

directing council



PAN AMERICAN  
HEALTH  
ORGANIZATION

XVII Meeting

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Trinidad and Tobago  
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Provisional Agenda Item 23

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STATUS OF Aedes Aegypti ERADICATION IN THE AMERICAS

Aedes aegypti eradication has already been achieved in the territories and countries mentioned below, which are considered free of the vector: Argentina, Bermuda, Bolivia, Brazil, British Honduras, Chile, Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Canal Zone, Paraguay, Peru, and Uruguay. Two other countries, El Salvador and Mexico, had already eradicated the vector but, as will be seen later in this paper, both were recently reinfested.

In addition to the reinfestations in Mexico and El Salvador, the Aedes aegypti problem continues to exist in the northern part of South America, in the United States of America, and in the Caribbean Area.

In the north of South America, French Guiana, Surinam, Guyana, Venezuela, and one locality in Colombia are infested.

French Guiana had been declared free of Aedes aegypti in 1958; however, in 1963, this department was found to be extensively reinfested and so far the eradication campaign has not been resumed. In Surinam, the campaign began in 1963 but the results obtained to date have been very meager. Guiana, after being free of the mosquito for several years, was found to be reinfested in 1962; the campaign was not resumed until 1965 and results so far have not been satisfactory. In Venezuela, the campaign has made no progress since 1962.

In Colombia, the eradication of the mosquito was achieved in 1961 but between September of that year and the end of 1966 the country has been repeatedly reinfested. The latest of these reinfestations occurred in the city of Cúcuta, near the frontier with Venezuela, at the end of 1965, and in the port area of the city of Santa Marta, on the Caribbean coast, in October 1966. Reinfestation in Santa Marta has already been eliminated; however, Cúcuta is still positive.

The United States of America, whose campaign covers Puerto Rico and the American Virgin Islands, began eradication operations in 1964, but the

campaign so far has been covering only part of the areas presumably infested by Aedes aegypti and results obtained have been limited.

In the Caribbean Area, the islands of Bonaire, Caiman, Saba, St. Eustatius, and Tobago are considered to be negative. All the other countries and territories in that area are to some extent infested by the mosquito. The campaign is in its final phase in Trinidad, where in recent years small foci of reinfestation have been found, and continues to make progress in Cuba although the results are not as great as had been anticipated. However, eradication operations have been suspended in Haiti, Jamaica, Dominican Republic, as well as in Dominica, Guadeloupe, and the British Virgin Islands. In all other Caribbean islands the campaign is at a standstill or is making very slow progress and the results obtained have not been satisfactory.

The delay in achieving the eradication of Aedes aegypti in extensive areas of the Hemisphere not only gives rise for those areas to a risk of urban yellow fever and other diseases transmitted by that vector, but continues to be the cause of the reintroduction of the mosquito into several countries and territories. Indeed, in the last six years, in addition to the reinfestations in Colombia, El Salvador, French Guiana, Guyana, Mexico, and Trinidad mentioned above, the following countries in the Caribbean have been reinfested: Antigua, Aruba, Bonaire, Grenada, Montserrat, Nevis, St. Kitts, and St. Vincent.

In addition to additional expenses to the Governments which had already spent considerable sums on the eradication of Aedes aegypti, these reinfestations help to delay the completion of the continental program and increase the danger that more extensive and more serious reinfestations may occur in the Hemisphere and may cause the whole program to fail.

The Governing Bodies of the Organization have been urging the countries and territories still infested to complete their Aedes aegypti eradication programs as soon as possible since the success of the program can only be assured if the present sources of reinfestation in the Americas are promptly eliminated. Nevertheless, in the last five years, the eradication campaign has made progress only in very limited areas; in several countries and territories the situation, in that period, has in fact appreciably worsened.

One of the obstacles hindering the campaign in the Caribbean and in the north of South America, was the resistance of Aedes aegypti to chlorinated insecticides. This problem has now been solved and residual action phosphorus insecticides which can be satisfactorily used against the mosquito are now available. However, if the program in these areas is to be successful, it is essential to eliminate the serious financial and administrative difficulties which the campaign continues to encounter in almost all the countries and territories still infested.

Bearing this situation in mind, and in view of the danger it represents for the continental program, the XVII Pan American Sanitary Conference,

in Resolution XIX, urged the Governments of the countries and territories already free of Aedes aegypti to maintain a strict vigilance service against reinfestation and that the service take all the necessary measures to prevent the reintroduction of the mosquito into those areas. It also urged the Governments of the countries and territories still infested to take timely measures to overcome any administrative difficulties that may be hampering the progress of their campaigns and to give the highest priority to the provision of the funds, personnel, and supplies needed to complete those campaigns as soon as possible.

In the same resolution, the Conference requested the Director of the Pan American Sanitary Bureau to take all necessary measures to strengthen and accelerate the continent-wide program; authorized him to obtain funds to finance the prompt eradication of Aedes aegypti; and requested him to study and put into practice appropriate systems for ensuring that the Aedes aegypti eradication campaign is carried out simultaneously and in a coordinated manner in all countries in which the problem still exists, including frequent and periodical meetings, under the auspices of the Pan American Sanitary Bureau, of the national authorities responsible for the programs.

In compliance with these instructions, the Director convened a Conference and a Study Group to make a complete review of the present status of the continental program and to study plans for duly coordinated campaigns in all areas still infested and for the maintenance of appropriate vigilance services in those which are already free of the mosquito.

The Conference and the Study Group met at Headquarters from 3 to 5 and from 6 to 12 April 1967 respectively. The reports of these meetings are submitted together with this paper to the Directing Council for consideration (Annexes 1 and 2).

As may be seen in the appropriate report, the Conference was attended by representatives of 20 countries of the Americas as well as a representative of each of the following political units: Netherlands Antilles, French Departments, Surinam, and British Territories. The following were invited, but were unable to send representatives: Barbados, Guyana, Haiti, Nicaragua, and Panama.

After examining the documents on the eradication campaign or the vigilance service in each of the countries and territories represented at the meeting, the Conference adopted a resolution recommending that the countries still infested fulfil as soon as possible their pledge to eradicate Aedes aegypti and recommended to the Director of the Bureau that he prepare a plan for a coordinated program to complete the eradication of the vector as soon as possible.

The Study Group, composed of eight experts with experience in Aedes aegypti eradication in various areas of the Hemisphere, made a detailed examination of the difficulties impeding the progress of the campaign; examined

the measures which should be taken to eliminate those difficulties; discussed plan for simultaneous and coordinated planned campaigns in all the countries and territories infested; and made recommendations on the organization and maintenance of appropriate vigilance services in the areas already free of the mosquito.

It also made an estimate of the cost of the campaign in each of the countries and territories, with the exception of the United States of America; put forward recommendations on the role of the Pan American Sanitary Bureau in the program; made an estimate of the technical personnel the Bureau should have for giving technical advice, coordinating and evaluating the eradication campaigns and the vigilance services.

With respect to the financing of the campaigns and the funds the Bureau would need in order to take an active part in a final drive to achieve Aedes aegypti eradication in the Americas, the Study Group recommended:

a) That if necessary, the Governments take appropriate steps to obtain funds from international agencies in order to supplement the funds they assigned to Aedes aegypti eradication.

b) That the Director study the possibility of establishing a special fund for Aedes aegypti eradication to provide the Bureau with the necessary additional funds for strengthening the program.

As to the obstacles to the success of the program, the Study Group, in its report, expressed itself as follows:

At present there is no technical problem preventing the eradication of Aedes aegypti in the Americas. Effective residual insecticides are available, as are techniques and methods which, as it has been proved in extensive areas in the Hemisphere, ensure the elimination of this vector when they are correctly used. That the program is not making satisfactory progress is due to the fact that in the most of the countries the other essential steps enabling the campaign to ensure the appropriate conduct of the whole process leading to the eradication of the vector have not been taken. Basically they are as follows:

a) Firm decision on the part of the Government to eradicate the mosquito and to accept the responsibility that that eradication involves;

b) Provision of sufficient funds to meet the needs of the campaign in personnel, equipment, and supplies, without interruption until eradication of the vector is achieved;

c) Setting up of an appropriate organization, on a national scale, which makes it possible for the program to develop its activities in a uniform and coordinated manner throughout the country;

d) Administratively autonomy and flexibility that enable the program to manage its budget without bureaucratic interference; to establish the work of its personnel; fix salaries and subsistence allowances; administer, move, punish, or dismiss its employees without delay or difficulty;

e) Legal support providing the campaign with authority to have its decisions carried out promptly and to carry out without delay the necessary measures to eradicate the mosquito.

The pages that follow summarize the status of the campaign in each of the countries and territories in which the Aedes aegypti eradication problem still exists, and the table and map accompanying this document show the present status of the program in the whole Hemisphere. (Annexes III and IV).

BARBADOS - Because of the resistance of the mosquito to chlorinated insecticides, the campaign has been using the phosphorus compound, fenthia, since the beginning of 1965. The Aedes aegypti strains prevalent in the country have shown extreme susceptibility to it, but the results the campaign is obtaining are not satisfactory. This is attributed to other difficulties which it has not yet been possible to eliminate.

These difficulties include a shortage of funds, which does not allow the program to engage the necessary field personnel for adequate coverage of the infested areas; a large number of houses which are not inspected or treated because they are locked; incomplete or inadequate treatment of many potential breeding places; and non-observance of the legislation supporting the campaign approved by the Government.

COLOMBIA - Eradication of the mosquito was achieved in the country in 1961. Since then, the Aedes aegypti problem has been limited to reinfestations occurring in the area of the frontier with Venezuela and in the port area of the city of Santa Marta on the Caribbean coast.

In the frontier area the city of Cúcuta was found to be reinfested in September 1961 and, in the following year, the locality of San Luis, situated 1 kilometer from Cúcuta, on the road to Venezuela, was also found to be reinfested. These two foci of reinfestation were eliminated in 1963; however, at the end of 1965, Cúcuta again became reinfested. As a result of this reinfestation, eradication operations were resumed in the city but in April 1967 it was still positive. An inspection of the city, which was completed in that month, showed two houses to be found positive for Aedes aegypti out of a total of 27,243 inspected.

In the port area of Santa Marta, a breeding place of Aedes aegypti was found in 1963 and another in 1964, both originating from mosquitoes transported by small craft coming from the Caribbean. These breeding places were promptly eliminated but in September 1966 the port was again found to be reinfested. That reinfestation was eliminated, and so far no further Aedes aegypti have been found in the area.

Apart from the reinfestation mentioned above, the country is considered to be free from the mosquito in accordance with the results of the last vigilance inspections made by the campaign. In 1966 the following localities were inspected and found negative for Aedes aegypti: San Luis, the city of Santa Marta, the port areas of Barranquilla, Buenaventura, Cartagena, and Las Flores, the international airports of Barranquilla and Cali, and six localities in the Department of Santander del Norte, situated on the frontier with Venezuela. In 1967, up to April, the following had been inspected under the vigilance program and found to be free of the mosquito: the ports of Santa Marta, Barranquilla, Buenaventura, and Las Flores, the international airports of Barranquilla and Cali, and the localities of San Luis and Puerto Santander on the frontier with Venezuela.

CUBA - Campaign activities are still mainly centered on the provinces of Pinar del Rio, La Habana, and Matanzas. Apart from these areas, eradication operations have so far been confined to a few municipalities in the province of Las Villas.

Up to April 1967, the campaign had inspected, in the initial survey, a total of 1257 localities, of which 981 were found to be infested with Aedes aegypti. Of the initial positive areas 931 were treated and of these 914 have already been verified one or more times since being treated. Of those verified, 783 were found to be negative in the last inspection; 131 are still positive.

The progress made by the campaign in the last five years has not been as rapid as was expected. That is mainly due to frequent infestations which have occurred in the work area and to the impossibility of adequately covering those areas with the personnel of the program. In order to deal with this situation, the Government has decided to incorporate the campaign into the public health services and to expand it in such a way that eradication operations are simultaneously carried out in all areas infested. By covering the entire island at the same time, the campaign will avoid the possibility of reinfestations and will be able to achieve the eradication of the mosquito within three or four years.

EL SALVADOR - The eradication campaign was completed in 1957 and in 1960 the country was declared free of Aedes aegypti. However, in June 1965, one area of the city of San Salvador was found to be reinfested. Subsequent investigations showed that the reinfestation was spreading to the whole city and its suburbs and that many other areas of the country had already been reinfested as well.

Eradication work was resumed in July 1965; however, in view of the limited funds available for the campaign, its activities have been centered mainly on the city of San Salvador and the international airport of Ilopango and even so it has not been possible to maintain a suitable work cycle in those two localities. Consequently, the results achieved by the campaign so far have not been satisfactory.

As for the cause of the reinfestation of the country, an investigation made in June 1965 showed that the mosquito was probably reintroduced into the town of San Salvador by means of used tires imported from the United States.

UNITED STATES OF AMERICA - Initiated in 1964, the campaign continues to cover only part of the areas considered infested by Aedes aegypti. Those areas, which measure 1,550,000 Km<sup>2</sup> approximately, and contain a population of about 41,000,000 comprise part or all of the territory of 10 States in the South-east of the country (Alabama, Arkansas, North Carolina, South Carolina, Florida, Georgia, Louisiana, Mississippi, Tennessee and Texas), Puerto Rico, and the American Virgin Islands. According to the latest data available, in the initial survey 649 municipalities were inspected in the continental territory of the United States, 56 in Puerto Rico, and 3 in the Virgin Islands. All of the municipalities inspected in Puerto Rico and the Virgin Islands as well as 248 of those inspected in the continental territory, were found to be positive.

Of the initially positive municipalities 30 were treated in the continental territory, 36 in Puerto Rico, and 3 in the Virgin Islands. All those municipalities have already been inspected at least once since being treated and all were found still positive at the last inspection.

GUYANA - This country, after being free of Aedes aegypti for several years, was found to be extensively reinfested in 1962; however, the Government was only able to resume eradication operations in 1965. So far, these operations have been confined to the city of Georgetown, where, despite repeated treatments, the results obtained have not been satisfactory. That situation is due to the administrative difficulties which the campaign has been experiencing since its resumption and the low susceptibility of the mosquito to the insecticide employed.

If the campaign is to be successful, it will be essential to replace that insecticide; however, before a new insecticide is used, the administrative problems hampering field work must be overcome.

HAITI - The campaign was suspended in 1958 and has not yet been resumed.

JAMAICA - Eradication operations, which were interrupted in 1961, have not yet been resumed. Aedes aegypti control in the country continues to be limited to mosquito control measures in international ports and airports.

MEXICO - The country completed Aedes aegypti eradication in 1961 and in 1963 it was declared free of the mosquito. Since then, the Aedes aegypti problem in Mexico has been limited to reinfestations occurring in the city of Nuevo Laredo on the United States frontier.

In June 1965 a small area in that city was found to be reinfested. That reinfestation was quickly eliminated but in February 1967 Aedes aegypti

were again found in Nuevo Laredo. The Government immediately took the necessary measures to eliminate the new reinfestation; however, up to April 1967, the city was still considered to be positive. The two reinfestations of Nuevo Laredo have been attributed to eggs transported in used tires imported from the United States.

DOMINICAN REPUBLIC - The campaign was suspended in 1962 and has so far not been resumed.

TRINIDAD AND TOBAGO - The island of Trinidad is considered to be free of Aedes aegypti, with the exception of the city of Port-of-Spain. In that city the mosquito continues to be found in the port area and in small craft coming from other Caribbean ports all infested by the vector. These small craft are responsible for the repeated infestations of the city in the last four years.

During that period, efforts have been made to prevent these small craft from transporting Aedes aegypti; however, despite the efforts made, it has not been possible as yet to solve the problem.

As for the island of Tobago, it continues to be considered free of the mosquito.

VENEZUELA - In the last five years, the campaign has made no progress. That is primarily due to lack of funds, which prevents adequate coverage of the infested areas of the country, and to serious labor difficulties which have made it impossible to obtain skilled field workers.

In order to guarantee the success of the campaign, the Government made a complete review at the end of 1966 and at present is studying the possibility of increasing the funds assigned to it and adopting other measures necessary to ensure that the mosquito is eradicated in the country within a period of six months.

#### FRANCE

Guadeloupe - Eradication operations, which were interrupted in 1962, have not yet been resumed.

French Guiana - This department was declared free of Aedes aegypti in 1958 but in 1963 its capital, Cayenne, was found to be reinfested. An investigation made by the Government in 1964 showed that reinfestation had spread to the whole city and its suburbs and that various localities in the interior were also positive. Because of this reinfestation the Government has taken Aedes aegypti control measures; however, vector eradication operations as such have not yet been resumed.

Martinique - A specific campaign for the eradication of Aedes aegypti has not yet been begun in this island. For some years, the Government has been



carrying on a general insect control program, but the results obtained in controlling Aedes aegypti by this program have been very scanty.

St. Martin - The French part of this island is considered to be free of Aedes aegypti; however, no recent information on the situation is available.

