determines the usefulness of this measure over a wide range of ecological situations in the DR. Field research in additional biological methodologies is being considered within this project. SNEM is capable of doing these interventions in the post-project period if they are proven cost-effective, but would require some additional technical assistance and training in planning and evaluating these biological control activities.

2.9 Other Vector-borne Diseases

The project will not provide support to technical assistance, training and operational research dealing with other vector-borne diseases in the DR. There are no plans to prepare and implement field or laboratory research operations for any diseases under this project except malaria and dengue.

2.10 Training

SNEM provides a variety of formal pre-service and in-service training experiences within the DR for its senior and mid-level staff. The spray operation field personnel are given in-service refresher training after each spray cycle. A portion of the in-service training is done on a ad-hoc basis at zone and sector meetings. The development of an organized, focused effective training effort is a high priority activity in the project. The project's training plan is considered technically appropriate and feasible.

The project plans to put approximately $197,000 into training support. The training is aimed primarily at developing malaria and dengue control entomological and research skills, but training experiences are also being scheduled for health education and operational skill development. The project plans to train up to 20 senior SNEM and UCMM staff in vector-borne diseases, which includes basic vector disease knowledge, alternative control methodologies and operational research skills. In order to develop more in-depth knowledge of vector-borne diseases, two candidates will be given an opportunity to obtain master's degree training in Public Health (MPH). Observation tours within the Latin-American Region and the U.S. are scheduled for a variety of SNEM officers to allow a more hands-on approach to vector control training. Attention is to be given to the needs for in-country training for the Voluntary Collaborators. The project's training efforts will be interlinked with training activities of PAHO to insure coordination of activities.

The training provided by the project is considered directly in accord with SNEM's needs and is directly in support of both SNEM's and the Project's objectives. The training schedule proposed by the project are ambitous, but realistic over LOP. (See Training Plan - Annex I).

2.11 Health Education

Health education designed to increase the understanding, cooperation, and participation of the people at the community level is as important as the technical operations of vector control, case finding, and treatment. Because it is relatively difficult to achieve results in this area, health education is often neglected in vector control programs around the world; the DR has been no exception. SNEM leadership, at the national level and in the provinces, recognizes the importance of health education and is attempting to strengthen that component of their program.

The SNEM utilizes a variety of educational techniques such as participation in village organizations, as well as direct contact by SNEM field workers to communicate program objectives, procedures, and schedules to the community. SNEM feels that these efforts have succeeded in creating villager acceptance, and to some extent, understanding of the program. A limited systematic effort is to be undertaken during the Project to study and change villagers' attitudes and practices through operational research, training of village collaborators and working with key community and government leaders.

This project will provide short-term consultation in health education to improve in-country training and funds for operational research to study community knowledge, attitudes and practices in relation to malaria and dengue. This health education activity is modest, but will result in a considerable local improvement in the management of health education functions within SNEM, and increased community awareness of the program over the LOP in the research areas. It will also provide experience to the UCMM faculty in community development.

2.12 Operational Research

Operational research, as opposed to basic research, constitutes those activities which are conducted to identify control problems to determine operational priorities, or to define problem solutions or effective interventions. Operational research does not include epidemiologic surveillance and evaluation of on-going operations. The operational research in this project is designed to generate knowledge and experience, on the basis of which control programs can be designed, conducted and/or improved.

It is clear that new approaches must be undertaken if SNEM is to improve its conduct of malaria and dengue control programs building on past experiences but not being limited by those experiences. It is possible to list many operational research topics which could be pursued productively. The following are, however, among the priority issues which are to be addressed and are being included in the project:

(a) Vector Bionomics

Evaluation of behavior avoidance to insecticides, insecticide resistance, transmission potential, identification of breeding habitat, man-vector contact and other factors will be studied.

(b) Alternative Methods of Controlling the Vectors of Malaria and Dengue

Exploratory use of biological control methodology, such as larvivorous fish use of Toxorhynchites predator larvae and BTI. There will also be trials of combined biological and adulticide (ULV) measures in control of Aedes aegypti areas of Santo Domingo.

Increasing use of source reduction and water management techniques.

Possible promotion of individual physical barrier methods such as bed nets in the trial areas.

(c) Epidemiology and Surveillance

Stratification: determination of epidemiologic variables whichwill be of assistance in the prioritization of malarious areas according to malaria endemicity and control potential. The project's field trials will indicate useful variables which may be considered in stratification.

Computer-based data management to e able rapid and precise analysis of epidemiologic data. This will be aided by the project through the provision of technical assistance, equipment and training.

(d) Field Trials of New Insecticides, including Larvicides

Testing of new or presently unused insecticides in the DR in pilot situations to determine residual and operational characteristics.

Use of new larvicides, especially for control of Aedes aegypti.

(e) Socio-Cultural Studies of Malaria

Knowledge, attitudes, practices (KAP) related to malaria, stratified by geographic, cultural, racial variables within the research areas.

(f) Quantification of migration among areas of differing malaria transmission levels in the two-three field operational research sites included in the project.

All these operational research efforts are technically feasible and can be tested over the LOP. It would appear that the use of larvivorous fish will be the method of choice for SNEM's operational program in the post-project period due to its acceptable environmental impact, cost, public acceptance, community participation aspect and effectiveness as a supplementary measure of control.

2.13 Long-Term Sustainability and Impact

If succesfully executed, the project will have assisted SNEM to move substantially forward in its transition from a vertically organized program emphasizing total coverage house-spraying and active case detection surveillance methods to an integrated program utilizing a selective mix of vector control measures and a better balance between active and passive case detection and treatment methods, for malaria, and also for other vector-borne diseases. Progressive reduction of malaria transmission by vector control and drug treatment for humans may reduce the geographical area to be actively controlled, thereby reducing the administrative and financial costs of the program. Successful execution will depend on a number of key variables, including vector resistance to the OP and chlorinated hydrocarbon insecticides, epidemiologically accurate direction of spray operations, cooperation and participation of the general public and general health services staff, reduction in P. falciparum malaria, collaboration of municipal authorities, and expanded use of feasible alternative control measures which are the result of operational research, increased training and technical assistance inputs.

An important impact from the standpoint of government administration will be significant savings from not having to continue to import large quantities of expensive insecticides. The long-term impact on social and economic development will be substantial in terms of reduced morbidity (and infant mortality) and increased productivity.

The project will also provide to UCMM the basis for additional vector control capabilities with the establishment of a laboratory and an insectary, training of key and support personnel in medical entomology as well as research methodology and in-depth, hands-on field experience.

3.2 Summary

The project is judged to be technically feasible and sound. The project design provides appropriate and sufficient technical assistance and training and includes a suitable mix of operational and baseline research which will enable the GODR to implement, through the SNEM and UCMM organizations, innovative and technically sound approaches to malaria and dengue control.

