# STRATEGY FOR CONTROL

# OF SCHISTOSOMIASIS

# IN THE DOMINICAN REPUBLIC

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# I PURPOSE OF THE STUDY

The USAID and the Government of the Dominican Republic (GODR) have requested assistance in developing a cost-effective intervention strategy to address the schistosomiasis problem in the Dominican Republic. In 1980, AID had sponsored an assessment of schistosomiasis and the strategy follows the guidelines set forth in that assessment report.

The report on this assignment includes a review of the prevalence and distribution of schistosomiasis in the country, and the snail control efforts by the Government. Recommendations are based on the most accepted control measures following a programmatic approach. Recommendations are also made on appropriate methodology for epidemiological surveys for the infection and the most sensitive and practical diagnostic methods.

A final objective of the study is to develop a limited research project to determine the possible biological control of the snail intermediate host Biomphalaria glabrata by another snail, Thiara granifera.

## II ENDEMIC AREAS OF SCHISTOSOMIASIS IN THE DOMINICAN REPUBLIC

Although a reliable estimate of schistosomiasis prevalence and distribution in the Dominican Republic is not available, it has been considered endemic in four eastern provinces (Health Region V, figure 1): San Pedro de Macorís, El Seibo, La Altagracia and La Romana. Of these, no evidence of infestation has been forthcoming from a major study in La Romana (Sánchez Limardo and Grullón Pérez, 1980; Brugal Montoya, 1979); and the presence of the disease in San Pedro de Macorís has not been reported or investigated. Hato Mayor, the site of the first finding of autochthonous schistosomiasis in the Dominican Republic in 1942, was thought to be the area of heaviest prevalence and the subject of several subsequent studies reviewed in the 1980 report by the Schistosomiasis Assessment Team (SAT). Likewise, the government of the Dominican Republic through the Centro de Erradicación de Bilharzia (CEB) has maintained case detection since 1970 through clinics serving the urban areas of Hato Mayor, and the nearby municipios of El Seibo and Higuey. In 1970, 377 cases (8.8% of specimens examined) were detected, declining steadily to 12 (0.3% of specimens examined) in 1979. Prevalence estimates derived from these figures (810.4/100,000 in 1970 and 37.8/100,000 in 1978) were based on population projections which combined rural and urban figures. Since case detection was mostly from urban areas, these rates may be underestimated. Naturally, the focus of surveillance on the three urban areas also biases the distribution. There are informal reports of a few cases from other eastern towns (Miches and Nisibón) but these are not necessarily indicative of local transmission. Outside the four eastern provinces a few other locales, including Santo Domingo, have been studied and these produced negative or equivocal results.

In the endemic area of Hato Mayor, El Seibo and Higüey, official figures provided by the government (Secretario de Estado de Salud Pública y Asistencia Social - SESPAS) indicate a considerable decline in confirmed cases over the past decade. For instance, there is the aforementioned decline in Hato Mayor from 377 cases in 1970 to 12 in 1979. Similar declines, with less consistent yearly data, are reported from Higuey and El Seibo. Dr. Amaury Méndez, of the CEB, indicated that most case detection is in urban clinics. Thus, the increase in numbers of rural clinics over the past decade may have diverted many patients from the CEB case detection system.

To obtain a more reliable estiamte of current prevalence, the SAT (1980) conducted a survey of randomly selected households in three localities: Barrio Gualey (Hato Mayor), Batey Guaiguai (Paso Cibao) and Barrio Ginandiana (El Seibo). Of 114 stools examined (modified Ritchie technique) from different individuals, 4 (3.5%) contained eggs of S. mansoni. This included, 1 positive from 49 specimens (2%) from Barrio Cualey; 1 positive from 32 specimens (3.2%) from Batey Guaiguai and 2 positives from 33 specimens (6.1%) from Barrio Ginandiana. The case from Hato Mayor had a relatively high egg count (152 eggs per gram) but had been treated previously by the CEB. The others represented new findings of light (10 epg) probably asymptomatic infections. Nonetheless, these attest to the continuing endemicity of schistosomiasis in the area.

Since the 1980 SAT report, case numbers have increased slightly. All these reports originate from CEB case finding which has been sporadic and largely limited to patients coming to the clinic with gastrointestinal complaints. A total of 30 such cases were diagnosed and treated in the

last six months of 1980, and these were: 16 from Hato Mayor; 1 from El Seibo; 11 from Higuey and 2 from Santo Domingo. The ages of these patients varied from 18 to 33 years, except one boy who was 5-year old and lived in Nisibón, (Altagracia Province) all those 5 years. During 1981 a total of 34 cases were diagnosed and treated at J.B. The age of these patients varied from 16 to 55.