#### NETHERLANDS

Aruba and Bonaire - Aedes aegypti has been eliminated from and reintroduced into these islands several times. At the present time, Bonaire is considered to be negative, but the last reinfestation of Aruba has not yet been eliminated.

Curaçao - The island is still extensively infested. Anti-Aedes aegypti activities have been limited to mosquito control measures in the port area of Willemstad and in the international airport, and the results obtained have been very limited.

Saba and St. Eustatius - These islands continue to be considered negative; however, no recent information on the situation is available.

St. Martin - The Dutch part of this island is infested but no anti-Aedes aegypti work is being carried on.

Surinam - Eradication operations continued to be centered mainly on the town of Paramaribo. The results obtained in this town since the initiation of the campaign in 1963 until April 1966 were limited, despite repeated treatments. That was due to the administrative difficulties which the campaign has been experiencing since the beginning as well as the development of mosquito strains resistant to chlorinated insecticides.

From May 1966 the campaign began to use fenthion and with this new insecticide the infestation index in the city, which was 21.5% in April, has fallen to about 3%. However, administrative problems which have been hampering the campaign since its initiation and prevent better use being made of the new insecticide, have not yet been solved.

In addition to Paramaribo, the campaign has covered the international port of Surinam, the frontier localities of Albina and Nickerie, and nine small localities in the suburbs of the capital. The results obtained in all these localities have been very limited.

#### UNITED KINGDOM

Antigua and Barbuda - Antigua was found to be extensively reinfested in 1964; however, so far, the eradication campaign in this island has not been resumed.

Barbuda was negative for several years but in 1965 the island was found to be reinfested.

Dominica - The campaign on this island has been suspended since 1957.

Grenada - According to the latest available data, this island has been re-infested after being negative for several years.

Granadines - In this group the islands of Carriacou, Petit Martinique, Bequia, and Union are infested but no eradication operations are being carried on in any of them.

Bahamas - The campaign in these islands continues to be very limited because of lack of funds. Consequently, the results obtained are not satisfactory.

Caiman Islands - In an inspection made in 1966 no Aedes aegypti were found in these islands. However, their negativity has yet to be confirmed.

Turks and Caicos Islands - In this group of islands the eradication campaign has not yet been initiated.

Virgin Islands - The campaign in these islands was interrupted in 1963 and has not yet been resumed.

Montserrat - This island was reinfested in 1964 and continues to be positive.

St. Kitts, Nevis, and Anguilla - The islands of St. Kitts and Nevis, after being negative for several years, were found to be reinfested in 1964 and 1966 respectively, but eradication operations have not been resumed in either of them. Anguilla is also infested and no eradication campaign is under way.

St. Lucia - Despite the extensive infestation of the island, the campaign continues to be limited to a part of Castries, the capital of the territory, and to Vigie, where the international airport is situated, because of lack of funds. In view of the resistance of the mosquito to chlorinated insecticides, and of the administrative difficulties besetting the campaign, the results obtained so far have not been satisfactory.

St. Vincent - This island was found to be reinfested in 1964 and the reinfestation has not yet been eliminated.

CD17/15 (Eng.)  
ANNEX I

REPORT OF THE CONFERENCE ON Aedes Aegypti  
ERADICATION IN THE AMERICAS



Pan American Health Organization

World Health Organization

# CONFERENCE ON AEDES AEGYPTI ERADICATION IN THE AMERICAS

WASHINGTON, D.C., UNITED STATES OF AMERICA

3-5 APRIL 1967

## CONTENTS

	<u>Page</u>
Introduction	1
List of Participants	3
Inauguration of the Conference	7
Summary	10
Recommendations	14
Conference (Agenda and Working Documents)	16

## INTRODUCTION

The Directing Council of the Pan American Health Organization, at its First Meeting held in Buenos Aires in 1947, entrusted to the Pan American Sanitary Bureau the solution of the problem of urban yellow fever in the Americas through the eradication of Aedes aegypti.

When PASB received these instructions, Aedes aegypti had already been eradicated in Bolivia and in a large part of Brazil. However, with the exception of Canada, all the remaining countries as well as all the territories in the Western Hemisphere were in some degree infested by the vector. In the 19 years that have elapsed since that time, Aedes aegypti has been eradicated from extensive areas in the Hemisphere, but much remains to be done before the continental eradication program is concluded. As a matter of fact, the problem still exists in the northern part of South America, where French Guiana, Surinam, Guyana, Venezuela and two localities in Colombia are infested; in El Salvador; in the United States of America; and in the Caribbean Area, where all the countries and territories, with the exception of a few islands, are extensively infested.

Apart from the danger to the infested countries and territories of the diseases transmitted by this mosquito, the presence of Aedes aegypti in those areas has been the cause of the frequent reinfestations which have been occurring in the Hemisphere and which are threatening the very success of the continental program to eradicate the vector.

This situation has been a matter of serious concern to the Governing Bodies of the Organization, which in successive resolutions have called upon the countries and territories still infested to complete eradication of Aedes aegypti as soon as possible, since the success of the continental program can only be ensured if the present sources of reinfestation in the Americas are promptly eradicated. However, in the last four years, the eradication campaign has made progress only in very limited areas; in a number of countries and territories the situation has in fact considerably worsened over this period.

In view of the seriousness of the present situation of the continental program, the XVII Pan American Sanitary Conference, held in Washington, 26 September to 7 October 1966, approved Resolution XIX in which the Conference instructed the Director of the Pan American Sanitary Bureau to take all necessary measures to intensify and accelerate eradication of Aedes aegypti in the Americas, and to study and put into practice the appropriate systems for ensuring that the eradication campaign is carried out simultaneously and in a coordinated manner in all the areas still infested. Among the measures designed to achieve such coordination, the Conference suggested that frequent and periodical meetings of the national authorities responsible for the program be held under the auspices of PASB.

As a first step towards implementation of the above-mentioned resolution, the Director convened a Conference on the Eradication of Aedes aegypti in the Americas. With the exception of Canada, all the countries and territories of the Hemisphere were invited to send representatives to the meeting, the purpose of which was a complete review of the continental program to eradicate the vector.

## PARTICIPANTS

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## URUGUAY:

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NOTE: The following countries were also invited: Barbada, Guyana, Haiti, Nicaragua and Panama.

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### INAUGURATION OF THE CONFERENCE

Dr. Abraham Horwitz, Director of the Pan American Sanitary Bureau, inaugurated the Conference with the following address:

"Eradication of Aedes aegypti in the Americas-- the purpose of this Conference-- means to interrupt the ecological cycle of yellow fever and to definitively protect urban areas against the jungle form of this zoonosis. It also means to arrest the transmission of dengue and to prevent the appearance in the Americas of hemorrhagic fever, a highly lethal disease transmitted by the same vector which at present has been identified only in the Far East. It is not the purpose of this Conference to reopen the discussion on why Aedes aegypti should be eradicated. That decision was taken some twenty years ago, and has been reaffirmed at each meeting of the Directing Bodies of our Organization as well as in numerous statements by the Ministers of Public Health and other distinguished health workers in the Americas. There is general agreement on that point. Nevertheless, the complete eradication of the vector in the Hemisphere has not been achieved. Although substantial progress has been made, it has not kept pace with events, for epidemic dengue is of recent appearance as is the threat of hemorrhagic fever. Furthermore, in these twenty years the jungle virus has repeatedly moved in epizootic waves through Central and South America, following a well-defined path. Fortunately these movements have not produced yellow fever epidemics because Aedes aegypti was not present in the countries concerned. However, in recent years, the mosquito has started to reappear in areas from which it had earlier been eliminated, and is again threatening the neighboring countries. The introduction of chlorinated insecticides in that period, greatly simplified the more techniques used but in some places Aedes aegypti has developed resistance to those most commonly employed, namely DDT and dieldrin. This fact has further complicated the problem; prior to the advent of insecticides, the procedures used, were essentially based on the use of larvicides. Although effective, they are proportionately much more costly.

We obviously do not need to justify Aedes aegypti eradication; the question we must deal with-- and this was decided by the XVII Pan American Conference-- is how to make more rapid progress in attaining our goal. This entails a detailed review of the present status of the problem, clearly defining the countries and territories in which the vector is present, those in which it has been reintroduced and those that remain free of it as a result of an active vigilance program. In the light of this quantitative and qualitative study, a new continental plan should be drawn up, clearly defining the responsibilities of each Government, according to the situation in its country as well as those of the Pan American Health Organization, as the coordinating agency. The methods to be employed for the eradication of Aedes will of course be determined by the results of the trials of new phosphorus insecticides. The areas in which new biological or operational studies are required must also be defined. The funds needed for the entire undertaking must be estimated, and a clear

distinction must be made between national contributions and international credit. In this last connection, I should like to suggest that the international credit agencies broaden their lending policy so as to include loans for the eradication of Aedes aegypti, on the same conditions as those for malaria eradication.

In accordance with the resolutions of the XVII Pan American Sanitary Conference, I have had the honor to call this Conference, which will be followed by a meeting of a study group to draw up a new and detailed continental plan based on such conclusions as you may reach here as result of your discussions. All the pertinent documents will have to be presented to the 56th Meeting of the Executive Committee, which will be held in Washington, from 26 April to 5 May, and to the XVII Meeting of the Directing Council of the Pan American Health Organization, XVIII Meeting of the Regional Committee of WHO, which will be held in Trinidad this October.

We have been fortunate in obtaining the invaluable counsel of a man who, in my opinion, is the greatest living authority on yellow fever and Aedes aegypti eradication -- Dr. Fred L. Soper. After a lifetime of experience, he fathered the idea of eradication, worked out its theoretical underpinning and shaped its practice. He inspired governments, institutions, individuals and international agencies. He made the Americas truly aware of the need to eliminate a risk which has had such tragic consequences in the recent past, and which may very well appear again, and buttressed that awareness with the firm resolve of the Governments. The prodigious task accomplished in this field is due to his efforts when he was Director of the Pan American Sanitary Bureau. Dr Soper is the veritable embodiment of the idea of eradication, an humanitarian endeavor that calls for boldness, resolution, steadfastness in action, and the imaginative to envision the social consequences of yellow fever. Those consequences stretch far beyond the borders of communities and of nations for they are more the result of Nature's design than of man's. And thus the eradication of a disease or a vector is still another reflection of man's struggle to conquer his environment, facilitate his adaptation, and stimulate progress.

The presence of Dr. Soper here today symbolizes our resolve to continue his work until it triumphs.

The essential task is to intensify the activities now in progress, or to resume them, as the case may be, until Aedes aegypti is eliminated from the continent. Outweighing all other reasons is the moral commitment. Some 20 years ago an obligation was assumed by the authorized representatives of the American Governments. It has been re-affirmed on many occasions. Substantial progress has been made at no small cost and that alone inhences the moral responsibility of the governments that have not done their part in what is unquestionably a unique undertaking, encompassing the entire continent, wherever Nature decides.

As an indispensable prelude to continental development the discharge of our obligation is a matter of urgency. It is generally agreed today that we must increase communication between our peoples, not only from north to south but from east to west of the Americas, and vice versa, such a step means bringing all that modern science and technology recommends for man's wellbeing to geographical regions where nature interposes formidable obstacles. A single example suffices -- the jungle and the great river basins. As these regions are settled, the presence of Aedes aegypti will entail serious immediate risks for the entrepreneur, the technician and the worker, and long-term risks for the inhabitants of towns adjacent to areas in the process of development.

If there is one characteristic that distinguishes the Americas today, it is the tendency to believe that nothing is impossible. We have only to observe the ideas and the proposals being advanced at the highest decision-making levels of the political sector, the myriads of real accomplishments, and the genuine zeal to move in concert and solidarity towards the progress and wellbeing of all the people. In this spirit, I am confident that fresh and vigorous efforts will be made to solve the problem before us and will culminate in the eradication of Aedes aegypti in the Americas.

### SUMMARY

In the 19 years that have elapsed since the Directing Council of the Pan American Health Organization entrusted to the Pan American Health Organization the task of eradicating Aedes aegypti from the Americas, that vector has been eliminated over extensive areas in the Hemisphere. Nevertheless, much remains to be done before the continental program to eradicate the mosquito can be concluded.

Up to the present time, the following countries have succeeded in eradicating Aedes aegypti and are considered free of the vector: Argentina, Bermuda, Bolivia, Brazil, British Honduras, Chile, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and the Panama Canal Zone. Nevertheless, the problem still exists in the United States of America; in one of the Central American countries; in the entire Caribbean area; and in the northern part of South America where French Guiana, Surinam, Guyana, Venezuela and two localities in Colombia are still infested.

The presence of Aedes aegypti in those areas represents a risk of urban yellow fever that must not be underestimated. Given the ease and rapidity of travel today, all the countries and territories of the Hemisphere, from the epidemiological point of view, are very close to the enzootic areas of South America. Likewise, epizootic outbreaks that occur periodically on the Continent can spread the virus to regions at great distances from the above-mentioned enzootic foci. In fact, in the past 20 years, as result of various epizootics, yellow fever virus has been identified in the forests of all the South American countries except Chile and Uruguay, as well as in the forest areas of Trinidad, Mexico and all the countries of Central America, with the sole exception of El Salvador. This indicates the magnitude of the danger presented by jungle yellow fever to the areas in the Hemisphere still infested by Aedes aegypti.

It would be difficult, merely by controlling Aedes aegypti in those areas, to maintain them permanently protected against yellow fever. Experience in Brazil has shown us that it is impractical to maintain a program to control the vector, over an indefinite period, that would assure maintenance of an infestation index under the critical level for transmission of the disease. It is clear, moreover, that such a permanent control program would, over the long term, cost more than its eradication. Likewise, it could not be recommended that such areas be protected exclusively by vaccination. Apart from the improbability that the entire population could be sufficiently and permanently immunized over an indefinite period, this type of protection would also prove to be more costly than eradicating the vector, over the long term. In the light of present-day knowledge the latter measure, that is, the eradication of Aedes aegypti, is undoubtedly the most inexpensive way of providing effective protection as well as the only means of definitively eliminating the possibility of an urban yellow fever outbreak in the area.

Apart from the threat of yellow fever, it must be kept in mind that countries and territories infested by Aedes aegypti also run the risk of dengue epidemics. Although this disease has an extremely low fatality rate, epidemics such as those that occurred in the Caribbean areas between 1963 and 1966 can cause serious economic losses, particularly to those countries where the tourist industry is an important source of income.

Furthermore, consideration must be given to the risk of hemorrhagic fever epidemics in those areas. Up to the present time, hemorrhagic fever has been identified only in Asia, where Aedes aegypti is believed to be the sole vector of the disease. However, the possibility cannot be excluded that the infection, which in certain Asiatic outbreaks has had a case-fatality rate of from 10 to 15 per cent, could occur in the Western Hemisphere.

At the same time, the areas in the Americas that are still infested by Aedes aegypti have been the cause of the frequent reinfestations which have occurred in the Hemisphere and which are endangering the success of the continental eradication program. In the last six years, the following countries and territories have been reinfested by Aedes aegypti from the areas mentioned above: Antigua, Aruba, Bonaire, Colombia, El Salvador, French Guiana, Guyana, Mexico, Montserrat, San Cristobal, San Vicente and Trinidad.

This situation has been a matter of concern to the Directing Bodies of the Pan American Health Organization, which in successive resolutions have called upon the countries and territories still infested to complete eradication of the mosquito as soon as possible, since the success of the continental eradication program can only be assured if the present sources of reinfestation in the Hemisphere are speedily eliminated.

Nevertheless, in the last four years, the eradication campaign has made only limited progress except in a few restricted areas; in a number of countries and territories the situation during this period has, in fact, worsened considerably. This development is due to financial, technical and administrative difficulties that are hampering the satisfactory progress of the campaign in almost all the countries and territories still infested.

Among those difficulties, the following merit special mention:

1. Insufficient funds and personnel to ensure adequate coverage of the infested areas;
2. Deficient organization and administration;
3. Personnel problems that impair the quality of field work;
4. Mosquito-resistance to chlorinated insecticides;
5. Reinfestations.

Aedes aegypti eradication by means of residual action insecticides basically comprises two operations: treatment of the areas found to be positive, and verification of treated areas to evaluate the results of the treatment. Each verification is followed by a new treatment of the areas still positive, until eradication of the mosquito is achieved.

If the campaign is to be successful, not only must treatment be carried out correctly with an effective insecticide, but the treatment-verification cycle be adjusted to the duration of the residual effects of the insecticide employed, and that such cycle be rigorously observed. In addition, areas capable of reinfesting one another must be treated and verified at the same time, as if they constituted a single locality.

If the campaign does not have sufficient funds and personnel to carry out this type of coverage, it will be extremely difficult to achieve eradication of the mosquito in a given country.