Table I

COST COMPARISON OF FIVE COMMONLY USED LARVICIDES - BASED ON WEEKLY APPLICATIONS

Larvicide	Formulation	Approximate Cost US$/kg	(L/kg Ha) Dosage	Approx. AI Cost $/Ha
1. Oil + 5%	-	.25 L	80 L	20.0
Spreader	-	.50 L	.4 L	20.2
2. Flit MLO	-	.32 L	18.7 L	6.0
3. Paris Green	50% powder	1.0 kg.	1 kg.	2.00
4. Temephos	EC-50%	19./ L	.111 kg.	4.22
(Abate 500-E)	SG-1%	1.65/kg.	.111 kg.	17.00
5. BTI	Sandoz	3.50 L	1-5L (5)	17.50

SG = Sand granules
AI = Actual insecticide
EC = Emul. concentrate
Sandoz = Trade name

Note: Paris Green is environmentally questionable due to persistance (PG).

Table II

COST ESTIMATES OF FIVE ALTERNATIVES OF MOSQUITO CONTROL IN A VILLAGE

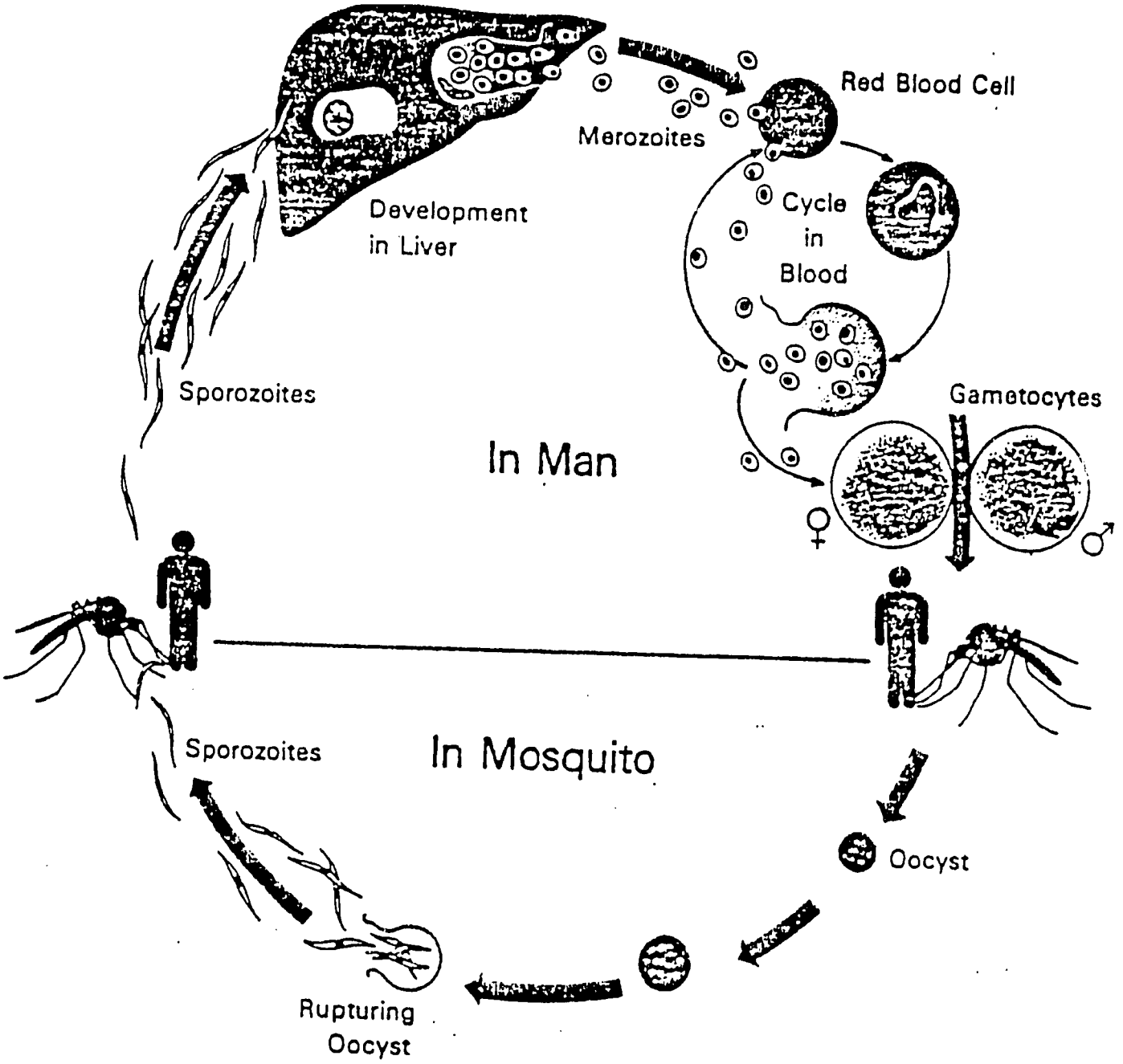
Given: Village pond, could be filled, drained, houses (50) can be screened, earth available, laborers available. There are alternative water sources. Filling costs $6,400.