Another endemic focus with active transmission seems to be at El Valle, El Seibo Province. Of 48 stool samples collected in 1981 from people coming to a clinic for free milk, 24 contained eggs of S. mansoni (Dra. Mercedes Vargas, UASD, personal communication). The youngest infected individual in this series was 8 years old. Certainly, this information helps describe the endemic area but it also demonstrates the inadequacies of the current case finding system and the potential for further spread of the disease.

## III DIAGNOSIS AND TREATMENT BY THE GOVERNMENT

The CEB is primarily responsible for diagnosis and treatment of schistosomiasis in the Dominican Republic. Until the 1980 Assessment the sedimentation technique described by Hoffman et.al. (1934) was the only method used by the CEB for diagnosis. It is a simple method easily adapted for use in areas where resources and training are minimal. Unfortunately, it is not quantitative. Moreover, unless large amounts of sediment are examined, it is also insensitive particularly when used to examine stools from individuals with light infections. Other Government laboratories do routine coprologic examinations for all ova and parasites. They use both direct smears, which are very insensitive, and saline flotation, which cannot detect eggs of S. mansoni or other trematodes. Neither are quantitative. There exist other techniques which are both quantitative and moderately to highly sensitive and could overcome these deficiencies.

At least since the inception of the CEB in 1970, selection of patients for treatment has been accomplished by examination of stools from patients coming to CEB clinics, usually for gastrointestinal complaints. Rarely, patients are referred by other clinics. Patients with eggs of S. mansoni in their stools receive specific treatment. Until 1973, Fuadin, an antimonial drug, was administered intravenously. From 1973 until the 1980 Assessment a single intramuscular injection of hycanthone (Extrenol, Sterling Winthrop) was used. Individuals treated with hycanthone were programmed to have stools reexamined at 15 days, two months, and six months post treatment. No records or tabulations of cure rates, side-effects or completeness of follow-up have been available at Hato Mayor.

The current and past practice of the CEB was to perform a physical examination and certain laboratory tests on each patient with schistosomiasis. This was done both as a control for treatment (post-treatment) and to detect morbidity (pre-treatment) from schistosomiasis. Laboratory tests included, serum transaminase, glucose, hematocrit and white blood cell count with differential. Dr. Amaury Méndez told us that he has not seen patients with elevated liver enzymes or with hepatomegaly or splenomegaly. However, there is no organized tabulation of these data - only individual patient records. Even if these indicators had detected an occasional patient with significant morbidity, a proper control group would be needed to accurately assess morbidity in the community. While apparent morbidity appears slight, it has not been well evaluated. Furthermore, the tests and patient selection are designed to detect only the most common clinical syndromes of schistosomiasis.

Since the SAT made recommendations in 1980, two improvements in diagnostics and treatment occurred. First, technicians received training in the modified Richie concentration technique (MRCT) and used it instead of the Hoffman sedimentation method. The MRCT is quantitative and reliable (95% sensitivity) at egg excretion levels as low as two eggs per gram of stool. However, the CEB had to revert to Hoffman sedimentation when they exhausted reagements for the MRCT. Second, they substituted oral or intramuscular oxamniquine (Vansil - Pfizer) for hycanthone as treatment. Dr. A. Méndez of the CEB anecdotally described oxaminiquine as giving minimal side effects and effecting much higher cure rates than hycanthone. He favored the oral administration. However, he mentioned that the major drawback was the high cost of treatment (about $9 a patient). Nevertheless, the advantages greatly outweigh this cost.

## IV SNAIL DISTRIBUTION

Biomphalaria glabrata, intermediate host of Schistosoma mansoni, has long been known to occur in the Dominican Republic. Ponce Pinedo (1946) and later Olivier et. al. (1952) found infected snails in the Hato Mayor region. It was believed at first that the snail was limited to the Las Guamas-Paña Paña drainage and to a segment of the Magua river near the mouth of the Paña Paña. Later surveys showed the snail to be far more widely distributed, including same foci outside the endemic area for schistosomiasis. Between 1963 and 1968 Etges and Maldonado (1969) found that the snail occurs, in addition to the Magua river drainage system, in swamps and stream in the town of Miches; in irrigation canals of the Cuaron river near the town of Nisibón east of Miches; in extensive rice fields and irrigation canals surrounding the town of Cotuí in the central valley; and in a large swamp 9 Km. from the northern town of Nagua. The limits of the above distribution encompass one-sixth of the total area of the country.