Punctuality is an essential element in the success of field work. Any delay in carrying out verification in a treated area, or in treating an area found to be positive, can delay eradication of the mosquito. Furthermore, it is of the utmost importance that eradication of the vector in a given country be completed within a short period. Campaigns that drag on for a number of years make for reinfestations within the country, as well as the development of Aedes aegypti strains resistant to the insecticides.

It is clearly very difficult for a campaign to carry out the verifications and treatments punctually and to meet its work schedule without delays, if it does not have complete administrative flexibility that enables it promptly to make any such measure as may be necessary to the satisfactory progress of the field work.

Eradication of Aedes aegypti demands the most painstaking, accurate and conscientious work, which can only be assured if certain basic conditions relating to the field personnel are satisfied, including the following: careful selection and training; adequate salaries; a strict chain-of-command, discipline, and clearly defined responsibilities; and strict, continuing and unremitting supervision of the field work, with the dual purpose of correcting errors of the field personnel and improving their technical competence.

The campaign will clearly not be able to establish and maintain these conditions if its directors do not have full authority to handle matters related to such personnel with complete independence. Furthermore, it is also clear that it will be extremely difficult in many countries for various reasons, to meet all of these requirements.

Nevertheless, it should be borne in mind that the above-described requirements are a decisive factor in the quality of work performed by the



the field staff, and that only high quality field work is capable of ensuring the success of a campaign of this type, in which incomplete treatment or less than the most scrupulous inspection of a single house can delay eradication of the mosquito in a given locality for several months.

Aedes aegypti resistance to chlorinated insecticides has largely contributed to the present situation of the campaign in the Caribbean and in the northern part of South America. The problem is present today, in varying degrees, in all the countries and territories of those areas. Because of insecticide-resistance, the campaign has been suspended in a number of places and has been considerably delayed in others.

Nevertheless, that problem can now be considered solved, since phosphorus compounds are already available that can replace the chlorinated insecticides in vector eradication. Such insecticides have a shorter residual action than DDT or Dieldrin, but the results obtained with them in various areas have already shown that strains of Aedes aegypti resistant to chlorinated insecticides can be eliminated with these compounds.

In any event, it is clear that an effective insecticide cannot by itself ensure the success of the campaign. Likewise, the fact that the continued and prolonged use of an insecticide can contribute to the development of resistant strains needs no further emphasis. The present vector-resistance to DDT can undoubtedly be attributed, at least in part, to the fact that many campaigns were unable for a variety of reasons to eradicate the mosquito within a reasonable period, despite the initial effectiveness of the insecticide.

There is no need to emphasize the importance of intra-country reinfestations to the success of its campaign, or the importance of inter-country reinfestations to the continental program, particularly after vector-resistance to chlorinated insecticides became generalized. It is sufficient to mention that some of the areas where the campaign is encountering its greatest difficulties today were once negative.

In the case of both autochthonous and imported reinfestations, the success of the campaign depends on its ability to prevent such reinfestations or to hold them to a minimum. For that purpose it will be necessary:

- a) to treat at the same time, as if they constituted a single unit, those areas of the country capable of reinfesting one another;
- b) to coordinate the campaign in an appropriate manner in all the areas of the Americas that are still infested;
- c) to maintain strict vigilance against the introduction of Aedes aegypti in areas that are being freed from the vector;
- d) to complete eradication of the mosquito as soon as possible.

### RECOMMENDATIONS

The Conference, after studying the reports presented by the participants and discussing the problems that are hampering progress of the continental campaign for the eradication of the vector, approved the following resolution.

#### THE CONFERENCE ON THE ERADICATION OF AEDES AEGYPTI IN THE AMERICAS,

Having examined the reports presented by the representatives of the participating countries and territories, and considering:

that the international commitments assumed at various times by the American countries and territories to complete eradication of Aedes aegypti are in part still pending;

that the presence of Aedes aegypti in extensive areas of the Hemisphere constitutes a grave risk of urban yellow fever and dengue epidemics, as well as the risk of epidemics of Asiatic hemorrhagic fever and other arbovirus diseases;

that the areas still infested are the cause of reinfestations in countries and territories that have already eradicated Aedes aegypti;

that these reinfestations are becoming more frequent and more serious as international communications increase;

that the delay in completing eradication in the areas still infested demands greater expenditures on the part of those countries that have already fulfilled their commitments, with great efforts, and now find themselves obliged to prolong costly vigilance services;

that the repeated reinfestations now occurring in the Americas are seriously endangering the very success of the continental program to eradicate the vector, and

that the problem of Aedes aegypti resistance to insecticides has been largely overcome.

#### RESOLVES:

- 1.- To recommend to the Participants that they convey to their Governments the unanimous decision of the Conference to urge the infested countries and territories to immediately fulfill the commitments they assumed to eradicate the Aedes aegypti.

2.- To recommend to the Participants that they reiterate to their respective Governments Resolution XIX of the XVII Pan American Sanitary Conference, of which the operative part reads as follows:

"1.- To urge the Governments of the countries and territories already free of Aedes aegypti to maintain a strict vigilance service against reinfestation and that service take all the necessary measures to prevent the introduction of the mosquito into those areas.

2.- To urge the Governments of the countries and territories still infested to take timely measures to overcome any administrative difficulties that may be hampering the progress of their campaigns and to give the highest priority to the provision of funds, personnel, and supplies needed to complete those campaigns as soon as possible.

3.- To instruct the Director to take all necessary measures to intensify and accelerate the continental campaign so that Aedes aegypti may be eradicated in the Americas as soon as possible.

4.- To authorize the Director of the Pan American Sanitary Bureau to obtain funds to finance the prompt eradication of Aedes aegypti.

5.- To request the Director to study and put into practice appropriate systems for ensuring that the Aedes aegypti eradication campaign is carried out simultaneously and in a coordinated manner in all the countries in which the problem still exists, including frequent and periodical meetings, under the aegis of the Bureau, of the national authorities responsible for the programs."

3.- To urge the Director of the Pan American Sanitary Bureau to plan a coordinated continental program designed to complete the eradication of Aedes aegypti in the Hemisphere as quickly as possible, so as to give effect to paragraphs 3, 4 and 5 of the Resolution quoted in the foregoing paragraph.

4.- To request the Director to transmit this resolution to the Member Governments of the Pan American Health Organization and to submit it to the Governing Bodies of the Organization.

CONFERENCE

(Agenda and working documents)

After concluding his opening remarks, Dr. Abraham Horwitz asked the participants to propose candidates for the positions of Chairman, Vice-Chairman and Rapporteur.

The following persons were nominated and elected:

Dr. Augusto Gast Galvis, Chairman  
 Dr. James V. Smith, Vice-Chairman  
 Dr. Jorge Zepeda, Rapporteur

The documents listed below were presented during the meeting in accordance with the agenda. The presentation of each document was followed by a period of general discussion, on the conclusion of which the resolution containing the Conference recommendations was approved.

<u>Number of document</u>	<u>Title</u>	<u>Numerical Index</u>
EA/1	The status of the <u>Aedes aegypti</u> Eradication Campaign in the Americas (Dr. V. P. Musa)	1
EA/2	The <u>Aedes aegypti</u> Eradication and Vigilance in Argentina (Dr. Julio Blaksley)	2
EA/3	The <u>Aedes aegypti</u> , its distribution and eradication in Bolivia (Dr. Luis Gamarra)	3
EA/4	The Anti- <u>aegypti</u> Vigilance in Brazil (Dr. Aníbal R. dos Santos)	4
EA/5	The Vigilance Service in Chile (Eng. Julio Bascalto V.)	5
EA/6	The <u>Aedes aegypti</u> Eradication Campaign in Colombia (Dr. Augusto Gast Galvis)	6
EA/7	The <u>Aedes aegypti</u> Eradication Campaign in Costa Rica (Eng. Horacio Ruíz Soto)	7
EA/8	The <u>Aedes aegypti</u> Eradication Campaign in Cuba (Dr. Pablo Resik Habib)	8

<u>Number of Document</u>	<u>Title</u>	<u>Numerical Index</u>
EA/9	The <u>Aedes aegypti</u> Eradication in the Dominican Republic (Dr. F. A. Cabrera Polanco)	9
EA/10	The <u>Aedes aegypti</u> Vigilance Program in Ecuador (Dr. Felipe Aroca)	10
EA/11	The <u>Aedes aegypti</u> Eradication Program in El Salvador (Dr. Alberto Aguilar Rivas)	11
EA/12	The <u>Aedes aegypti</u> Vigilance Service in Guatemala (Dr. René Rafael Alvarez)	12
EA/13	Present Status of the <u>Aedes aegypti</u> Vigilance Campaign in the Republic of Honduras	13
EA/14	Status of the Eradication Campaign in Jamaica (Dr. David A. Keen)	14
EA/15	The <u>Aedes aegypti</u> Vigilance Service in Mexico (Dr. Adrián Torres Muñoz)	15
EA/16	The Eradication Campaign in the Netherlands Antilles (Dr. Michel Van Veldhoven)	16
EA/17	The <u>Aedes aegypti</u> Eradication in Paraguay (Dr. Alcides Almada López)	17
EA/18	The <u>Aedes aegypti</u> Eradication Campaign in Peru - Vigilance Service (Dr. A. de la Fuente)	18
EA/19	The <u>Aedes aegypti</u> Eradication Campaign in Surinam (Dr. Edwin van der Kuyp)	19
EA/20	The <u>Aedes aegypti</u> Eradication in Trinidad and Tobago (Dr. O. Siung)	20
EA/21	The <u>Aedes aegypti</u> Eradication Campaign in the United Kingdom Territories in the Caribbean (Mr. J. V. Davies)	21
EA/22	The United States <u>Aedes aegypti</u> Eradication Program (Dr. J. V. Smith)	22
EA/23	The <u>Aedes aegypti</u> Eradication in Uruguay (Dr. Solon Verissimo)	23
EA/24	The <u>Aedes aegypti</u> Eradication Campaign in Venezuela (Dr. Miguel Dorante)	24
EA/25	The Early History of <u>Aedes aegypti</u> Eradication (Dr. Fred L. Soper)	25

Number of  
Document

Title

Numerical  
Index

EA/26

The Aedes aegypti Eradication in the French De-  
partments in the Americas (Dr. R. Hyronimus)

26

CD17/15 (Eng.)  
ANNEX II

REPORT OF THE STUDY GROUP ON  
Aedes Aegypti ERADICATION



PAN AMERICAN HEALTH ORGANIZATION  
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REPORT OF THE STUDY GROUP ON AEDES AEGYPTI ERADICATION

Washington, D.C., U.S.A. 6-12 April 1967



## CONTENTS

	<u>Page</u>
Introduction	1
Present status of the <u>Aedes aegypti</u> eradication program	5
Obstacles to the completion of the program	6
Need to complete eradication of the vector in the Hemisphere	8
Basic requirements for an <u>Aedes aegypti</u> eradication campaign	10
Operation of the program	11
Insecticides for eradication of <u>Aedes aegypti</u>	20
Vigilance service	21
Research	23
Participation of PAHO/WHO in the continental program	24
Cost of the continental program	26
Financing	27
Manuals and forms for use in the program	28
Conclusions and recommendations	28

PAHO STUDY GROUP ON Aedes Aegypti ERADICATION

Washington, D.C. - 6-12 April 1967

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Mexico, Mexico (Chairman)
- Dr. Solón Veríssimo, Ministry of Public Health  
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Secretariat

- Dr. Alfredo N. Bica, Chief, Communicable Diseases Branch, PASB
- Dr. Edward Cotta, Medical Officer, PASB
- Dr. Moisés González Caballero, Medical Officer, PASB
- Dr. Pedro Freire Fausto, Medical Officer, PASB
- Dr. V. P. Musa, Medical Officer, PASB (Secretary)
- Dr. Oswaldo da Silva, Chief, Malaria Eradication Branch, PASB
- Dr. Fred L. Soper (Consultant)
- Mr. J. W. Wright, Vector Biology and Control, WHO

## AEDES AEGYPTI ERADICATION IN THE AMERICAS

### Report of a PAHO Study Group

The PAHO Study Group on Aedes aegypti eradication in the Americas met in Washington, D.C., U.S.A., from 6 to 12 April 1967. Dr. Alfredo N. Bica opened the meeting and welcomed the members of the Group in the name of the Director of the Pan American Sanitary Bureau.

Dr. Adrián Torres Muñoz was elected Chairman; Dr. Solón Veríssimo, Vice-Chairman; and Mr. Freddy González Valdivieso, Rapporteur.

#### 1. INTRODUCTION

"Man's victory over urban yellow fever in the Americas did not come easily, did not come rapidly, and did not come cheaply." Dr. Fred L. Soper

"If there is one characteristic that distinguishes the Americas today, it is the tendency to believe that nothing is impossible. We have only to observe the ideas and proposals being advanced at the highest decision making levels of the political sector, the myriads of real accomplishments and the genuine zeal to move in concert and solidarity towards the progress and well-being of all the people." Dr. Abraham Horwitz

Yellow fever is a rural and urban human disease transmitted by the domestic mosquito, Aedes aegypti. Aedes aegypti, an African mosquito, breeds by preference in artificial water containers of all kinds. This selective breeding has enabled Aedes aegypti to travel to all the continents of the world and to establish itself as an indigenous infestation in all of them.

Yellow fever is also a jungle disease of animals (monkeys, marmosets, and marsupials) transmitted by forest mosquitoes.

Urban and jungle yellow fever occupy distinct ecological niches; either may exist for long periods of time entirely independent of the other.

Man becomes a victim of jungle yellow fever when bitten by infected forest mosquitoes. The person infected in the forest is the link through which yellow fever endemicity is reestablished in cities and towns. Jungle yellow fever virus is readily urbanized in the presence of Aedes aegypti.

Aedes aegypti first came under attack in Havana in 1901; the disappearance of yellow fever in Havana led to successful campaigns in the endemic centers of Panama, Brazil, Mexico, and other countries. Unexpectedly, these campaigns resulted in the disappearance of yellow fever not only from the endemic centers but from large tributary areas. This widespread disappearance of yellow fever led in turn to the belief that yellow fever could be eradicated by a temporary limited attack on the Aedes aegypti mosquito in the endemic centers.

The Rockefeller Foundation initiated a campaign for the eradication of yellow fever in 1915. A reconnaissance of the yellow fever situation in 1916 was followed by active collaboration with infected countries in anti-Aedes aegypti campaigns. Such campaigns were carried out in Ecuador, Colombia, Peru, Mexico, Central America, Bolivia, and Brazil. In each country, yellow fever receded and disappeared from its cities and towns.

An unusual rural endemic of aegypti-transmitted yellow fever in northeastern Brazil was dominated in 1934. This marked the final victory of the Foundation's effort to eradicate yellow fever; Aedes aegypti-transmitted yellow fever, the only yellow fever known when the campaign for eradication started, had been eliminated. However, no victory celebration was held because of the discovery of jungle yellow fever and the repeated observation of the reinfection of cities and towns from jungle outbreaks.

The first shock of disillusion came in 1928 with the reinfection of Rio de Janeiro where yellow fever had been unknown for twenty years. The outbreak of 1928-1929 in Rio came at a time when there were no ready sources of infection known. Rio became once more a true endemic center which, during fifteen months, disseminated the infection to smaller towns in the interior and along the coast, from Buenos Aires to Pará. Urban outbreaks secondary to the Rio epidemic were dominated only after a three-year campaign.

The unexplained reinfection of Rio was followed by similarly mysterious infections of three widely separated towns in Colombia (1929), Venezuela (1929), and Bolivia (1932). These four Aedes aegypti-transmitted epidemics occurred at points many hundreds of miles from each other and so isolated that there could be no possibility of the infection passing from one to the other.

The discovery of jungle yellow fever in Brazil in 1932, and in Brazil, Bolivia, and Colombia in 1933, gave a ready explanation of the source of virus for the unexplained outbreaks in Brazil, Bolivia, Colombia, and Venezuela. This discovery made it clear that the victory over urban yellow fever was an empty one which could be negated at any time by the introduction of yellow fever virus from the jungle. The prevention of urban yellow fever then would depend either on maintaining costly anti-Aedes aegypti services permanently in all cities and towns or on eradicating this mosquito completely from the region.

Fortunately, the confirmation of jungle yellow fever in widely separated points in Brazil, Bolivia, and Colombia in 1933 occurred simultaneously with the demonstration in a number of Brazilian cities that the Aedes aegypti mosquito could be eradicated.

The reinfection of Rio de Janeiro in 1928 was erroneously but inevitably attributed to the unobserved transfer of virus from the notoriously endemic area of northern Brazil. As a result, the anti-Aedes aegypti campaign in the north was intensified. This intensification amounted to a complete reorganization beginning in 1930.

Detailed maps were prepared to ensure getting complete coverage of each community worked; careful detailed daily records of all work done were kept; sufficient supervision and field checking was done to permit certification of the validity of the Aedes aegypti breeding indices; and the destruction or oiling of all containers found with mosquito larvae was strictly enforced to guarantee against the continuing infestation of individual water containers. As a final check on anti-larval work, especially trained inspectors searched houses for adult Aedes aegypti. This search resulted in the discovery and elimination of the final hidden breeding places on which low level infestation depends.