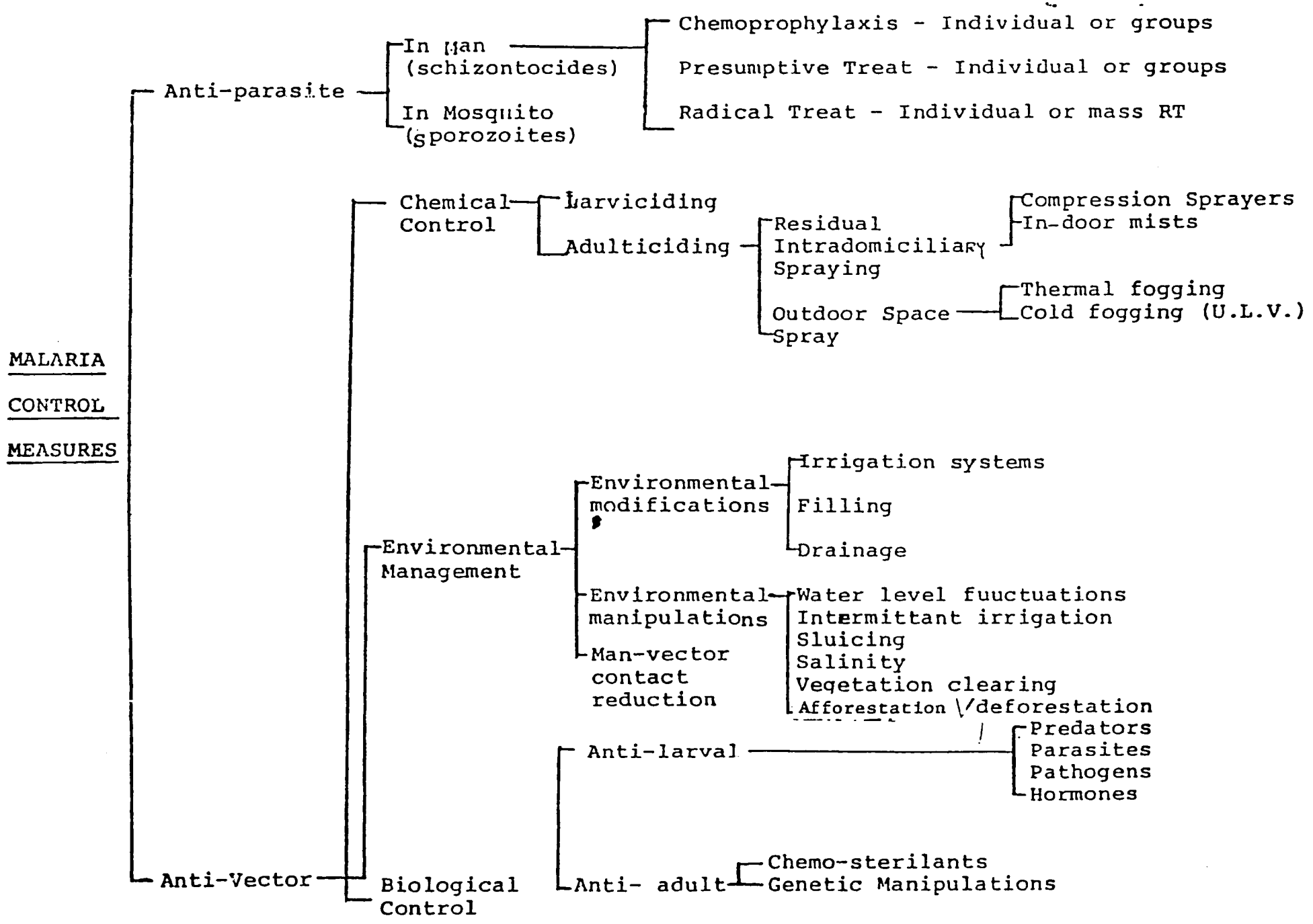
ITEM	Drain	Mosquito Proofing	Fill	Cut-fill + Larvivorous Fish	Larvicide
1. Capital Cost	5,200	10,000	6,400	3,500	-
2. O&M	100	1,000	-	260	12,000
Interest	520	1,000	640	350	-
Amortization	91	175	112	61	-
3. Total Annual Cost	711	2,175	752	671	1,200
4. Effectiveness	95%	80%	100%	90%	90%
5. Cost/ Effectiveness (AC / % Effectiveness)	748	2,719	752	746	1,333

Conclusion: Drainage, filling and cut and filling plus larvivorous fish have about the same cost effectiveness.

: Other considerations -- social acceptance--
All cost-effective techniques acceptable.

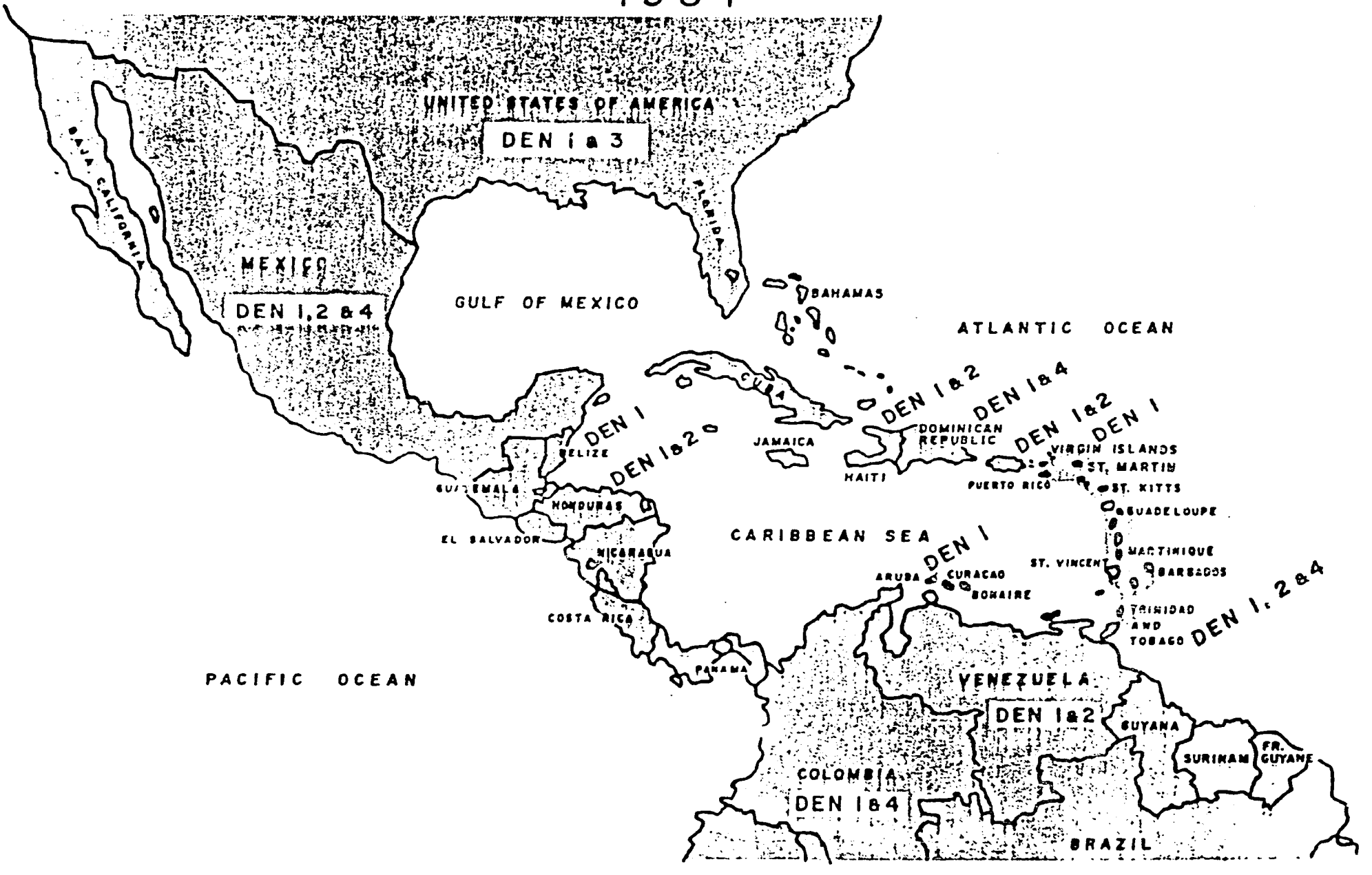
Malaria Life Cycle




MALARIA CONTROL MEASURES
Anti-parasite
In Man (schizontocides)
In Mosquito (sporozoites)
Chemoprophylaxis - Individual or groups
Presumptive Treat - Individual or groups
Radical Treat - Individual or mass RT
Anti-Vector
Chemical Control
Larviciding
Adulticiding
Residual Intradomiciliary Spraying
Compression Sprayers
In-door mists
Outdoor Space Spray
Thermal fogging
Cold fogging (U.L.V.)
Environmental Management
Environmental modifications
Irrigation systems
Filling
Drainage
Environmental manipulations
Water level fuuctuations
Intermittant irrigation
Sluicing
Salinity
Vegetation clearing
Afforestation \/deforestation
Man-vector contact reduction
Biological Control
Anti-larval
Predators
Parasites
Pathogens
Hormones
Anti- adult
Chemo-sterilants
Genetic Manipulations