The eradication of Aedes aegypti and the complete disappearance of this mosquito from all the large cities of north Brazil was the result. Once eradication had occurred, it proved to be more economical to eliminate Aedes aegypti from the suburbs and the interior towns from which reinfestation might come than to maintain the large city control programs indefinitely. Thus the concept of the eradication of Aedes aegypti throughout Brazil became the unofficial policy of the National Yellow Fever Service.

The initial hesitation of many workers and health authorities to undertake this tremendous task, which involved anti-mosquito campaigns in every state and territory of the country, was overcome by the behavior of yellow fever itself.

Between 1934 and 1940, a series of wavelike epidemics of jungle yellow fever moved from the headwaters of the Amazon River Valley in Mato Grosso down into the Paraguay-Paraná Basin. These epidemics swept through the monkey-infested forests of all of the states of southern Brazil, of Paraguay, and of Misiones Province in Argentina. During this period yellow fever cases were found in a number of cities and towns; four infectious cases were identified in Rio de Janeiro itself. (Had Aedes aegypti still been present, the reinfection of Rio, as in 1928-1929, would surely have been repeated.) Sharp local Aedes aegypti-transmitted outbreaks, clearly due to urbanization of jungle virus, were observed in 1935-1936 in Teófilo Otoni and Figueira in Minas Gerais, and in Cambará, Paraná. Other less well documented invasions of cities and towns occurred during this period.

Following this experience, there was never any doubt of Brazil's determination to eradicate Aedes aegypti; it became the official objective of the National Yellow Fever Service in 1942. In the meantime, Aedes aegypti had been eradicated in Bolivia. In 1942, Bolivia proposed to the XI Pan American Sanitary Conference that the countries of the Americas should join in a campaign for the continental eradication of Aedes aegypti.

Brazil continued to suffer reinfestation with Aedes aegypti along its other southern frontiers. The problem of the frontier with Uruguay was settled by a coordinated program which resulted in the eradication of Aedes aegypti in Rivera in 1947.

To meet the serious problem of reinfestation from Paraguay, Brazil brought the proposal for the permanent solution of the urban yellow fever problem through the eradication of Aedes aegypti in the Western Hemisphere in 1947 before the Directing Council of PAHO. The Directing Council acted favorably and entrusted the problem to the Pan American Sanitary Bureau for the solution of legal, technical, and financial questions.

The following year yellow fever appeared in Panama, close to the Canal, and during the next decade invaded one after another of the countries of Central America, British Honduras, and Mexico. Since 1947, yellow fever has been shown to exist in Trinidad and all of the countries of the mainland of the Americas except Canada, the United States, El Salvador, Uruguay, and Chile. In 1966, yellow fever occurred in six South American countries, from the shores of the Caribbean in the north to Rio Grande do Sul, Brazil, and Corrientes Province, Argentina, in the south.

Since 1944 jungle yellow fever has invaded the Paraguay-Paraná River system five times without causing any urban yellow fever. This absence of urban yellow fever is guaranteed by the continued absence of Aedes aegypti in this region.

The cumulative effect of the Rockefeller Foundation-sponsored program beginning in 1918, and of the continuing drive for the eradication of Aedes aegypti in the Americas is a period of freedom from urban yellow fever during the past thirty years, unique in the history of the past four centuries. Since 1937, only two instances of yellow fever occurring in the presence of Aedes aegypti have been recorded: one at Senna Madureira, in the Amazon Valley of Brazil, in 1942, and the other at Port of Spain, Trinidad, in 1954. A very real threat of urbanization of yellow fever virus in Venezuela in 1966 was met by large-scale fumigation and massive vaccination of urban and rural populations.

The countries of the Americas subject to the invasion of jungle yellow fever, which have already eradicated Aedes aegypti, must realize that the guarantee of their safety from reinfestation lies in the completion of the eradication of Aedes aegypti in the Americas.

The countries which still have Aedes aegypti must recognize that their permanent protection from yellow fever, dengue, and hemorrhagic fever depends on completing the eradication of Aedes aegypti.

## 2. PRESENT STATUS OF THE AEDES AEGYPTI ERADICATION PROGRAM

So far, the mosquito has been eradicated in the following countries, which are considered to be free of it: Argentina, Bermuda, Bolivia, Brazil, British Honduras, Chile, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and the Panama Canal Zone. The problem persists in the northern part of South America, in one country in Central America, in the United States of America, and in the Caribbean Area.

In the northern part of South America, French Guiana, Surinam, Guyana, Venezuela, and two localities in Colombia are infested.

French Guiana had been declared free of Aedes aegypti in 1958, but in 1963 this department was found to be extensively reinfested, and eradication operations have not yet been resumed there. In Surinam, eradication operations were begun in 1963, but the results obtained so far, have been very meager. After being free of the mosquito for several years Guyana was found to be reinfested in 1962, but the campaign was not resumed until 1965, and the results obtained since then have not been satisfactory. In Venezuela, the campaign has been unable to make any progress in the last four years.

Colombia achieved eradication of the mosquito in 1961, but, between September of that year and the end of 1966, the country has been repeatedly reinfested. The latest of these reinfestations were discovered in the City of Cúcuta near the Venezuelan border at the end of 1965, and in the port area of Santa Marta, on the Caribbean coast, in October 1966.

Aedes aegypti eradication was achieved in Central America several years ago, but in June 1965, the capital of El Salvador, a country which had been free of the mosquito since 1967, was found to be reinfested. To begin with, the reinfestation was thought to be confined to a few areas in San Salvador, but as soon as eradication operations were resumed in the city, the situation became clear and, by the beginning of 1966, it was known that San Salvador was completely infested, and that reinfestation had spread to another 24 localities situated in the adjoining areas. Furthermore, an investigation made in September 1966 showed that many other areas in the country had also been reinfested. However, in view of the small number of personnel available to the campaign since it was resumed, eradication operations have been limited to the City of San Salvador, and to the International Airport of Ilopango, and even so, it has not been possible to sustain an adequate work cycle in these two localities. Consequently, the results obtained by the campaign so far have not been satisfactory.

The United States of America, whose campaign includes Puerto Rico and the American Virgin Islands, began eradication operations in 1964. The campaign covers only part of the areas presumed to be infested by Aedes aegypti, and the results obtained so far have been very meager.

In the Caribbean Area, the campaign is in its final phase in Trinidad where, in recent years, small foci of reinfestation have been found. It is advancing in Cuba, although the progress made has been less than was anticipated. Eradication operations have been suspended in Haiti, Jamaica, the Dominican Republic, as well as in Dominica, Guadeloupe, and the British Virgin Islands. In the remainder of the area the campaign is bogged down or is moving forward very slowly, and the results obtained have not been satisfactory.

### 3. OBSTACLES TO THE COMPLETION OF THE PROGRAM

The Study Group examined the working documents of the Conference on Aedes aegypti Eradication in the Americas held in Washington, D.C. from 3 to 5 April 1967, under the auspices of the Pan American Sanitary Bureau.

This examination showed that, in the last five years, the eradication campaign had made some progress in very limited areas, and that in several countries and territories the situation had in fact considerably worsened. That development was due to the financial, technical and administrative difficulties which are hampering the satisfactory progress of the campaign in almost all the countries and territories still infested.

Among those difficulties special mention must be made of the following:

1. Insufficient funds and personnel to ensure adequate coverage of infested areas.
2. Deficient organization and administration.
3. Personnel problems which impair the quality of field work.
4. Resistance of the mosquito to chlorinated insecticides.
5. Reinfestations.

The eradication of the vector by means of residual-action insecticides comprises fundamentally two operations: the treatment of areas found to be positive, and the verification of treated areas in order to evaluate the results of the treatment. Each verification is followed by a new treatment of the areas found still infested until eradication of the mosquito is achieved.



If the campaign is to be successful, not only must treatment be carried out correctly with an effective insecticide, but the treatment-verification cycle must be adjusted to the duration of the residual effect of the insecticide employed, and that cycle must be strictly complied with. In addition, areas capable of easily reinfesting one another must be treated and also verified at the same time, as if they formed a single locality.

If the campaign does not have sufficient funds or staff available to carry out this type of coverage, it will be very difficult to eradicate the mosquito in a country.

Punctuality is an essential factor in the success of field operations. Any delay in making the verification of a treated area, or in treating an area found positive, can delay elimination of the mosquito. Moreover, the eradication of the vector in a country must be completed within a short period of time. Campaigns which drag on for many years make for reinfestation within the country itself and for the development of insecticide resistance.

It is clearly extremely difficult for a campaign to carry out verification and treatment punctually, and to put a work program into effect without delays if it does not have complete administrative flexibility which enables it to take without loss of time such measures as may be necessary for the satisfactory conduct of field activities.

The eradication of Aedes aegypti calls for painstaking, exacting, and honest work which can only be obtained if certain basic conditions relating to field personnel are satisfied, including the following: careful selection and training; adequate salaries; a strict chain of command, discipline, and defined responsibilities; strict, continuous and unremitting supervision of field work with the dual purpose of correcting faults and improving the technical competence of the personnel.

Clearly the campaign will not be able to establish or maintain those conditions if the administration of the campaign does not have the authority to act with complete independence in all matters relating to personnel. Furthermore, it is obvious that in many countries it will be very difficult, for various reasons, to meet these requirements.

Nevertheless, it should be borne in mind that they are a decisive factor in the quality of the work done by the field personnel, and only high quality field work is capable of ensuring the success of a campaign, in which incomplete treatment or careless inspection of a house may delay eradication of the mosquito in a locality for several months.

Aedes aegypti resistance to chlorinated insecticides has largely contributed to the present situation of the campaign in the Caribbean Area and in the northern part of South America. The problem exists today, to some extent, in all the countries and territories in those areas. Because of this resistance, the campaign has been suspended in various places and has been considerably delayed in many others.

However, at present the problem has lost much of its importance since we already have some organophosphorus insecticides available which can be used to replace the chlorinated insecticides. The residual action of those insecticides is shorter than that of DDT or Dieldrin. As a result, it is more expensive to use them, but the results obtained in some areas show that they can eradicate Aedes aegypti resistant to chlorinated insecticides.

In any event, it is obvious that an effective insecticide cannot by itself ensure the success of the campaign. Likewise there is no need to emphasize that the continued use of an insecticide in a campaign which is unnecessarily prolonged favors the development of resistant strains. There is no doubt that the present resistance of the vector to DDT is to a certain extent the result of the fact that, for various reasons, many campaigns were unable to eradicate the mosquito in a reasonable period of time, despite the initial effectiveness of the insecticide.

There is no need to emphasize the importance that reinfestations occurring within a country have for its campaign nor the importance that inter-country reinfestations have for the continental campaign, especially after the vector has developed resistance to chlorinated insecticides. It is enough to mention the fact that some of the areas where the campaign is today meeting major difficulties were formerly negative.

Both in the case of autochthonous and of imported reinfestations, the success of the campaign depends on their being averted or reduced to a minimum. For that purpose it is essential: a) to cover at the same time, as if they formed a single locality, the areas of the country capable of reinfesting one another with ease; b) to coordinate the campaign in an appropriate manner in all the areas still infested in the Americas; c) to maintain strict vigilance against the reintroduction of Aedes aegypti in areas which are being freed of the vector; d) to complete eradication of the mosquito as soon as possible.

#### 4. NEED TO COMPLETE ERADICATION OF THE VECTOR IN THE HEMISPHERE

In the opinion of the Study Group, the existence of Aedes aegypti in extensive areas of the Hemisphere represents a threat of urban yellow fever that should not be underestimated. Eradication of the mosquito in a majority of the countries most exposed to the virus from the jungle areas in South America eliminated the possibility of urban yellow fever in their territories. Consequently, opportunities for the introduction of the virus to other countries have diminished. Nevertheless, it must be borne in mind that, in view of the ease and rapidity of modern travel, all the countries and territories of the Hemisphere are, from the epidemiological standpoint, very close to the enzootic areas of South America.

In the same way the epizootic outbreaks which periodically occur in the Hemisphere may carry the virus to areas far distant from the above-mentioned enzootic foci. In actual fact, in the last 20 years, as a result of several epizootics the presence of yellow fever virus has been confirmed in the forest areas of Trinidad and of all the countries and territories on mainland of the Continent with the exception of Canada, the United States of America, El Salvador, Chile, and Uruguay. This finding indicates the extent of the threat that jungle yellow fever represents for the areas in the Americas infested by Aedes aegypti.

By the mere control of Aedes aegypti in those areas, it would be extremely difficult to keep them permanently protected against yellow fever. Experience in Brazil showed that it was not practicable to sustain indefinitely a control program capable of ensuring that infestation indices would remain below the level critical for the transmission of the disease. Furthermore, it is clear that permanent control of the mosquito would in the long run cost more than eradication. Again, the protection of those areas solely by means of immunization is not to be recommended; in addition to the fact that it is highly improbable that it would be possible to maintain the whole population sufficiently and permanently immunized for an indefinite period, that type of protection would also turn out in the long run to be more expensive than the eradication of the vector. There is no doubt, in the light of present knowledge, that this last-mentioned measure namely, the eradication of Aedes aegypti, is, not only the least expensive way of effectively protecting those areas, but also the only way of definitively eliminating the possibility of the occurrence of urban yellow fever in them.

In addition to the threat of yellow fever, we should also take into account the risks of epidemics of dengue fever which the countries and territories infested by Aedes aegypti are exposed to. Although dengue fever is not a particularly serious disease, epidemics of dengue, like those which occurred in the Caribbean area between 1963 and 1966, can cause serious financial losses especially in countries where the tourist trade is an important source of revenue.

Another risk which infested countries incur is that of epidemics of hemorrhagic fever. So far, hemorrhagic fever has been identified only in Asia where Aedes aegypti is regarded as possibly the sole vector of the disease. However, the possibility that this infection, for which the case fatality rate in certain Asian outbreaks has been 10 to 15 per cent, may occur in the Western Hemisphere cannot be excluded.

The eradication of Aedes aegypti will definitively eliminate the possibility of the occurrence in the Americas of epidemics of dengue fever or hemorrhagic fever against which no vaccine is available.

Moreover, the areas still infested by Aedes aegypti in the Americas have been the cause of the frequent reinfestations which have been occurring in the Hemisphere. In the last six years, the following countries and territories have been reinfested: Antigua, Aruba, Bonaire, Colombia

El Salvador, French Guiana, Guyana, Mexico, Montserrat, St. Kitts, St. Vincent and Trinidad.

In addition to the additional heavy outlay of funds they demand of the countries and territories which have already spent considerable sums of money on the eradication of the mosquito, these reinfestations also delay the completion of the continental program and increase the risk that the Hemisphere may experience more extensive and serious reinfestations capable of nullifying the program.

Aedes aegypti eradication has been achieved in 80 per cent of the ecologically favorable areas in the Americas. Owing to a lack of data we cannot calculate the amount of money spent on that endeavor. However, we do know that the attack on the vector in the Hemisphere has already cost millions of man-days of work for repeatedly inspecting and treating millions of houses. The safeguarding of that enormous investment in money and effort is of vital importance to the Americas.

The Study Group is of the opinion that it can only be safeguarded if the eradication of Aedes aegypti in the Hemisphere is completed without further delay.

#### 5. BASIC REQUIREMENTS FOR AN AEDES AEGYPTI ERADICATION CAMPAIGN

In the opinion of the Study Group there is at present no technical obstacle to the eradication of the vector in the Americas. Effective residual action insecticides are available, as are techniques and methods which, when correctly applied, have been shown in extensive areas in the Hemisphere to ensure the elimination of Aedes aegypti.

However, it is not enough that the eradication of the vector should be feasible from the technical point of view; it must also be administratively and financially feasible. In other words, in addition to appropriate insecticides, techniques, and methods, the administrative and financial conditions must be such as to ensure the proper development of the whole process leading to the eradication of Aedes aegypti. Basically, those conditions are as follows:

- a) Firm decision on the part of the Government to eradicate the mosquito, and to assume the responsibility that eradication involves;
- b) Sufficient funds to cope uninterruptedly with the personnel, supply, and equipment requirements of the campaign until such time as the eradication of the vector is achieved;

- c) Appropriate organization on a national scale, enabling the campaign to carry out its activities in a uniform and coordinated manner throughout the country.
- d) Administrative independence and flexibility whereby the campaign can handle its budget without bureaucratic interference; establish conditions of employment of its staff; fix salary scales and per diem allowances; engage, transfer, discipline, or dismiss staff without delay or difficulty;
- e) Legal provisions providing the campaign with authority to quickly enforce its decisions and to adopt without delay the necessary measures to eradicate the mosquito.

## 6. OPERATION OF THE PROGRAM

The foregoing chapter outlines the basic requirements for the success of an Aedes aegypti eradication campaign.

In the following paragraphs some comments on those requirements will be made, and other factors, which so far have not been mentioned but which the Group considers extremely important for the satisfactory conduct of the campaign, will be examined.

### 6.1 Planning and organization of the campaign

The campaign must be planned to end in as short a time as possible. Generally speaking it should not last for more than four years. Only in exceptional circumstances where the positive area is very extensive, infestation is high and general, and there is the problem of heavily infested large cities, should the duration of the campaign be extended to a maximum of 6 years.

Aedes aegypti eradication must be regarded as a specific and urgent activity outside the routine activities of public health administrations. Nevertheless, as it is an activity which is to be continued for some years, it cannot be carried out satisfactorily without exceptionally efficient organization and planning..

In practice the success of the campaign depends on administration, methods, and funds. As stated in the foregoing chapter, at present the necessary technical elements for eradicating the mosquito are available. Likewise, for most of the countries and territories still infested, the cost of a campaign using modern techniques is not an insuperable obstacle, provided that the government gives Aedes aegypti eradication the priority it deserves. Furthermore, countries that need them may possibly obtain international funds for their campaigns. Consequently, the Study Group is of the opinion that the factor on which most emphasis must be laid is the efficient administration of all campaign activities.

We cannot expect satisfactory work from mediocre workers. Hence, the importance of the careful selection and training of the campaign staff and of a system that provides for the promotion of the best workers, to ensure that the campaign attracts first class personnel. The salaries must be sufficiently high to attract competent applicants, and to induce the collaborative spirit so necessary for a program of this scope. Working conditions must be attractive enough to induce personnel to wish to remain in the service, since excessive staff turn over reduces the quality of the work. Furthermore, it is difficult to count on the loyalty, discipline, and efficiency of a poorly paid staff.

The management of the program must be in the hands of a specialist with broad administrative experience, who is assisted by suitable and capable subordinates. When suitable personnel cannot be found in the country, thought should be given to the recruitment of temporary staff from abroad as a possible solution to the problem. The organization of the campaign must be based on a precise distribution of activities, a clear definition of the powers and duties of each employee, and lucid instructions.

Detailed knowledge of the country, the ecological conditions encountered by Aedes aegypti in various regions of the territory, internal and international communications, and other important factors will make it possible to draw up a suitable plan of work for the campaign. It is not enough to have prepared this plan beforehand; it is essential to continue to collect data and to study them so that they can be used in time to rapidly correct any errors that may have been made.

## 6.2 Legislation

The Aedes aegypti eradication campaign must be supported by the population and that support can be obtained through health education and propaganda. Furthermore, the campaign needs legal support, since the measures which will apply will be general in character. The nature of the legal measures to be adopted will vary according to the conditions in each country and the legislation in force. However, when those measures are framed, the following should be borne in mind:

- a) To confer on program staff the right to enter all premises and houses in order to take such measures as the campaign considers necessary for the elimination of Aedes aegypti, including the application of insecticides to all actual and potential mosquito breeding places.
- b) To make it a duty of the owners of uninhabited houses and of the occupants of houses which are habitually closed during working hours to permit campaign personnel to enter those dwellings.

- c) To authorize the campaign to apply or cause to be applied appropriate measures for definitively eliminating Aedes aegypti breeding places, and for preventing the appearance of new breeding places.
- d) To authorize the campaign to implement such measures as may be considered necessary for preventing the reintroduction of the vector into the country or into areas of it already free of the mosquito.
- e) To authorize the campaign to impose penalties.

### 6.3 Management of the campaign

In order to eradicate Aedes aegypti the countries must mount a specific campaign to which the National Public Health Administration will have to assign the necessary priority. The management and supervision of eradication operations will have to be the responsibility of a central service which will be responsible for operations throughout the national territory. Where necessary, sectional services dependent on the central administration will be established and will be made responsible for operations in different parts of the country. However, it is essential that the central organization be given the necessary degree of authority, and that it be in a position to guide, coordinate, and supervise campaign activities throughout the country, both as regards to its technical and administrative aspects.

In some countries it will be advisable to establish a national Aedes aegypti eradication council composed of senior public health authorities, the director of the campaign, and PASB representatives. This council will have to meet periodically in order to evaluate the progress of the campaign, to study such problems as may be hampering it, and to assist in solving them. Likewise, the council will be responsible for keeping the highest government and health authorities informed of the status of the campaign, and of winning for the program the support and prestige it must have.

The structure of the central service and of the sectional services will obviously depend on the size of the country and the importance of the problem. Nevertheless, the most appropriate and advisable arrangement seems to be centralization of the technical and administrative management of the program and decentralization of program execution.

Both the central service and the sectional services will have to be organized in such a way that they can fully cope with the administrative and technical needs of the program and ensure that it is conducted satisfactorily.

14.

#### 6.4 Health education

The Study Group considers it unnecessary to emphasise the importance of health education in a campaign of this type. The extraordinary assistance that the population can give in eliminating a mosquito which breeds in domestic and peri-domestic artificial water containers is quite clear.

In principle, national integrated health plans should include health education activities connected with the campaign, designed to inform and motivate communities with respect to Aedes aegypti eradication and the cooperation they can give to the campaign. For that purpose close relations must be maintained from the outset, and mutual cooperation must be established with the general health services, whose staff will have to have sufficient knowledge of the Aedes aegypti problem and of the methods adopted to solve it, to be able to collaborate efficiently with the campaign.

In addition to these health education programs, the campaign will have to train its own staff how to publicize the program and enlist the collaboration of the population. The appropriate use of pamphlets, posters, and handouts, as well as the joint action of schools, the press, professional, civic, cultural and social groups are among the most effective measures for motivating communities.

In countries which do not have any health education programs the campaign itself will, from the very outset, have to carry out those activities and to recruit for that purpose such expert staff as it considers necessary.

#### 6.5 Budget

Once it is started, an Aedes aegypti eradication campaign should be pursued without interruption or without reduction of the necessary operations. Consequently, the initial budget must make provision for the total cost of the program, from the beginning to the end. Every effort should be made to ensure that these allotments are approved once and for all. When the government, as usually happens, can only provide funds by annual allotments, they will have to be adjusted to a plan mapped out in a detailed program which is approved before the campaign is begun.

When proposing the initial budget, it must be made very clear that it is impossible to foresee the details of program execution with any degree of accuracy. The course of the campaign is determined not by a mechanical but by a biological process, and for this reason, its strategy may have to be modified as operations advance. Consequently, the greatest possible flexibility must be given to the financial administration of the program, and the director must be given wide powers in the use of funds.



Aedes aegypti operations have to be regarded as a continuous and dynamic whole. Any interruption of those operations not only delays the completion of the campaign, but may also cause a return to the point of departure. Consequently, punctuality in the provision of funds will always be an essential condition to the success of the campaign. It is therefore recommended that the system for the supply of funds makes provision for the campaign always to have at its disposal the necessary amount of money to cover all expenses for a minimum period of three months.

#### 6.6 Personnel

Manpower is a decisive factor in the success or failure of an Aedes aegypti eradication campaign. Consequently, this component must be given due importance in the planning, organization, and execution of the program.

The Group emphasizes the need for strict and precise staff regulations from the very outset, so as to ensure that work is of the quality needed for eradicating the mosquito.

To obtain this type of work the Group is of the opinion that the following staff conditions should be met:

- a) Careful selection and training.
- b) Adequate remuneration including the payment of travel and per diem allowances.
- c) Maintenance of a strict grading system, discipline, and defined responsibilities.
- d) Strict, continuous, and unremitting supervision of field activities, with the dual purpose of correcting errors and improving the technical competence of personnel and the quality of their work.
- e) Establishment of a promotion system by means of which an employee may advance to higher levels solely on the basis of merit.
- f) Prompt and appropriate penalties for breaches of campaign regulations.

Careful attention should be paid to the selection of personnel of all grades. In selecting personnel, special attention should be given to the following aspects:

- a) Moral character;
- b) Physical capacity to carry out the work for which the applicant is being considered;
- c) General educational, professional, and technical background which should be appropriate to the post the applicant will hold;
- d) Demonstrated interest in, and understanding of, the program itself.

Training will be provided for personnel at all levels and of all grades, and its prime purpose will be to prepare staff members for their duties. In the opinion of the Study Group, an employee with a good knowledge of the general aspects of the program will be better able to carry out the specific functions assigned to him. Consequently, personnel training should comprise both a general part, on the basic aspects of the campaign, and a special part, including intensive and specific training for the activities he will be responsible for.

In any event, training will not be limited to the initial training that the employee receives on joining the staff. General and specific in-service training will be continued by means of appropriate supervision and special activities such as meetings and discussions, specially intended to help the staff refresh and increase their knowledge.

The appropriate management of field personnel through a well-defined, functional, and expeditious system is essential to the satisfactory operation of the program. Decisions concerning personnel selection, recruitment, authorization for leave or holidays, promotion, disciplinary action, and separation from the service should be taken solely and exclusively in accordance with the program regulations.

If personnel management, particularly personnel discipline, is defective, eradication will not be achieved. If this situation is not taken care of at the very start, there will be technical deficiencies in eradication operations, low personnel morale, and finally, the discredit and failure of the program.

#### 6.7 Stages of the campaign

The most advisable strategy for an Aedes aegypti eradication campaign is that which provides for the simultaneous coverage of all the infested area of the country. Such a strategy eliminates the possibility of autochthonous reinfestations, and normally makes it possible to eradicate the mosquito within a period of three to four years.

Only in exceptional circumstances when simultaneous coverage is not possible for financial reasons because the infested area is very

extensive, should any consideration be given to the use of a strategy based on the division of the infested area into two, or at most, three parts, each of which would be covered separately. This strategy obviously increases the time needed to complete the eradication campaign in the country, and makes it necessary to adopt strict internal vigilance measures to prevent the reinfestation of the areas being freed of the mosquito until eradication is completed in the country.

It is clearly very difficult to apply this strategy successfully if the infested area cannot be divided into parts between which vehicular traffic is relatively limited and concentrated on a few main roads so that a strict system of vehicle control can be established capable of preventing or reducing to a minimum the transportation of the mosquito in any of its stages of development. In the same way, the possibility of the vector being transported from one area of the country to the other by means of rail, ship or air traffic must also be provided for.

In any event, before any decision is made to apply this strategy in any country, the whole question must be very carefully considered and all the drawbacks and the risks involved in it must be carefully weighed against the reduced costs which such a strategy may imply for the campaign as opposed to the strategy of simultaneous coverage of the entire infested area.

Whichever of the two strategies is adopted, an Aedes aegypti eradication campaign comprises four basic stages: preparatory, attack, consolidation, and maintenance. If the strategy adopted for the program is coverage by parts, the order of succession of the four stages will naturally be the same in all parts of the territory. However, the several parts into which the infested area is divided will not be in the same stage at the same time, since eradication operations are begun in each of the parts at different times.

#### 6.7.1 Preparatory

The following activities are carried out in this stage although not necessarily in this order: preparation of the plan of operations; setting up of offices and establishment of the administrative system; recruitment and training of personnel; purchase of supplies and equipment; geographical reconnaissance of the area to be covered, including preparation of maps, numbering of blocks, and, if necessary, the numbering of houses; and the preparation of work itineraries.

A start will also be made on activities designed to inform and motivate the population about the program and enlist the cooperation of the community in eradicating the mosquito.

The duration of the preparatory stage will of course vary, depending on the extent of the infested area, and the scope of the program. Generally speaking, this stage should be completed in the period of three to

five months but in some instances a longer period will be necessary. In any event this period should not exceed one year.

#### 6.7.2 Attack

Once the preparatory stage is completed, eradication operations proper will be begun throughout the area it is planned to cover. In the opinion of the Study Group, these operations should be carried out along the lines set forth in the PAHO manual of technical and administrative standards for the Aedes aegypti eradication campaigns.

Aedes aegypti eradication by means of residual-action insecticides comprises basically the following three operations:

- a) Initial survey to ascertain the exact distribution of the mosquito in each locality;
- b) Treatment of positive localities;
- c) Verification (post-treatment inspection) of treated localities to evaluate the results of treatment. Each verification will be followed by a further treatment of the areas found to be still infested until eradication of the mosquito is achieved.

The Group recommends that the methods laid down in the above-mentioned PAHO Manual be applied in these operations.

Essential factors in the attack phase are correct coverage of each locality, strict compliance with work itineraries, punctual maintenance of treatment and verification cycles, and efficient field operations. This can only be achieved as a result of the appropriate orientation, coordination, and supervision of the activities of all personnel.

To facilitate the attainment of this aim, field personnel should be organized into teams composed of not more than five or six workers as a maximum, with a team leader. For every five team leaders there will be a supervisor, who will be responsible for the general supervision of the work of the five teams. At a third level of supervision every 25 teams will have an inspector who will be responsible for the orientation, coordination, and general supervision of the work of the teams.

The treatment-verification cycles adopted will depend on the duration of the residual action of the insecticides used by the campaign.

In the opinion of the Study Group, a cycle of 3 months for DDT or dieldrin and two months for the organo-phosphorous insecticides currently being used against Aedes aegypti, will be adequate. Nevertheless,

it should be borne in mind that only careful evaluation of the results obtained in the early months of work, supported by laboratory observations on the duration of the residual action of the insecticide, can say whether the cycle adopted by the campaign is adequate or whether it needs to be adjusted to the special conditions existing in the area.

Furthermore, the results obtained with insecticide applications must be continuously and carefully evaluated in order to promptly discover any defect interfering with the eradication of the mosquito.

It is strongly recommended that if the infestation index in a locality is not drastically reduced through the application of the insecticide, as is to be expected, a careful and complete investigation should be made before normal operations are continued to determine and eliminate the cause of the failure of the treatment. If this is not done, the campaign may suffer severe setbacks and financial losses which would have been avoided.

The duration of the attack phase coincides in practice with the duration of the eradication of the mosquito, since this stage is to be considered completed only when the localities in the area covered have been inspected and found negative at least once and the Aedes aegypti problem in the area is reduced to the sporadic occurrence of small isolated foci of the mosquito.

The duration of the attack phase varies considerably, since it obviously depends on a whole cluster of factors. However, in normal circumstances, this stage should be completed in from 1 to 3 years, according to the size of the area covered and its degree of infestation.

### 6.7.3 Consolidation

In this stage the foci of Aedes aegypti that have managed to survive the attack operations will be eliminated.

In order to find these foci, the verification cycle employed in the attack phase will be continued in all the initially positive localities considered negative. These inspections will confirm that localities are negative and will prevent reinfestations.

The Group is of the opinion that in addition to the search for larvae, search for adult mosquitoes should be made in the course of the verification of certain localities in which the conditions make for the existence of hidden breeding places, in order to identify any possible hidden focus of the mosquito.

The consolidation phase is to be considered completed when all localities in the initially positive area are negative by the last verification.

## 6.7.4. Maintenance

In this phase the inspection will be continued in the initially positive area until it can all be declared free of the mosquito, in accordance with the criteria for eradication established by PAHO.

During this stage a specific vigilance service will have to be organized.

7. INSECTICIDES FOR ERADICATION OF Aedes aegypti

The Study Group noted that in some areas of the Americas Aedes aegypti is still susceptible to DDT. It recommended that the eradication campaign in those areas be based on the use of this cheap, effective, and safe insecticide.

The Study Group noted with satisfaction that considerable progress had been made in the last five years on the development of new insecticides that could be used in areas where Aedes aegypti resistance to chlorinated insecticides has developed.

Among these new insecticides special mention must be made of the organophosphorus insecticides, Abate, fenthion and malathion. Abate is a highly effective, persistent, and safe insecticide, and the WHO Expert Committee on the Safe Use of Pesticides in Public Health (WHO Technical Report Series No. 356, 1966) has agreed to its application in drinking water in slow release formulations. Fenthion and malathion have been shown to be effective and safe products for peripheral use and area treatment and for application to non-potable water.

Evidence was submitted to the Study Group indicating that fenthion and malathion, when used in association with Abate, at the correct dosage, and in accordance with the recommended application techniques, are effective in work cycles of up to two months. The Study Group recommends that eradication programs in areas where DDT and dieldrin resistance has been confirmed be based on the use of the above-mentioned organo-phosphorus insecticides.

The Study Group was informed of the trials of new insecticides for use against Aedes aegypti, which PAHO has been carrying out in Jamaica in cooperation with the Government of that country, and of studies on the same problem being carried out in the United States of America and Venezuela.

The Study Group was also informed of the long-term program undertaken by the World Health Organization for the evaluation and testing of new insecticides. More than 40 manufacturing companies are currently providing this program with recently developed compounds; so far, more

than 1,400 compounds have been examined and new chemicals are being received at the rate of 200 a year. All these compounds are systematically evaluated by a group of ten laboratories and 4 WHO field research units. This evaluation includes cross-resistant studies, selection experiments, formulation development and toxicological research. The basic purpose of the program is to anticipate resistance problems and to develop suitable substitutes for the insecticides in use. A number of these currently under study (in addition to those mentioned) appear to be suitable for Aedes aegypti eradication.