DENGUE IN THE AMERICAS

1984



Reported Cases of Dengue in the Americas by Country, 1984*

Country	Date of last reported case	Cumulative total total for year	Virus Serotype
Aruba	December	?	DEN-1
Barbados	December	63	
Belize	December	137	DEN-1
Colombia	December	?	DEN-1,4
Dominican Republic	June	260	DEN-1,4
El Salvador	September	462	
Guyane	December	Sporadic	
Grenada	December	3	
Guadelupe	December	339	
Haití	September	328	DEN-1,2
Honduras	December	378	DEN-1,2
Jamaica	December	12	
Martinique	December	Sporadic	
Mexico	December	27,312	DEN-1,2,4
Puerto Rico	December	1,872	DEN-1,2
St. Christopher - Nevis	December	1	
Trinidad & Tobago	December	31	DEN-1,2,4
U. S. A.**	December	67**	DEN-1,3
U. S. Virgin Islands	December	72	DEN-1
Venezuela	December	?	DEN-1,2
Total		31,337	DEN-1,2,3,4

*Information reported:

Pan American Health Organization, Washington, D. C.; Caribbean Epidemiology Center, Port of Spain, Trinidad; Pasteur Institute, Cayenne, French Guiana; Instituto de Salubridad y Enfermedades Tropicales, Mexico City, Mexico; Gorgas Memorial Laboratory, Panama City, Panama; Instituto Nacional de Salud, Bogotá, Colombia; Instituto Nacional de Higiene "Rafael Rangel," Caracas, Venezuela; Puerto Rico Health Department, San Juan; San Juan Laboratories, Division of Vector-Borne Viral Diseases, Center for Infectious Diseases, Centers for Disease Control.

**Imported cases only.

DENGUE IN THE AMERICAS
1982

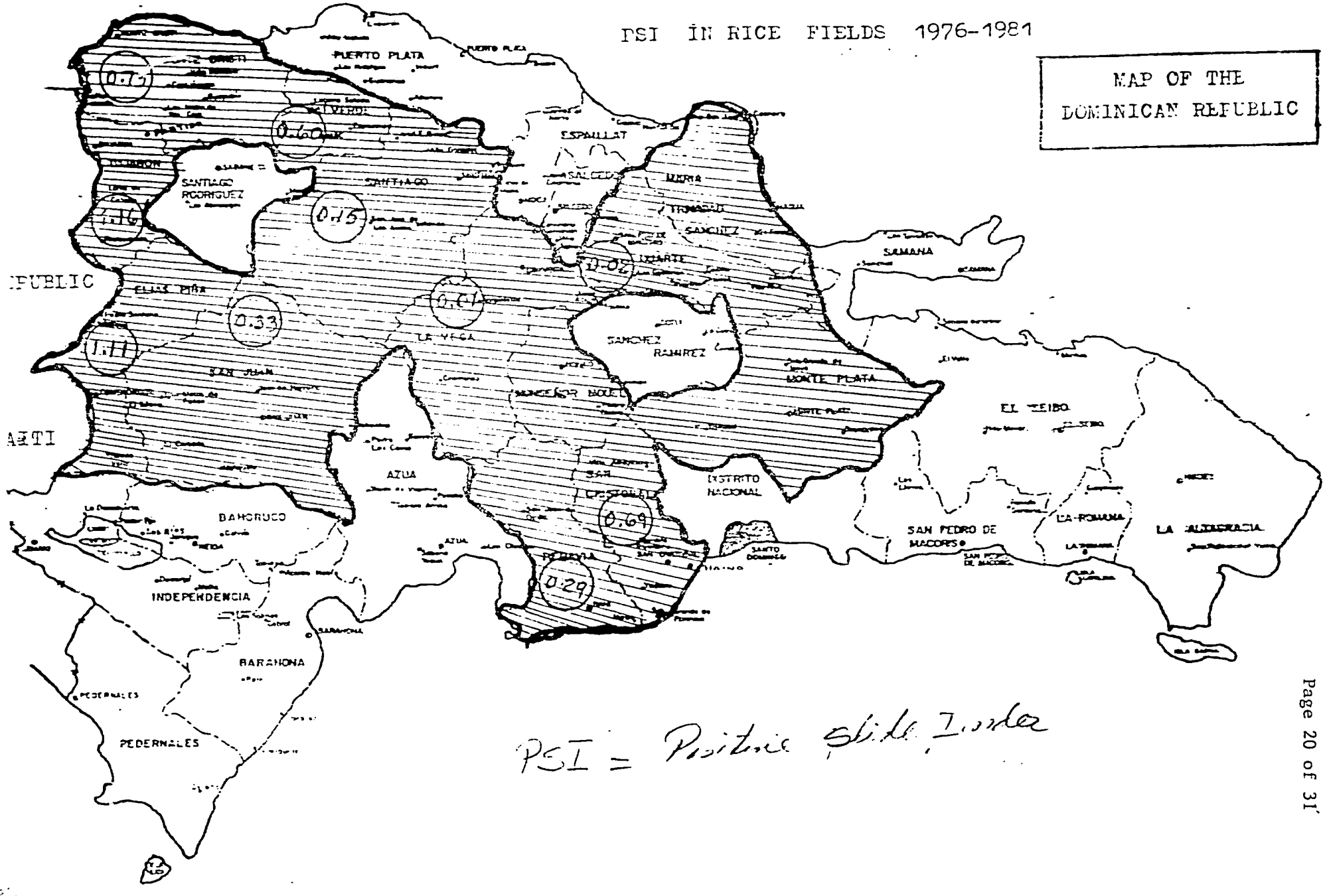
Reported Cases of Dengue in Countries of the Caribbean Basin, Central and South America, 1982*