Therefore, it does not appear likely that provided the eradication of this mosquito from the Americas is undertaken energetically and comprehensively that insecticide resistance should prove in the immediate future to be a major technical obstacle to the successful termination of the program.

## 8. VIGILANCE SERVICE

Vigilance to prevent reinfestation should be initiated as soon as Aedes aegypti eradication is completed. This vigilance will be continued without interruption in the Americas for as long as there are infested areas in this Hemisphere. Upon completion of Aedes aegypti eradication in the Hemisphere, it will only be necessary to maintain vigilance in the ports and airports in communication with infested ports and airports of other continents.

The Study Group has examined the reports on vigilance service in the countries in the Hemisphere that have already achieved Aedes aegypti eradication, presented to the Conference on Aedes aegypti Eradication in the Americas held in Washington from 3 to 5 April 1967. This examination showed that some countries were maintaining a perfectly adequate vigilance service; others have unsatisfactory vigilance services which need to be strengthened; still others do not maintain any vigilance activity.

It is unnecessary to emphasize the risk of reinfestation being run by countries which are not maintaining adequate vigilance services in their territories, especially those, which, because of their geographical situation and ease of communications, are more exposed to the sources of reinfestation in the Hemisphere. Nor is there any need to insist on the advisability of all areas free of the mosquito in the Americas maintaining an efficient vigilance service.

This service should be aimed at preventing the importation of the mosquito and at discovering and promptly eliminating any reinfestation which it has not been possible to prevent.

For the achievement of these objectives the following measures are recommended:

### 8.1 Preventive Measures

These measures should include:

- a) Control of air traffic, to ensure compliance by airlines with the provisions of the international sanitary regulations dealing with disinsection of aircrafts.
- b) Control of sea and river transport, to ensure that small craft coming from abroad keep their water containers mosquito-proof; to inspect large vessels coming from infested areas, particular attention being paid to those parts of the vessels that may contain Aedes aegypti breeding places.
- c) Control of land transport. It is essential to control railroads and other forms of land transport coming from infested countries. Where necessary, they must be disinfected and all containers capable of transporting mosquito eggs must be treated. Special attention should be paid to used tires, regardless of their mode of entry, and importers should be required to provide information on their origin and destination. Such goods shall be appropriately treated.

## 8.2 Means for discovering reinfestations

These vary from country to country depending on whether the country free of Aedes aegypti is adjacent to countries also negative or adjoin countries still infested.

In the first instance the Study Group recommends:

- a) Vigilance at all international ports and airports, and all frontier posts served by international communication systems.
- b) Inspect at least 10% of the houses, existing in these localities, at a six-monthly cycle.

In the second instance the Study Group recommends:

- a) Surveys in localities in which the ecological conditions are favorable to the vector, including inspection of at least 10% of existing houses.
- b) A six-month verification cycle covering 10% of the houses in initially positive localities.
- c) A three-monthly verification cycle covering at least 33% of the existing houses in international ports and airports, and at frontier posts situated on a frontier with an infested country.



The Study Group emphasizes the important role played by aircraft in the transportation of the mosquito from one country to another. With the continually increasing speed and size of modern aircraft the importance of the problem is growing. In the future, plans relating to the movement of air freight will require special attention.

It is to be noted that many countries still accept aerosol treatment when airborne, before landing, as a satisfactory means of disinsection. However, there is abundant evidence that this procedure is ineffective, and its future use is not recommended.

The countries should adopt as a uniform practice one of the two procedures approved by the WHO Expert Committee on Insecticides, namely, disinsection with "block away" and the automatic Dichlorvos disinsection.

## 9. RESEARCH

In the opinion of the Group, research is an essential factor in solving many of the problems which may arise in the course of an Aedes aegypti eradication campaign.

The Study Group therefore recommends:

- a) That the present WHO program to develop new insecticides be continued and intensified, with particular reference to compounds that could be used in Aedes aegypti eradication. Special attention should be given to the development of an effective ovicide.
- b) That studies on resistance levels of Aedes aegypti to the different insecticides being used be performed systematically. It is suggested that PAHO/WHO provide the countries with such technical assistance as they may need for carrying out these studies.
- c) That PAHO/WHO assist the Governments in investigating any administrative problems that may arise in the course of the eradication program.
- d) That PAHO/WHO give consideration to expanding the activities of the testing unit in Jamaica so that it might undertake research on all aspects of the ecology, biology, and eradication of Aedes aegypti.
- e) That PAHO/WHO take steps to regularly provide interested governments with information on all aspects of the ecology, biology, and eradication of Aedes aegypti.

## 10. PARTICIPATION OF PAHO/WHO IN THE CONTINENTAL PROGRAM

The Study Group is of the opinion that the Pan American Sanitary Bureau has been playing a decisive role in the Aedes aegypti eradication program in the Americas. As a result of the stimulus and cooperation of the Bureau, which has included technical assistance provision of supplies and equipment, and, in some cases, financial support, it has been possible in the last nineteen years to eradicate the mosquito in many countries. In all the other countries and territories of the Hemisphere, eradication campaigns have been undertaken although many have not been successful.

As is stated in other parts of this report, it is of vital importance to the Americas that the Governments of the countries and territories still infested accelerate their campaigns so that the eradication of the vector in the Hemisphere can be completed as soon as possible.

In the opinion of the Group, this final effort to definitively solve the problem of urban yellow fever in the Americas will only be successful if PASB takes an active part in it. The participation of the Bureau should, in the opinion of the Group, include the following activities:

- 1) Efforts toward convincing the governments to give the highest possible priority to the program. It is suggested that for this purpose the Director of the Bureau get into direct touch with the highest government authorities.

- 2) Energetic and broad cooperation with the countries and territories still infested in conducting their campaigns. This cooperation should include technical assistance on all aspects of the program; financial assistance in the form of supplies and equipment, according to the availability of budgetary funds, and, in special cases, at the request of governments, direct participation in the programs. It should also include assistance to Governments to enable them, where necessary, to obtain external credit in the form of grants or loans for financing their campaigns.

- 3) Coordination of eradication programs in order to solve the problem of the reinfestations which are occurring in the Hemisphere. For this purpose it is essential to prepare and carry out a plan of operations designed to eliminate or reduce to a minimum the possibility of the importation of the mosquito. The ideal strategy for this coordinated program would of course be the simultaneous eradication of the vector in all the countries and territories infested. If this is not possible, the strategy applied might envisage the eradication of the mosquito by groups of countries and territories, whereby each group to be covered at one and the same time would comprise all the countries and territories which can easily reinfest one another, and the program would be begun in each group as soon as all the component units were prepared to do so.

It should be borne in mind that this strategy can only reduce the possibility of reinfestation and that its success will depend upon each group initiating and carrying out its program as soon as possible. The Study Group suggests that, before a decision is taken on the strategy to be adopted and a plan of operation is prepared, PASB make careful study of the matter, in consultation with the governments concerned.

Furthermore, the Study Group is of the opinion that it is highly advisable for PASB to intensify and broaden its assistance to countries and territories already free of Aedes aegypti in maintaining their vigilance services. The Group noted that some of those countries at present maintain adequate vigilance services; others are carrying out insufficient vigilance activities; and still others do not have any vigilance service at all.

In view of the importance to the success of the continental program of appropriate vigilance in all areas free of the vector the Group recommends:

a) That PASB assist the governments maintaining vigilance services to make an evaluation of those services so that they may correct any deficiencies they have. It is suggested that this evaluation should be undertaken as soon as possible and it should include the inspection by local personnel and by PASB staff of a sample of the localities most exposed to reinfestation. It is also suggested that this type of valuation be repeated regularly in the future, especially in the countries that are most exposed to reinfestation, at intervals of not more than one year.

b) That PASB should assist the countries which do not have any vigilance service to plan, organize, and maintain appropriate vigilance in their territories. It is suggested that this assistance include technical advisory services, personnel training, and, in some cases, the provision of supplies.

The Study Group realizes that if the Bureau is to play the part expected of it in accelerating the continental eradication program, it will need more funds than its regular budget could supply. For that reason the Study Group, bearing in mind Resolution XIX of the XVII Pan American Sanitary Conference, which authorized the Director of the Pan American Sanitary Bureau to obtain funds to finance the prompt eradication of Aedes aegypti, suggests to the Director that he explore the possibility of establishing a special fund for the eradication of Aedes aegypti which will provide the Bureau with the additional funds it needs for intensifying the continental program.

To give some idea of the total amount of money the Bureau would need, the Study Group has made an estimate of the specialized personnel needed for advising, coordinating, and evaluating all the eradication campaigns and vigilance services. Table No. 2 attached to this report shows the distribution of these personnel by duty station, suggested by the Group, and the cost of this personnel, including travel expenses.

The personnel recommended by the Group includes those officials who would make up the coordinating unit of the program, at the central office level, two zone coordinators, the advisers attached to the various projects, and the personnel of the insecticide testing unit.

It should be borne in mind that the number of personnel were estimated on the understanding that eradication will be carried out simultaneously in all areas still infested. If that is not the plan adopted for the program, it will be necessary to revise personnel requirements according to the new strategy. Furthermore, it should be borne in mind that the duty stations of the personnel with the exception of those attached to country projects will of course be subject to such changes as the circumstances require.

#### 11. COST OF THE CONTINENTAL PROGRAM

One of the responsibilities the Study Group received from PASB was that of estimating the cost of Aedes aegypti eradication in the countries and territories still infested in the Hemisphere on the basis of the data contained in the documents submitted to the Conference on the Eradication of Aedes aegypti already mentioned in this report.

Some of these documents included the budget prepared by the Government concerned for their campaign; some only mentioned the present annual cost of the campaign; and still others contained no information on the cost of the program. Furthermore, two countries still infested have not provided any information.

On the basis of the data and the information available the Group estimates that the total cost of the campaign in the areas still infested, with the exception of the United States of America, will amount to approximately \$79 million. Table No. 1 attached to this report shows the distribution of these costs by country.

The criteria of the Group in calculating these costs were as follows:

a) For the countries that submitted a budget for their campaign, the estimates prepared by them were accepted.

b) For the countries which presented an incomplete budget or did not present any cost estimates, the cost of the campaign was estimated on the basis of the number of houses in the presumably infested area in each country or territory. The number of houses was estimated on the basis of the population of the area.

It must be borne in mind that the costs calculated by the Group are to be regarded only as an approximate estimate which does little more than give an idea of what the program might cost. In view of the

lack of accurate information, the Study Group had to calculate the cost of the campaigns, except for the few countries that presented their budgets, on the basis of general indices and averages which, given the diversity of the areas to which they were applied, can clearly give rise to sizeable errors. Furthermore, the cost estimates presuppose that the campaigns will last for the number of years given in Table 1; however, it must be borne in mind that any forecast of duration of a campaign of this type can only be approximate. Even then, the forecast is subject to a considerable margin of error.

## 12. FINANCING

The foundation of any program of eradication is the provision of adequate funds for its implementation. There is little doubt that the lack of funds has been at the root of many of the failures that have been reported. The Group is of the opinion that PASB can play a vital role in remedying the situation, and recommends that the Bureau take the following measures:

a) To bring to the attention of the Governments of the countries in which Aedes aegypti still exists, the great benefits to health and the economy that will be derived from eradication of the mosquito in their territories.

b) To persuade these governments of the absolute necessity of allotting sufficient funds for an adequate period of time and of solving their administrative problems and of providing personnel to permit the attainment of eradication as soon as possible.

c) To stimulate the governments to recommend to international credit agencies that their credit policy make provision for the granting of loans for Aedes aegypti eradication program.

d) To assist the governments in obtaining funds from bilateral and multilateral sources to supplement their national budgets for eradication.

The Study Group recognizes that it is no simple matter to obtain funds from granting agencies; however, it is aware that PASB has had similar experience in obtaining funds for community water supply, malaria, smallpox eradication, and other programs. It strongly recommends that this experience be brought to bear on the problem of Aedes aegypti eradication. In particular, it suggests that the support of the World Bank and the Inter-American Development Bank be sought, and that the possible assistance of the United Nations Development Programme, UNESCO, and other bodies be investigated. In making these recommendations the Study Group is fully aware that agreements must be concluded between governments, and the credit agencies, and that the role of PAHO is essentially advisory in character.

### 13. MANUALS AND FORMS FOR USE IN THE PROGRAM

The Study Group is of the opinion that it is essential to revise and bring up to date the manual on technical and administrative standards for Aedes aegypti eradication campaigns prepared by PASB in 1956. It recommends that the Bureau undertake this work during the present year, and that in the future this manual be periodically revised to keep it up to date. The Group also recommends that the manual be widely distributed so that the persons in charge of eradication programs and vigilance services in all the countries and territories of the Hemisphere have a reference work at their disposal.

The Group is of the opinion that, in order to effectively coordinate the continental program, it is essential to maintain up-to-date information that can be easily understood and interpreted by the persons and agencies interested in the programs. The Group therefore recommends that PASB revise the guide for the reports on the Aedes aegypti eradication campaign in the Americas, published in 1960 by the Bureau, with a view to up-dating and improving it. It suggests that, in revising it the following be taken into account:

- a) Need for simple, unambiguous forms.
- b) Need for changes in the forms because of the new insecticides and methods in use.
- c) Advisability of making the adaptations required by modern methods of handling statistical data.

### 14. CONCLUSIONS AND RECOMMENDATIONS

In 1947 the PAHO Directing Council entrusted the Pan American Sanitary Bureau with the solution of the urban yellow fever problem in the Americas through the eradication of Aedes aegypti. So far, the mosquito has been eradicated from about 80 per cent of the areas that are ecologically favorable to the vector in the Hemisphere. However, the problem still exists in the United States of America, El Salvador, Colombia, Venezuela, Guyana, Surinam, French Guyana, and in all the countries and territories of the Caribbean with the exception of a few small islands.

The presence of Aedes aegypti in these areas represents a continuing threat of urban yellow fever and other diseases transmitted by the vector for the countries that are still infested, as well as the risk of reinfestation for those which have completed eradication of the mosquito. As a matter of fact, in the last six years several countries and territories were reinfested by Aedes aegypti coming from those areas.

If the problem of urban yellow fever is to be definitively solved in the Hemisphere, it is essential to complete eradication of the mosquito in the above-mentioned areas without further delay in order to protect the enormous investment in money and effort which the eradication of Aedes aegypti has already cost the Americas.

As has been stated earlier in the report, there is no technical obstacle to the eradication of the mosquito. Effective residual action insecticides are available, as are techniques and methods that ensure the elimination of Aedes aegypti when correctly applied. However, the continental eradication program is not progressing satisfactorily.

As is mentioned in the report, this is due to the fact that in most of the countries and territories the campaign does not meet the essential conditions for the appropriate development of the whole process leading to the eradication of Aedes aegypti. These conditions are basically as follows:

- a) Firm decision on the part of the Government to eradicate the mosquito and to assume the responsibility that eradication involves;
- b) Sufficient funds to cope uninterruptedly with the personnel, supply, and equipment requirements of the campaign until such time as the eradication of the vector is achieved;
- c) Appropriate organization on a national scale enabling the campaign to carry out its activities in a uniform and coordinated manner throughout the country.
- d) Administrative independence and flexibility whereby the campaign can handle its budget without bureaucratic interference, establish conditions of employment of its staff; fix salary scales and per diem allowances; and engage, transfer, discipline or dismiss staff without delay or difficulty;
- e) Legal provisions providing the campaign with authority to quickly enforce decisions and to adopt the necessary measures to eradicate the mosquito without delay.

The Pan American Sanitary Bureau has been playing a decisive role in the Aedes aegypti eradication program in the Americas. As a result of the stimulus and assistance of the Bureau, which has included technical advisory services, the provision of supplies and equipment, and, in some cases, financial support, it has been possible in the last nineteen years to eradicate the mosquito in many countries. Eradication campaigns have been undertaken in all the other countries and territories of the Hemisphere, although many have not been successful.

It is of vital importance to the Americas that the government of the countries and territories still infested accelerate their campaigns so that the eradication of the vector in the Hemisphere is completed as soon as possible. This final effort to definitively solve the problem of urban yellow fever in the Americas will only be successful if PASB takes an active part in it. The participation of the Bureau should, in the opinion of the group, include essentially the following activities:

- 1) Efforts toward convincing the governments to give the highest possible priority to the program. It is suggested that for this purpose, the Director of the Bureau get into direct touch with the highest government authorities.
- 2) Energetic and broad cooperation with the countries and territories still infested in conducting their campaigns. This cooperation should include technical assistance on all aspects of the program; financial assistance in the form of supplies and equipment according to the availability of budgetary funds, and, in special cases, at the request of governments, direct participation in the program.
- 3) Coordination of eradication programs in order to solve the problem of the reinfestations which are occurring in the Hemisphere. For this purpose it is essential to prepare and carry out a plan of operations designed to eliminate or reduce to a minimum the possibility of the importation of the mosquito into the areas already free of it.

As mentioned above, 17 countries and territories have already achieved eradication of Aedes aegypti, and are currently considered free of the vector. Of these, some are maintaining satisfactory vigilance services; others are carrying out insufficient vigilance activities; and still others are not carrying out any vigilance operations at all.

In view of the importance to the success of the continental eradication program of vigilance operations in all the areas already free of the mosquito, it is recommended that PASB assists:

- a) The governments that maintain vigilance services, in making periodical evaluations of those services for the purpose of correcting any deficiencies which may exist in them;
- b) The countries and territories which are already free of the vector but which do not have any vigilance services, in organizing and maintaining appropriate vigilance.

It is clear that if PASB is to be able to fulfil the role expected of it, in accelerating the continental Aedes aegypti eradication program, it will have to have more funds than its regular budget can supply. For that reason, seeing that the XVII Pan American Sanitary Conference in



Resolution XIX authorized the Director of the Bureau to obtain funds to finance the prompt eradication of Aedes aegypti, it recommends to the Director that he explore the possibility of establishing a special Aedes aegypti eradication fund that will provide the Bureau with the additional funds it needs to accelerate the continental program.

Clearly, the foundation of any eradication program is the provision of adequate funds for its implementation. There is little doubt that lack of funds has been at the root of many of the failures that have been reported. If the continental program is to be successful, this situation must be remedied. It is therefore recommended:

a) That the Governments bring their influence to bear in international credit agencies to have them enlarge their credit policy to include the grant of loans for Aedes aegypti eradication.

b) That PASB provide the Governments with advisory services in obtaining bilateral and multilateral funds to supplement their national budgets for eradication.

TABLE No. 1

ESTIMATED COST OF THE ERADICATION PROGRAM IN THE COUNTRIES AND TERRITORIES  
STILL INFESTED

Country or territory	Total houses in infested area	Duration of campaign (years)	Cost in US\$		
			Personnel, supplies & Equipment	Insecticides	Total Cost
Antigua	14,000	3	170,000	6,000	176,000
Bahamas	29,000	3	345,000	13,000	358,000
Barbados	52,000	3	484,000	15,000	499,000
Colombia	41,000	2	38,000	1,000	39,000
Cuba	2,330,000	4	27,000,000	400,000	27,400,000
Dominica	14,000	3	170,000	6,000	176,000
Dominican Republic	740,000	4	5,536,000	330,000	5,866,000
El Salvador	220,000	4	2,070,000	30,000	2,100,000
French Guiana	8,000	3	113,000	4,000	117,000
Grenada	22,000	3	280,000	10,000	290,000
Guadeloupe	66,000	3	734,000	30,000	764,000
Guyana	135,000	4	1,160,000	60,000	1,220,000
Haiti	689,000	4	1,364,000	318,000	1,682,000
Jamaica	467,000	5	3,641,000	208,000	3,849,000
Martinique	67,000	3	734,000	30,000	764,000
Montserrat	3,000	3	45,000	1,000	46,000
Netherlands Antilles	44,000	3	522,000	20,000	542,000
St. Kitts-Nevis-Anguilla	13,000	3	170,000	6,000	176,000
St. Vincent	19,000	3	252,000	9,000	261,000
St. Lucia	21,000	3	275,000	10,000	285,000
Surinam	70,000	3	827,000	32,000	859,000
Trinidad and Tobago	50,000	2	161,000*	-	161,000
Turks and Caicos Islands	3,000	3	45,000	1,000	46,000
Venezuela	1,768,000	6	31,496,000*	-	31,496,000
Virgin Islands (U.K.)	3,000	3	45,000	1,000	46,000
	6,888,000		77,677,000	1,541,000	79,218,000

\* Including cost of insecticides.

TABLE No. 2

PASB PERSONNEL NEEDED TO ADVISE, COORDINATE, AND EVALUATE ERADICATION  
CAMPAIGNS AND VIGILANCE SERVICES

Duty Station	Type of Personnel					
	Consultant	Entomologist	Statistician	Health Inspector	S.T.C.	Annual Cost US\$
Headquarters	2	-	1	-	20 months	94,607
Insecticide Testing Unit	-	1	-	1	6 months	43,638
Zone I	1	1	-	-	-	38,649
Zone II	1	1	-	-	-	38,649
Colombia	-	-	-	1	-	13,607
Cuba	1	-	-	4	-	81,555
Dominican Republic	1	-	-	2	-	51,364
El Salvador	1	-	-	2	-	51,364
Haiti	1	-	-	2	-	51,364
Jamaica	1	-	-	2	-	51,364
Venezuela	1	-	-	4	-	81,555
Antigua, Montserrat, St. Kitts-Nevis-Anguilla, Virgin Islands (U. K.), Bahamas, Turks and Caicos Islands	1	-	-	4	-	81,555
Guadeloupe, Martinique and French Guiana	1	-	-	3	-	67,948
Barbados, Grenada, St. Lucia, St. Vincent and Dominica	1	-	-	5	-	98,139
Netherlands Antilles, Guyana, Surinam and Trinidad and Tobago	1	-	-	4	-	81,555
TOTAL	14	3	1	34	26 months	926,913

## REPORT FOR MARCH 1967 ON THE AEDES AEGYPTI ERADICATION CAMPAIGN IN THE AMERICAS

Country	Dates		Area initially presumed to be infested		Localities and other units inspected since beginning of campaign					Present status
	Beginning	Last Inspection	Total in square Km.	Percent inspected	Number	Initially positive				
						Total	Total	Treated		
								Total	Still positive	
Argentina	VI.53	III.67	1.000.000	100,0	3.741	165	165	165	-	EV
Bolivia	VI.32	IX.66	100.000	100,0	282	65	65	65	-	EV
Brazil	I.31	XII.66	5.358.822	100,0	268.576	36.119	36.119	36.119	-	EV
Colombia	XI.50	III.67	280.000	100,0	3.801	355	355	355	2	IA
Costa Rica	IV.49	V.55	20.000	100,0	1.342	104	104	104	-	E
Cuba	III.54	III.67	100.000	35,2	1.225	963	928	914	135	IA
Chile	VI.45	III.67	104.373	100,0	301	48	48	48	-	EV
Ecuador	VI.46	III.67	69.454	100,0	2.824	337	337	337	-	EV
El Salvador	IV.49	III.67	18.675	100,0	973	216	190	190	r)21	RA
United States	V.64	XII.66	1.536.819	71,1	25.573	9.921	...	...	...	IA
Guatemala	I.49	III.67	36.423	100,0	2.485	138	138	138	-	EV
Guyana	III.46	III.67	4.662	100,0	93	21	21	21	11	IA
Haiti	X.53	IX.58	27.750	49,4	2.379	605	602	435	27	I
Honduras	IX.49	XII.66	69.929	100,0	600	53	53	53	-	EV
Jamaica	II.50	XII.66	11.424	100,0	r) 13	12	2	2	2	IA
Mexico	I.51	III.67	1.000.000	100,0	4.272	600	600	600	1(R)	EV
Nicaragua	I.50	XII.66	65.263	100,0	3.126	18	18	18	-	EV
Panama	II.49	VI.60	56.246	100,0	2.853	44	44	44	-	E
Paraguay	I.48	III.67	200.000	100,0	1.561	98	98	98	-	EV
Peru	I.40	XII.64	638.000	100,0	4.320	191	191	191	-	E
Dominican Republic	X.52	VIII.62	42.020	80,4	1.420	351	351	319	15	I
Trinidad and Tobago	I.51	XII.66	3.108	100,0	128	122	122	121	1	IA
Uruguay	X.48	XII.66	187.000	100,0	1.020	133	133	133	-	EV
Venezuela	VI.48	III.67	710.000	71,8	6.176	746	704	665	97	IA
Anguilla	IV.53	VI.65	88	100,0	19	19	19	19	18	I
Antigua	VIII.54	X.65	r) 440	100,0	50	47	47	47	25	I
Aruba	III.52	XII.66	174	100,0	9	9	9	9	9	IA
Bahamas	VI.54	III.67	r) 11.406	1,3	13	10	10	10	10	IA
Barbados	III.54	III.67	171	100,0	r) 59	r) 59	r) 59	r) 59	r)29	IA
British Honduras	X.50	XII.66	22.965	100,0	84	2	2	2	-	EV
Bermuda	I.51	1963	53	100,0	9	9	9	9	-	N
Bonaire	IX.52	III.67	246	100,0	6	6	6	6	-	NA
Curaçao	X.51	II.67	448	100,0	5	5	5	5	5	IA
Dominica	II.51	VI.65	r) 751	50,0	136	66	66	66	16	I
Grenada	XI.52	VI.62	311	100,0	8	8	8	8	...	I
Granadines	XI.52	VI.62	65	100,0	7	5	5	5	4	I
Guadeloupe	I.57	X.61	1.619	4,9	53	38	38	27	20	I
French Guiana	V.49	XII.66	91.000	100,0	222	55	55	55	...	RA
Caiman Islands	-	-	259	-	-	-	-	-	-	N
Turks and Caicos Islands	-	-	430	-	-	-	-	-	-	I
Virgin Islands (US)	VIII.64	XII.66	344	100,0	55	55	...	...	...	IA
Virgin Islands (UK)	III.60	II.63	r) 155	74,6	23	23	23	23	8	I
Martinique	XI.53	IX.66	1.000	100,0	34	21	21	21	19	IA
Montserrat	V.56	III.67	83	100,0	33	16	16	16	3	IA
Puerto Rico	IX.64	XII.66	8.896	73,5	r) 908	r) 891	...	...	...	IA
Saba, St. Eustatius	VII.58	VIII.59	31	100,0	16	15	15	15	-	N
St. Kitts-Nevis	IV.53	IX.66	308	100,0	43	43	43	43	7	I
St. Martin	XII.58	III.64	34	100,0	18	15	15	15	15	I
St. Vincent	III.53	II.65	332	100,0	8	8	8	8	...	I
St. Lucia	V.53	XII.66	259	100,0	50	50	50	50	37	IA
Surinam	XII.62	III.67	48.000	30,3	52	52	52	52	52	IA
Canal Zone	1948	XI.66	1.432	100,0	21	2	2	2	-	EV

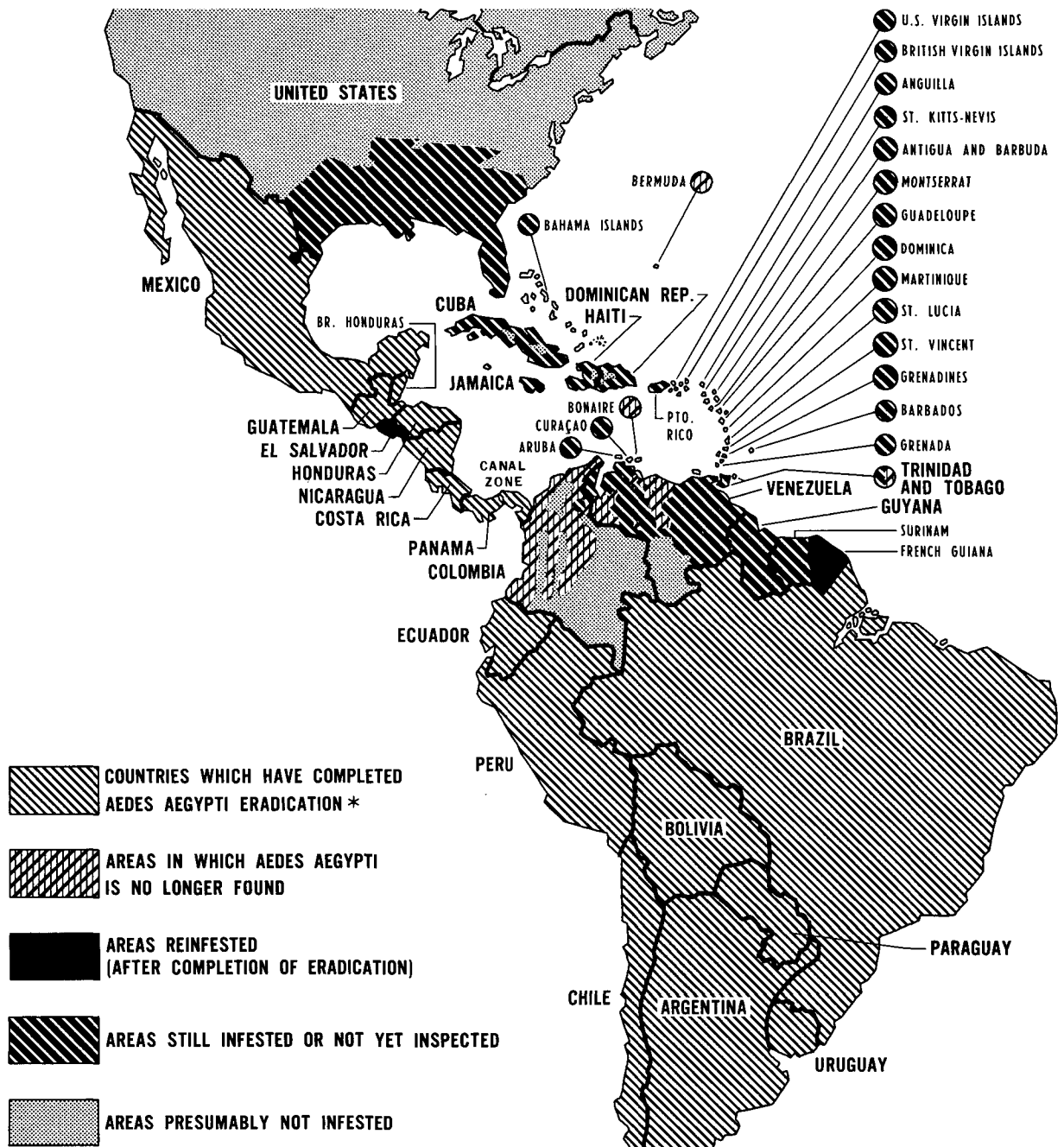
A - Program in operation; E - Eradication completed; N - Negative

I - Infested; R - Reinfested (after completion of eradication) V - Vigilance service

r - Revised figures; - - Zero or stationary

... - Data not available

# STATUS OF THE AEDES AEGYPTI ERADICATION CAMPAIGN IN THE AMERICAS, MARCH 1967



\* ERADICATION CARRIED OUT ACCORDING TO THE STANDARDS ESTABLISHED BY THE PAN AMERICAN HEALTH ORGANIZATION

*directing council*

PAN AMERICAN  
HEALTH  
ORGANIZATION

XVII Meeting

*regional committee*

WORLD  
HEALTH  
ORGANIZATION

XIX Meeting

Port of Spain  
Trinidad and Tobago  
October 1967



Provisional Agenda Item 23

CD17/15 (Eng.)

ADDENDUM I

25 September 1967

ORIGINAL: ENGLISH

ERADICATION OF AEDES AEGYPTI

REPORT OF THE PAHO

WORKING GROUP ON LABORATORY COLONIES OF AEDES

AEGYPTI

Washington, D.C. 17-19 July 1967

PAHO WORKING GROUP ON LABORATORY COLONIES OF Aedes Aegypti

Washington, D.C., 17 - 19 July 1967

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Dr. Herbert F. Schoof, Technical Development Laboratories, Aedes aegypti Eradication Program, National Communicable Disease Center, Savannah, Georgia. Vice-Chairman.

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Observer

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Mr. J. W. Wright, BVC/WHO

## INTRODUCTION

The Group was welcomed on behalf of the Director of the Pan American Health Organization by Dr. Charles L. Williams, the Deputy Director, who stated that the Group had been brought together to discuss the obligations that the Organization had under the terms of RESOLUTION XX of the XVII PAN AMERICAN SANITARY CONFERENCE that met in September 1966.

Dr. Williams reviewed very briefly the history of urban yellow fever in the Americas during the past 50 years and mentioned the mandate that the Organization received in 1947 from its Directing Council to solve the continental problem of urban yellow fever through the eradication of Aedes aegypti. He then pointed out that Paragraph 3 of RESOLUTION XX stipulates that the eradication of A. aegypti from a country could not be certified by the Organization if there were any laboratory colonies of the species in a portion of the country in which the ecological conditions were favorable to the development of the vector.

He added that Resolution XX requested the Director of the Organization to convene a group of experts to establish the conditions those colonies must satisfy if their presence in a country or territory is not to prevent that country or territory from being considered free of A. aegypti by the Governing Bodies of the Organization.

Dr. Williams ended by saying that the Organization has had the privilege of convening the Group in order to have the benefit of its combined wisdom in a matter of prime importance to the Organization; and that the results of the deliberations of the Group will be of great assistance to the Organization in the execution of the responsibilities that have been assigned to it by its Governing Bodies.

The Group elected Dr. Carroll N. Smith as Chairman, Dr. Herbert F. Schoof as Vice-Chairman, and Dr. George B. Craig, Jr., as Rapporteur.