Country	Date of last reported case	Cumulative total for year	Virus Serotype
Antigua	October	25	
Barbados	December	99	Den 4
Belize	December	482	
Brazil	May?	?	Den 1 & 4
Colombia	October	6,537	Den 4
Dominican Republic	November	435	Den 4
El Salvador	December	5,095	Den 4
Grenada	November	7	
Guadeloupe	December	Sporadic	
Guatemala	December	33	
French Guyane	December	Sporadic	Den 4
Haiti	December	215	Den 1
Honduras	December	1,217	
Jamaica	December	21	Den 2 & 4
Martinique	December	Sporadic	Den 4
Mexico	December	30,904	Den 1 & 2
Puerto Rico	December	4,141	Den 1 & 4
St. Lucia	November	31	
St. Vincent	September	1	
Suriname	December	25?	Den 1 & 4
Trinidad and Tobago	December	12	Den 1,2 & 4
USA**	December	144	Den 1,2 & 4
Total		49,424	Den 1,2 & 4

*Information provided by:
Pan American Health Organization, Washington DC; Caribbean Epidemology Center, Port of Spain, Trinidad; Pasteur Institute, Cayene, French Guyane; Instituto de Salubridad y Enfermedades Tropicales, Mexico; San Juan Laboratories, DVBVD, CID, CDC.

**Imported cases only.

PSI IN RICE FIELDS 1976-1981



PSI = Positive Slide Index

OPERATIONAL RESEARCH

I. Aedes aegypti

A. Purpose

The purpose of this portion of the project is to determine the feasibility of developing practical integrated control intervention(s) for the reduction of the Aedes aegypti vector population below dengue transmission thresholds. Working in conjunction with research staff at UCMM and control staff in SNEM, the project will encompass research efforts and provide training in Aedes aegypti bionomic baseline data collection control techniques and operational methods. The project will also investigate and evaluate emergency dengue control procedures.

B. Approach

1. Establish baseline data on Aedes aegypti habitat, production distribution, etc.

   a. Survey of breeding containers in selected study areas. All breeding containers will be identified and typed.

   b. Determine mosquitoes' productivity for container types, utilizing various techniques. Larval densities will be estimated weekly. Pupal counts and/or 24 hr. collections of emerging mosquitoes will be made from 25 randomly selected containers at each study area.

   c. Determine adult mosquito populations in study area utilizing landing rate counts. At least one 24 hr. count from 2 people will be made to determine periods of highest biting frequencies. A weekly examination of one oviposition jar per premise for egg counts and UV-Fay-Prince traps for 24 hour adult collections will be employed.

2. Using the same sampling methods as above, evaluate interventions procedures for effectiveness and cost in reducing Aedes aegypti population in study areas.

3. Compare exposure rates of dengue susceptible human populations in intervention areas and in comparison control areas. This phase will be done in collaboration with the SESPAS Dengue Virus Surveillance project.

C. Methods

Five areas of approximately 100 hectares each (A,B, C, and D) will be

selected. Baseline data will be acquired by selecting 100 premises at random in each site within a buffer area and counting number and type of mosquito breeding containers. On 25 premises the container types will be analyzed for the productivity of Aedes aegypti. Adult densities will also be monitored at these 25 premises using 1 hour landing rate counts during periods of peak activity. In addition to oviposition jars, UV-Fay-Prince traps will be used for monitoring natural population fluctuations. These data will be correlated to the container productivity four times over 14 days prior to employment of interventions, The relationship among traditional Aedes aegypti population indices and the data obtained will be assessed.

Area A

Following the acquisition of baseline data, 2 mosquito fish will be introduced into each breeding container in a selected portion (size determined by availability of resources) of the area. After a stabilization period (length determined by pre-study observations) correlations of productivity and mosquito adult densities will be made following the same procedures used in baseline data acquisition. Over the course of the project, exposure to dengue virus in susceptibles from this area will be compared to exposure rates in the control area (non-intervention). Population monitoring of both Aedes aegypti and of fish will continue throughout the project and the evaluation of this control method will be assessed.

Area B

Following the acquisition of baseline data, this area will be used for the introduction of Toxorhynchites, an African mosquito, the larvae of which consume the larvae of other mosquitoes but do not develop into adults which bite humans. This will be combined with the integrated use of ULV and/or fog malathion applications. Two applications, 12 hours apart with malathion will be made each week, followed 12 hours later with a single introduction of 400 adult Toxorhynchites/hectare.

Evaluation of adult Aedes aegypti production and dengue transmission will be assessed as in Area A.

Area C

Following the acquisition of baseline data, this area will be treated with abate (Temephos) 1 ppm using Briquettes or 1% sand granules. These will be introduced into all containers supporting development of Aedes aegypti.

Effectiveness, duration and ease of application will be evaluated for 2 treatments during the first year.

Area D

Following acquisition of baseline data this area will serve as the emergency treatment area. Blanket coverage of the area will be made with up to three ULV applications per week of malathion (500g/ha). The short-term emergency control of Aedes aegypti populations will be evaluated for rapidity, effectiveness and cost.

Area E

Following acquisition of baseline data, this area will serve as a non-intervention control area. Studies will be conducted on *Aedes aegypti* behavior, biology, and ecology, including marking and recapture for dispersal and longevity studies, and their possible influence on dengue transmission.

II. Malaria

A. Purpose

The purpose of this portion of the project is to identify the optimum component interventions to enable the development of a practical integrated program to control the anopheline mosquito vectors of malaria to the level in which malaria no longer constitutes a serious health problem in the the D.R. Working in conjunction with research staff at UCMM and control staff in SNEM, the project will include a major research effort. It will provide training in bionomic baseline data collection, operational research to identify intervention techniques best adapted to the eco-epidemiological conditions revealed by baseline data, and field-testing in the application of promising interventions. The project will evaluate the technical feasibility and the cost-efficiency of each intervention technique tested.

B. Approach

1. Establish a Bionomic Data Base

SNEM has identified five principal malaria problem areas: Elías Piña, Pedernales, La Altagracia, Dajabón, and Independencia. These areas will be evaluated by a special preliminary team to determine entomological factors, including identification of vector(s), population levels, baseline levels of insecticidal resistance or avoidance, transmission rates, degree of endo and exophagy, time and place of vector-human contact and preliminary assessment of breeding sources. Another objective of this team will be to identify areas for evaluation of new control interventions. Selection of four test areas will be based on high incidence of malaria and corresponding high anopheline density; a representative sample of the population; a location which presents a minimum of logistic problems and where selected interventions can be applied. Preferably, each area would also be located near a regional SNEM office.

The preliminary team will be composed of specialists in each of four fields; insecticidal resistance, behavior avoidance, sporozoite detection, mosquito bionomics. This group will also include project staff and trainees who will assist the specialists and at the same time learn the techniques being demonstrated.