### 1. NEED FOR COLONIES OF AEDES AEGYPTI FOR SCIENTIFIC PURPOSES.

A. aegypti has immeasurable value as a research tool for scientists. It is a superb experimental animal for biochemical, physiological, histological, cytological, genetical, ethological, and toxicological research and for the development of new approaches to the control of this and other species. It is indispensable as an experimental vector of certain arboviruses that cause disease in man and animals. Knowledge applicable to all phases of vector control and culicidology has been derived from investigations with A. aegypti.

A. aegypti poses problems to public health on both the national and international levels. Even though the species were to be eradicated from the Americas, it will continue to be a serious problem in Southeast Asia and Africa. Certain unique research programs being conducted in



the Americas have applications far beyond the boundaries of this hemisphere and their continuation represents an essential obligation to international health.

To further research efforts with this species and to meet the criteria for A. aegypti eradication, it is imperative that the establishment and maintenance of colonies be restricted to those of known value for research purposes. A colony is defined as a unit of caged specimens capable of reproducing itself for one or more complete generations under laboratory conditions. Non-essential colonies include those devoted to any non-scientific use, such as training purposes, displays, fish food and hobbies, and those for which a colony of another species could be substituted without detriment to the research. The decision on the essentiality of any specific colony rests upon the national government concerned, which should avail itself of the services of an advisory group representing diverse interests and appropriate international agencies.

2. DEFINITION OF AREAS THAT ARE: a) ECOLOGICALLY FAVORABLE; AND  
b) ECOLOGICALLY UNFAVORABLE TO A. AEGYPTI.

The ecologically favorable areas in the United States of America include the Yellow Fever Receptive Areas as defined under Article 70 of the INTERNATIONAL SANITARY REGULATIONS, Third Annotated Edition, 1966, namely: the States of Alabama, Arkansas, Florida, Georgia, Hawaii, Louisiana, Mississippi, North Carolina (added on 4 November 1966), South Carolina, Tennessee, and that part of Texas east of a line extending from Del Rio through Wichita Falls and including those two cities. Puerto Rico and the Virgin Islands (U.S.A.) are also included. In the Caribbean Area the following countries and territories are similarly designated in the I. S. R.: Antigua, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Montserrat, Netherlands Antilles, St. Kitts-Nevis-Anguilla, St. Lucia, St. Vincent, Trinidad and Tobago, and the Turks and Caicos Islands.

Additional ecologically favorable areas comprise the Bermuda Islands, and all the countries and territories on the mainland of the Americas located south of the border between Mexico and the United States of America, except the southernmost portions of Chile and Argentina.

From time to time other areas may be designated as being ecologically favorable by national ministries of health, e.g. counties or states bordering on the Yellow Fever Receptive Areas. In defining such areas ecologic factors such as elevation, temperature and rainfall should be taken into consideration.

The Group recognizes that ecologically unfavorable areas may exist within the Yellow Fever Receptive Areas, and in very exceptional circumstances of national, or world, health importance applications may be made

to governments for continuance or establishment of laboratory colonies of A. aegypti in such ecologically unfavorable areas.

Any increases in the extent of the Yellow Fever Receptive Areas, as defined in the I. S. R., Third Annotated Edition 1966, that are made from time to time, shall automatically cause such areas to be considered as ecologically favorable areas. But any decrease in the extent of the Yellow Fever Receptive Areas, defined in similar fashion, shall NOT per se change the status of the area from ecologically favorable to ecologically unfavorable.

The ecologically unfavorable areas comprise the balance of the continental United States of America, all of the Dominion of Canada, and those portions of the other countries and territories of the Americas possessing a combination of climatic and geographic conditions that preclude the continued survival of A. aegypti.

3. CONDITIONS GOVERNING THE ESTABLISHMENT, OPERATION, AND INSPECTION OF LABORATORIES WITH COLONIES OF A. AEGYPTI.

It would be advisable for all the member governments of PAHO to open and maintain a registry of all public and private organizations with laboratories that maintain colonies of A. aegypti.

The registry should record the name and location of the laboratory or organization, the name of the professional in charge of the laboratory or organization, the name of the professional in charge of the breeding and use of the colony, and the general purpose for which the colony of A. aegypti is maintained.

The registry would be updated annually, and the current information conveyed to PAHO so that the information could be distributed by WHO/PAHO to the interested laboratories and organizations throughout the world.

In each country or territory the national ministry of health or its equivalent, e.g. the Public Health Service of the United States, with the technical assistance of the Pan American Health Organization, should prepare and issue Regulations governing the establishment and operation of colonies of A. aegypti devoted directly or indirectly to research purposes.

Such Regulations, together with any specifications and procedures outlined in them, would take into consideration, but not necessarily be limited to, the strains of A. aegypti to be maintained in the laboratory the physical facilities employed in the rearing and use of the colonies, the qualifications of the professional or professionals responsible for the colony and its use, the general nature of the research program of the laboratory, surveillance measures to be carried out by personnel of the laboratory staff itself, and inspection of the laboratory and colonies by personnel of the ministry of health.

These Regulations should also include provisions for the discontinuation of colonies as conditions warrant during the progress of the national program for the eradication of A. aegypti.

4. PERMANENT SECURITY AND SURVEILLANCE MEASURES TO BE MAINTAINED  
IN AND BY LABORATORIES WITH COLONIES OF A. AEGYPTI.

A. FACILITY REQUIREMENTS

1. Building:

- a) The security area, comprising both the rearing and experimental areas, shall be as mosquito-proof as it is possible to make it. Preferably the security area shall be windowless. Any existing windows shall be permanently sealed except for emergency exits, which may have a breakable seal.
- b) All openings from security areas shall be protected by filters or durable screens fine enough (20 mesh to the inch or finer) to retain all A. aegypti adults.

2. Room Layout

- a) The rearing and experimental use area shall open only into a second secure room or vestibule and not directly to the outside. Exits from the second secure room or vestibule shall be through an anteroom provided with double doors, so arranged that one door can be opened and closed before the other is opened. Protective netting curtains on doors may be an additional safety measure.
- b) Security areas shall have smooth light colored walls and ceilings in order to facilitate inspection for A. aegypti adults. The anteroom shall be well lighted, with smooth walls and ceiling, light colored and empty. Floors shall be smooth and light in color.
- c) All drains shall be screened and must enter a secure sewer system, in which all stages of the mosquito will be killed.

B. LABORATORY AND REARING PROCEDURES

1. Eggs:

- a) All eggs shall be stored in closed containers in the rearing room.

- b) Excess eggs shall be destroyed with heat or chemicals, before disposing of them. This shall include all eggs papers or strips and loose eggs, hatched or unhatched.

2. Larvae and Pupae:

a) Larvae:

Larvae shall be reared under conditions that will prevent the escape of adults from the larval medium into the general rearing area in case pupal collections are not made as scheduled. This may be accomplished by covering the containers with tight fitting lids, maintaining the larval containers in a screened enclosure, or similar means.

b) Pupae:

1) Pupae shall be routinely collected, so that no adults emerge in the larval rearing containers.

2) Pupae shall be placed in special containers and the container introduced into the adult cage for emergence. The design of the pupal container shall permit its removal from the cage without escape of adults.

3) Unneeded larvae and pupae and discarded rearing water shall be treated by heating or with chemicals so that only dead waste materials enter the sewerage system.

3. Adults:

a) Cages shall be of such design as to prevent escape of adults. The host animal should not be introduced directly into the cage, i.e. there should be a screen barrier between the mosquitoes and the host.

b) The rearing room shall be kept neat and clean and no sugar, sugar solution or fruit should be left exposed.

c) Hosts for blood feeding:

1) Animal room separate from the rearing room.

a) After use the host animal shall be examined for the presence of escaped mosquitoes that may have been attracted to it, immediately prior to its removal from the rearing room.

2) Animals housed within the rearing room.

a) After use the host shall be examined for the presence of escaped mosquitoes that may have been attracted to it, immediately prior to being returned to its cage. All animal cages shall be kept in a screened enclosure.

4. General Procedures:

- a) No live mosquitoes in any stage shall be removed from security conditions. All mosquitoes transported from one secure area to another shall be enclosed within a solid surface container that cannot be accidentally opened.
- b) When passing through any door, within or from the secure area, persons shall make an adequate inspection to insure that no mosquitoes are carried on their clothing or person.
- c) Any escaped mosquitoes observed shall be immediately captured and destroyed.
- d) Access to rearing and laboratory facilities that use A. aegypti shall be limited to authorized personnel who understand the need to retain all live stages under security conditions.
- e) Mechanical devices that prevent escape or trap escaped mosquitoes are suggested as adjuncts to the security measures described above.

C. SURVEILLANCE PROCEDURES

I. Purpose: The principal objective of surveillance is to provide a continuous evaluation of the security measures that are in operation to prevent the escape of A. aegypti.

II. Technique: The presently recommended method of surveillance is the use of the oviposition container, or ovitrap, a device designed to attract female A. aegypti that are seeking a site for oviposition.

(This device was developed in 1964 and a description of an early model published by Fay and Eliason in Mosquito News, 1966, vol. 26, pp. 531-535. Information about the model in current use may be obtained from the National Communicable Disease Center, Technical Development Laboratories, P.O. Box 769, Savannah, Georgia 31402, U.S.A., which has expressed its willingness to provide sample ovitraps upon request.)

A. Material required for ovitraps

1. Tapered wide-mouth glass jars of one-pint capacity ("Atlas" 723, or equivalent).
2. Wooden paddles (6" tongue depressors).
3. Brown paper towels, or brown blotting paper.
4. High gloss black enamel paint.

B. Preparation

1. The cover of the jar is discarded and the jar itself painted on the outside with high gloss black enamel.
2. The wooden paddle is used to hold a strip of paper towelling about 4-3/4" wide on which the eggs are collected. The strip is wrapped around the paddle about 1/4" from one end, and overlapped on one surface, after which the strip is cut off flush with the side of the paddle, and stapled to it at each end.
3. An identification number is written on the exposed end of the paddle, which is then fastened vertically against the inner surface of the jar with masking tape or a paper clip.
4. When the ovitrap is put in place, 100 ml (approximately 1 inch) of water is added. More water may be necessary in areas of high evaporation but in all cases the volume used should be limited to that which will keep the jar and paper moist during a period of one week.

III. Survey pattern and operation:

- A. Remove or protect all potential breeding containers on the premises.
- B. Select sites for ovitraps within and surrounding the facilities in which the mosquitoes are reared or used, as follows:
  1. Inside buildings in:
    - a) Rooms where mosquitoes are housed or handled.
    - b) Halls adjacent to rearing or handling rooms and to outside exits.
  2. Outside buildings at:
    - a) Approximately 150 feet intervals around buildings within 25 feet of the building.

b) Additional sites up to 300 feet from the building.

3. The number of ovitraps used within a room or inside area depends on the presence of other oviposition sites, e.g. a greater number is required in a rearing room than in a use room.

C. Selection of ovitrap sites

1. Inside building: place ovitraps in darker corners or areas of rooms.
2. Outside building: place ovitraps beneath bushes or shrubbery and in shady areas rather than in open sunny spots.

D. Frequency of inspection

1. Collect and examine the ovitrap paddles weekly throughout the year at all indoor sites. Follow a similar schedule for outdoor sites except during the period when weather conditions preclude survival of adult mosquitoes.

At each inspection the water in the ovitrap shall be examined for larvae. Paddles transported to the laboratory should be handled in a manner that will prevent loss or transfer of eggs.

2. Clean the ovitrap at each inspection or replace it with a fresh one.
3. As other species (e.g. A. triseriatus, A. mediovittatus) may oviposit in ovitraps, the identity of the eggs, particularly those from outdoor sites, shall be checked microscopically.

E. Records

1. Prepare a sketch or map to show the location of all ovitrap sites. Number each site.
2. Maintain a permanent record of all findings for all sites. (The distribution of standard record forms by the national regulatory agency would facilitate the maintenance of uniform records.)

5. REGULATIONS FOR THE TRANSPORT, BY WHATEVER MEANS, OF VIABLE  
A. AEGYPTI - EGGS, LARVAE, PUPAE, AND ADULTS - BETWEEN THE  
COUNTRIES AND TERRITORIES OF THE WESTERN HEMISPHERE AND FROM  
OTHER PARTS OF THE WORLD

Shipment of viable A. aegypti shall not be made by any laboratory or person, to any other laboratory or person, in another country or territory of the Western Hemisphere unless the receiving laboratory provides the shipping laboratory with an IMPORT PERMIT for the specific shipment of viable A. aegypti. Furthermore, a laboratory or person in the Western Hemisphere shall not receive a shipment of viable A. aegypti from any other part of the world unless the receiving laboratory or person first acquires an IMPORT PERMIT for such shipment. This restriction applies to all means of transport, including hand carriage.

The Import Permit for the viable A. aegypti would be issued by the national ministry of health of the country or territory in which the receiving laboratory was located. In the United States of America the import permit would be issued by the Foreign Quarantine Program, Public Health Service, National Communicable Disease Center, Atlanta, Georgia, in the form of a permit to import quarantinable material.

The application for the Import Permit would be required to identify the strain, or strains, of A. aegypti to be imported, the origin of the material and the specific purpose for which the material was to be used. If the strain, or strains, were known to be resistant to insecticides, that information would have to be supplied together with any other information that the ministry of health found it desirable to require.

In addition to forwarding the Import Permit, the receiving laboratory would be required to state whether it was located in an ecologically unfavorable area for A. aegypti as referred to herein, or in an ecologically favorable area for A. aegypti, and if the latter, whether or not the area was reported to be infested with A. aegypti.

It would be mutually advantageous if each national ministry of health would report annually to PAHO and WHO regarding the number of Import Permits for A. aegypti it issued, and if it would arrange for every laboratory within the country or territory to report immediately to PAHO/WHO the details of all shipments of A. aegypti that the laboratory received from or sent to a foreign country. Were this to be done a currently accurate international register of strains of A. aegypti could be established and maintained. This whole process would be very greatly facilitated if PAHO/WHO were to provide standard forms for use in reporting.



## RECOMMENDATIONS

1. The Group recognizes the importance of the program for the eradication of Aedes aegypti in the Western Hemisphere and the danger of reinfestation of ecologically favorable areas through escaped mosquitoes from laboratory colonies. Therefore the Group agrees that non-essential colonies should be eliminated. At the same time, it recognizes the important contribution emanating from research with this species in the past and continuing need for such research in the future. It, therefore, commends the decision in Resolution XX of the XVII Pan American Sanitary Conference to provide for the maintenance of research colonies in ecologically unfavorable areas.

The Group recommends that in the delineation of areas suitable for colonies, due consideration should be given to the scientific fact that restricted unfavorable areas may and do exist in larger geographical and political entities which may be designated as favorable. Colonies in such ecological islands might represent a reduced hazard.

2. The Group recommends that the standards given in detail herein be accepted as meeting the requirements for the maintenance of colonies in ecologically unfavorable areas.
3. The Group recommends that PAHO advise its Member Governments that they should open and maintain a Register of all public and private organizations with laboratories that maintain colonies of A. aegypti and that they keep PAHO currently informed of the entries in the Register so that information can be distributed world-wide by PAHO and WHO.
4. The Group recognizes the need for a concerted effort to develop and publish information on the safe maintenance of colonies of A. aegypti, and of other insect vectors of disease of man and animals. It recommends that PAHO and WHO support additional research to develop safe methods of insect colonization and undertake the collection of presently available information and its publication in a suitable handbook or manual, the latter to be revised as necessary. For this purpose a file of current concepts and methods in this rapidly developing field would be of great value.

The Group recommends that persons responsible for the maintenance of colonies of A. aegypti give additional attention to special techniques for security and surveillance that are applicable for certain limited research purposes. For example, genetic methods allow the development of mosquitoes that have very little or no potential for escape and survival. Such strains could be used for some studies in toxicology, physiology, and parasitology.

Also, isolation chambers (glove boxes) provide highly secure conditions for small-scale rearing and use.

5. The Group recommends that national agencies responsible for the eradication of A. aegypti consider the possibility of distributing certain special items of supply or equipment needed for security and surveillance that are not readily available in commercial channels.
6. The Group recommends that regulatory measures applicable to the importation of A. aegypti into a country should also be made applicable to shipments between persons or laboratories within the same country.
7. Recognizing that the problems associated with the maintenance of colonies of A. aegypti differ in no basic way from those connected with other insect vectors of disease, the Group recommends that PAHO/WHO encourage the formulation and promulgation of standards similar to those described herein for the maintenance of other disease vectors of potential hemispheric importance.
8. While not disagreeing in any way with the provisions of Resolution XX of the XVII Pan American Sanitary Conference, the Group desires to emphasize that there may be exceptional circumstances when in the national interest it may be necessary to give consideration to the maintenance of colonies of A. aegypti in ecologically favorable areas. The Group is strongly of the opinion that this fact should not be excluded from future considerations of the over-all problem by the national governments and the international agencies concerned.