The preliminary team will spend approximately 1.5 weeks at each of the four selected problem areas to acquire this initial baseline data. It is estimated that at least four additional weeks will be required to process this information. To evaluate the entomological factors at each test area the following procedure will be used.

Two subteams of two persons each will conduct two 12-hour biting collection, using standard procedures of 15, 30, or 45 minute collections each hour depending on the density of vector population. One subteam will be indoors and the other outdoors, and the nightly biting cycle in these two habitats will be recorded. A portion of the specimens collected will be used as voucher specimens and retained to confirm the identify of the species. The remaining specimens will be divided into the following test groups:

1) insecticide resistance,
2) sporozoite detection,
3) colonization for subsequent resistance and taxonomic studies.

The development and spread of insecticide resistance and its associated critical impact on the cost and effectiveness of vector control programs is well documented in the WHO Expert Committee Reports on insecticide resistance (1976, 1980). World Health Organization expert committee, 1980, identified the detection and evaluation of resistance as the first priority in operational research programs.

DDT resistance will be evaluated using biochemical field test kits and compared to standard WHO adult contact test. Within each test area, adult mosquitoes will be selected from at least three sites. Pools with at least 25-30 mosquitoes from each site will be tested utilizing procedure modified from Brogdon (1984). If resistance is found, biochemical micro-assay methods will be used together with bio-assays to assess the implications of this resistance for the malaria control program and proposed interventions.

Inspected mosquitoes with sporozoites in salivary glands will be used to evaluate the transmission potential of vector populations. Natural infection rates will be determined using the ELISA (enzyme-linked immunosorbent assay) field test kit. A portion of the mosquitoes from the biting collections and also from resting collections will be used. Pools of at least 25 identified specimens will be used in the ELISA test. This new rapid procedure will be able to provide considerably more data than the former, time consuming, individual mosquito dissection method. Mosquito colonies will be established in the laboratory with field caught specimens. These will be maintained to provide continuing material for insecticidal testing and taxonomic confirmation of the species.

The bionomic investigations will utilize information from the indoor/outdoor biting collection as well as incorporating the use of fluorescent markers on indoor biting populations to help determine the duration that vector specimens remain in dewellings and thus the potential exposure to residual insecticide. Vector mosquito breeding habitat will be identified and assessed for the selection of the most appropriate control intervention.

2. Applied Research

In consideration of such potential problems as pesticide contamination on the environment. vector resistance and high cost of imported chemicals, a major thrust of the project will be to identify, develop and

evaluate additional and/or alternative cost-effective vector control methods. Major emphasis will be placed on the use of biological control agents, including new formulations of Bacillus thuringiensis H-14 (Bti). Testing of new formulations of Bti including aqueous flowable, non-aqueos flowable and several tupes of granules, currently underway at the International Center for Public Health Research, will provide the starting point for the selection of effective mosquito control materials.

Materials that are selected following the initial screening at the Center will then be plot-tested in the D.R. Special attention will be given to the technique and training of applications of the larval and adult materials to identify methods and periods of greater impact.

Selected alternative control methods will be plot-tested in at least three regions in the Dominican Republic. Priority areas will include irrigated agriculture lands and areas of high tourist activity. The selection of these areas will be based on presence of high levels of malaria transmission, logistical considerations and diversity of ecological conditions or mosquito producing habitats, e.g., flowing or standing water, swamps or marshes, etc.

For evaluation of larvicidal materials, three sites of approximately two hectares each will be treated by hand (compression sprayers and/or backpack units) with each of the candidate compounds. Effectiveness of the materials will be assessed by sampling of mosquito populations and comparing these to natural populations in similar untreated control areas. Cost, ease of application, duration, effectiveness, and effect on non-target organisms will be considered in the evaluation of the candidate compounds. Materials showing the greatest promise will be operationally tested in other areas by SNEM to confirm their potential.

The emphasis on applied research will be directed toward an integrated vector control approach. Special attention will be given to the control on vector life stages through source reduction and/or habitat modification, including draining, filling or removing vegetation from mosquito breeding areas. This type of control, where it can be applied, is effective and over the long-term more economical than the continous use of chemicals. In addition to the economic incentive, these approaches avoid such adverse effects as pesticide contamination of the environment. Evaluation of source reduction techniques will be made on a case-by-case basis to determine the role they could plan in an alternative contact effort.

Integrated vector control studies will also examine the utilization together of combinations of methods to obtain a satisfactory reduction in vector populations. When promising biological materials have been identified, these will be tested in combination with various species of herbivorous and larvivorous fish to evaluate the potential for an integrated approach, where this may be feasible i.e. in enclosed or impounded areas.

3. Operational Field Testing

After the applied research plot studies, candidate compounds and other methods that show the greatest potential will be selected for operational field-testing by SNEM. Under the guidance of technical consultants, field-test areas will be selected and application of materials will be made within the context of the ongoing operational SNEM programs. New control methods on techniques will be adapted to the available SHEM programs and resources. Evaluations of operational field-testing will be made against data from established baseline studies and from control areas where no intervention has been attempted.

Evaluations will emphasize the practical applications and cost-effectiveness to determine whether it would be feasible to incorporate this method into the SNEM program.

SOCIAL SOUNDNESS ANALYSIS

The Dominican Republic is a nation with more than 6 million people in an area approximately the combined size of Vermont and New Hampshire, occupying the eastern 2/3 of the island of Hispaniola in the Caribbean Sea between Puerto Rico and Cuba. Haiti occupies the western third of the island.

The terrain is mostly mountainous with a marine tropical climate.

The predominant ethnic groups are: Caucasian 16%, Black 11% and mixed 73%. Roman Catholicism is the religion of 95% of the population.

About 50% of the people live in rural areas and pursue agriculture, most as small landholders.

Agriculture contributes about 17% of the GDR and tourism brings in nearly 47% of foreign earnings. Both relate in important ways to the disease control purposes of the project; tourism because it is especially sensitive to the presence or threat of malaria and dengue fever; agriculture because Haitian immigrants seeking work in the sugar cane fields and elsewhere in the DR contribute significantly to the malaria problem.

This analysis is keyed to three basic factors:

1. the equitable distribution of benefits under the program,

2. the problem of Haitian immigration, and

3. the social acceptance of the techniques to be used in the project for the control of malaria and dengue fever.

Equitable distribution of benefits is assured. Any person in danger of becoming ill from malaria or dengue fever has the potential of benefiting directly from this project's results and there is no discrimination on the basis of education, income, age, race or sex.

Benefits are skewed somewhat in the directon of the urban and rural poor. Malaria interventions are targeted in the areas of Dajabon, Elias Pina, Pedernales and Punta Cana, all primarily rural. Interventions for the dengue fever portion of the project will be centered in several barrios in Santo Domingo, where the residents are predominantly poor. The project's emphasis on operational research as the basis for developing techniques useful for a national control program of malaria and dengue fever ultimately should benefit most citizens in the D.R., either directly by relief from disabling disease or indirectly by encouraging tourism and agri-business.

HAITIAN IMMIGRATION

Precise knowledge of the numbers of Haitian immigrants is impossible, but substantial numbers enter the country illegally and intensify the malaria problem in the DR. The area along the border of the two nations is particularly malaria prone, and this is where much of the project work in malaria control will be concentrated. Haitians in search of work follow a pathway (Exhibits 1, 2) across the north of the Dominican Republic ending in Puerto Plata and others follow a southern route ending roughly in Punta Cana. From either terminus, the Haitians then disperse throughout the countryside.

Many other Haitian drift back and forth across the border to visit and to sell crafts.

Blood samples are taken of legal immigrants and, if the test is positive, a card is issued which contains information concerning the workers' destination for tracking purposes. Much of the immigration is illegal, however, and not subject to any control or surveillance.

SNEM has three decades of experience in malaria control in the DR, and their spokesperson state that substantial unanimity exists among Dominicans and Haitians alike in accepting the disease concept of malaria. This extends to a willingness among both groups to seek medical treatment for symptoms and to support control measures. On occasions, Dominicans have even called SNEM requesting that something be done about mosquitoes.

While little objection has been encountered to spraying DDT, some negative reaction to the indoor use of malathion has occurred because of its odor.

Within the past three years, SESPAS has conducted several country-wide programs of innoculation and chemotherapy directed at polio, DPT and malaria. Polio was the target of the first campaign and public acceptance was very good, especially among the middle and lower class. Upper classes tended to have some reservations, but these were persons who usually purchase private medical care.

The multiple injections required for DPT and some problems resulting from faulty administration of oral medication in the malaria campaign reduced acceptance somewhat, but participation among the people remained relatively high.

Scattered incidents of skepticism were reported, some people believing that oral medication was a form of population control.

By contrast, the environmental control methods used by SNEM for malaria, including use of larvivorous fish and source reduction have raised few objections. This augurs well for the public acceptance of control methods under this project, because a number of the project's research activities are environmental interventions. For example, a pre-project trial of one of the *Aedes aegypti* interventions was conducted between January and June 1986 in one of the *barrios* of Santo Domingo. Fish were introduced into 20 55-gallon drums

used for water storage on approximately 15 premises. People accepted the placement of the fish and, after five months, approximately 20% of the barrels still contained fish.

Experience has demonstrated, however, that it is advisable to inform people in advance of new or unfamiliar interventions, and plans to do so are included as part of this project.

From its experience with the mass innoculation and preventive chemotherapy campaigns, SESPAS has developed a detailed organizational structure and sophisticated educational materials for public education. These operations are centered in Centro Nacional Comunicacion Education de Salud (CENACES), a division of SESPAS. Educational materials developed for the mass campaigns include radio and television announcements, and leaflets distributed with newspapers and through schools. Slide presentations prepared for the malaria campaign were reviewed and were found to be interesting and informative tools for public education and for training volunteers. Slide presentations included sections on disease transmission, blood sampling and ways that the ordinary citizen can help to reduce sources of mosquito breeding. The presentations have sound tracks in Spanish and in the Creole language spoken along the border between the DR and Haiti.

In areas without electricity, schools or newspapers to help with communication, a speech in the village center about the health program can be an effective way to inform the local populace. CENACES' personnel have experience with this mode of informing the public and possess the awareness of words to use or to avoid in various parts of the country.

CENACES seems able and willing to target public education efforts in areas selected for the project to minimize potential adverse effects on tourism. The new government, however, is expected to effect personnel and other changes at SESPAS and CENACES that could radically affect program capability and emphasis.

The new government probably will also be as sensitive as the former to any public information programs playing up malaria or dengue fever out of fear that these will affect tourism adversely. The project includes plans to maintain close contact with government officials about the project, its procedures and its expected benefits.

In summary, the project will benefit urban and rural poor and, ultimately, all Dominican citizens to the extent that it can help to provide better disease control. The major institutions which can assist with the project - SNEM, CENACES and UCMM - are willing to pledge their energies and resources to help accomplish its purposes.

Based on this evaluation, the proposed project is socially sound. It takes into account the cultural and institutional needs of the people within the country.

EXHIBIT 1

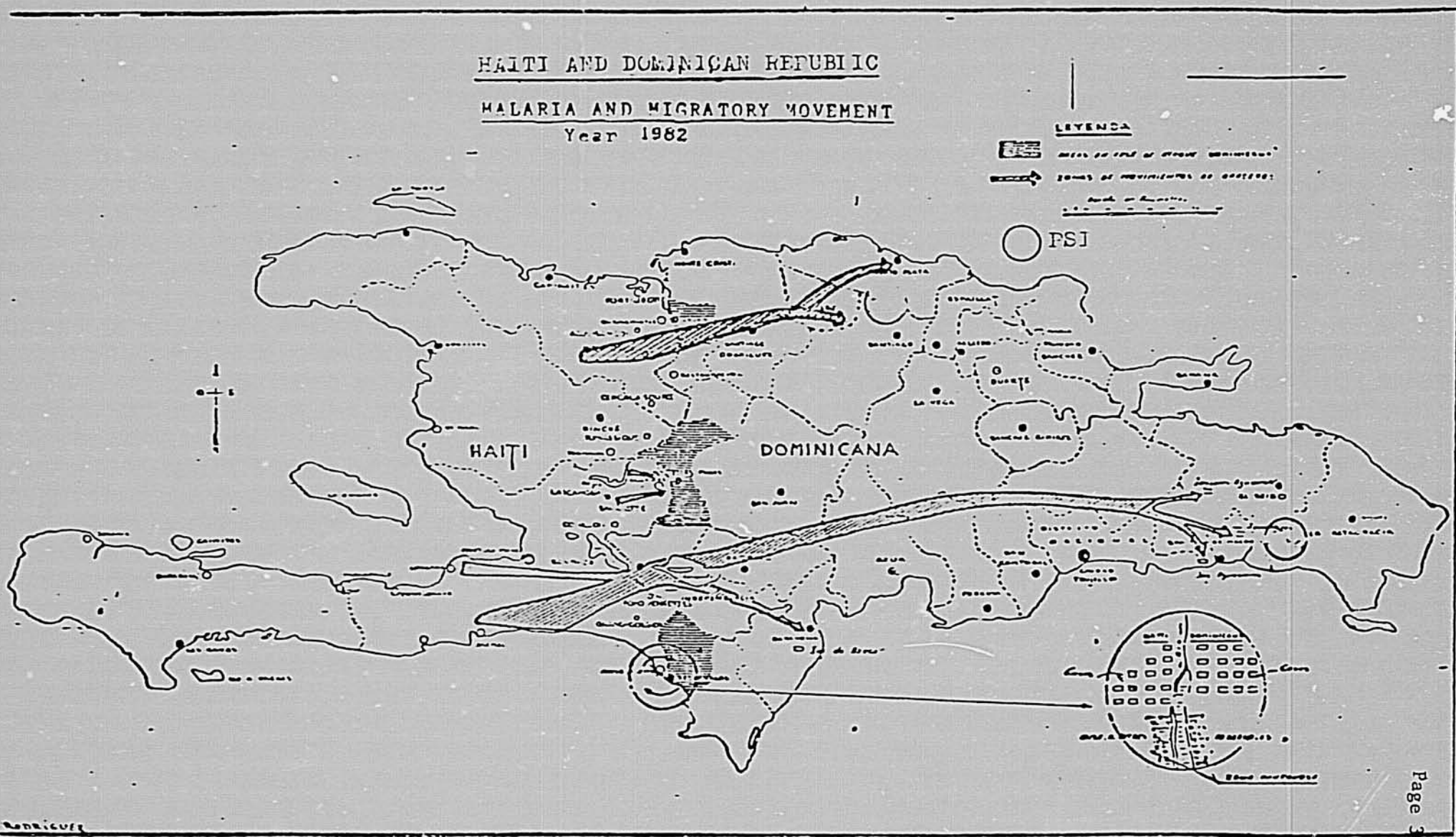

HAITI AND DOMINICAN REPUBLIC
MALARIA AND MIGRATORY MOVEMENT
Year 1982
LEYENDA
PSI
HAITI
DOMINICANA

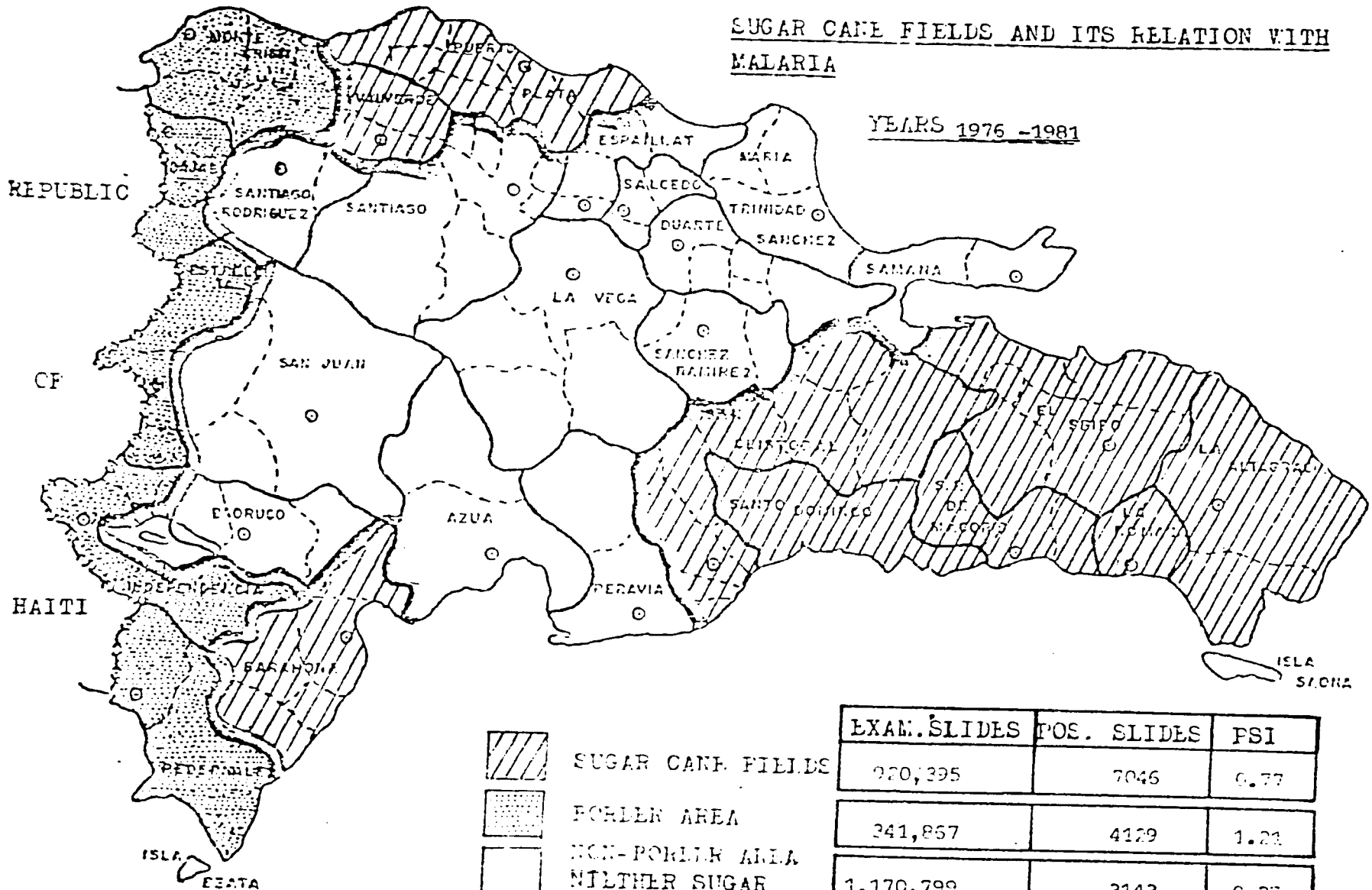
EXHIBIT 2
1-0

MAP OF THE DOMINICAN REPUBLIC
MINISTRY OF PUBLIC HEALTH AND SOCIAL SECURITY
MALARIA ERADICATION PROGRAM

SUGAR CANE FIELDS AND ITS RELATION WITH MALARIA

YEARS 1976 -1981

REPUBLIC OF HAITI



	EXAM. SLIDES	POS. SLIDES	PSI
SUGAR CANE FIELDS	920,395	7046	0.77
BORDER AREA	341,857	4129	1.21
NON-BORDER AREA NEITHER SUGAR CANE AREA	1,170,799	3143	0.27
TOTAL-------	2,433,061	14318	0.59

PROJECT DEVELOPMENT TEAM

USAID:

Lee R. Hougen, Chief, HPD, USAID/DR
Pirie Gall, PDD
Larry Cowper, Chief, Vector Borne Diseases, ST/H
Al Farwell, Consultant, ST/H - Vector Biology and Control
Lisa Early, HPD
Debra DeWitt McFarland, PDD
Larry T. Armstrong, PDO

University of South Carolina:

Dr. Winona Vernberg
Dr. Mac Tidwell
Dr. F. H. Lewandoski

GODR:

Dr. Delmin Cury, SNEM
Dr. Andre Peralta, UCMM

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