Later other foci in the eastern and central parts of the country were added (Vargas, 1973 and Vargas and Gómez 1976) including Gilandiana and Los Guincoles sectors, and Sabana de la Mar (El Seibo Province); Higuey (La Altagracia Province); Ramón Santana (San Pedro de Macorís Province); Laguna de Guerra (National District); Zoological Gardens (Santo Domingo); Casa de Alto (San Francisco de Macorís Province); and Pimentel (Duarte Province). In another survey, a population was located at Pinar Quemado near Jarabacoa (La Vega Province).

A recent survey by a schistosomiasis Assessment Team (1980) added the following localities for distribution of B. glabrata: El Seibo

Province (well at Las Palmillas; swamp in Hato Mayor near Paña Paña stream; cattle-watering ponds at Paso Cibao 9 Km. south of Hato Mayor and 10 Km. east of Hato Mayor; swamp near El Valle; irrigation canals and large rice plantation at Paraje La Cruz, 6 Km. south of Sabana de la Mar; irrigation canals and large rice plantation, 10 Km. west of Miches). La Altagracia Province (Laguna del Barrio Sabeka, Higuey; Arroyo Cahero, Barrio San Martín, Higuey). Distrito Nacional (aquatic ponds, Botanical Gardens, Santo Doming; large pond and swamp, main highway before Haina). Sánchez Ramírez Province (drainage canal, rice plantation about 5 Km. west of Cotuí). Naturally, a substantial number of other sites examined had no vector snails. These results attest to the potential for widespread but clustered distribution of B. glabrata, but in no way are intended to fully describe its distribution.

## V REVIEW OF SNAIL CONTROL EFFORTS IN THE DOMINICAN REPUBLIC

### Chemical Control

Attempts to control schistosomiasis vectors in the Dominican Republic started shortly after the studies of Olivier et al (1952). Vaughn et al (1954) used sodium pentachlorophenate (Santobrite) in briquette form. A single application of this molluscicide at an estimated rate of 15 ppm eradicated Biomphalaria glabrata from the Arroyo Paña Paña (a flowing stream) for a period of six months. Another stream Arroyo Las Guamas (a series of connected pools with negligible flow) was treated by santobrite at a rate of 5 ppm. The snails in the latter stream were exterminated, as evidenced by examination of the stream bed one week after the molluscicide operation.

Three methods were used in applying santobrite and these were: (a) scattering the briquettes evenly in the stream bed where they sank to the bottom and gradually dissolved; (b) placing the briquettes on the rocks in the flowing water between pools; (c) sprinkling the chemical in solution onto the surface of pools left in absence of flowing water. In general, the chemical was distributed easily and rapidly without the use of special equipment. However, the method of placing the chemical in the rapidly flowing water on rocks, between pools of the Arroyo Paña Paña was preferable to the other two methods used.

About 1972, the Center for Eradication of Bilharzia (CEB) of the Secretariat of Health started using molluscicides as part of their control effort. At first, Frescon (notritylmorpholine) was used in alternation with Bayluscide (niclosamide); but eventually, Frescon was used alone and its use is being continued to the present. The current formulation

is the 16.5% emulsifiable concentrate. The procedure, used originally and apparently unchanged to the present, consists of applications of Frescon to snail sites every 14 days for three successive times and thereafter at monthly intervals. Unfortunately, no calculation of water volume was being, or is being made, before the treatment of any snail site. An unmeasured quantity of the chemical is usually dumped in the water whenever snails are encountered.

Biological Control

Attempts at introduction of biological control of Biomphalaria glabrata in the Dominican Republic started in 1963, when Etges and Maldonado seeded the Arroyo Paña Paña and collateral bodies of water with 1,750 specimens of Marisa cornuarietis. This is an operculate ampullarid snail which has been demonstrated to compete with B. glabrata in farm ponds and lakes in Puerto Rico. M. Cornuarietis also preys on egg masses and young snails on the aquatic vegetation which it eats voraciously. In the Dominican Republic M. cornuarietis is now found in several streams in the Hato Mayor area and also in the Seibo river. Outside the endemic region it is found in the Coteí area as determined by a recent study by the SAT in 1970. Etges and Maldonado (1969) reported that surveillance during the five year period after the introduction indicated that the snails were initially washed downstream for several kilometers, but eventually returned to Hato Mayor. Since 1967, a dense population has been established in the Mayor river. A cement pond was built in back of the health subcenter in Hato Mayor for raising M. cornuarietis. In the absence of much apparent attention, the tank seems to be still productive of live snails.

However, no attempt has been made, in the last decade, to introduce M. cornuarietis into natural habitats of B. glabrata for biological control of the latter snail. Remnants of M. cornuarietis still exist in the endemic area in the Hato Mayor area and also in the Seibo river.

Although not a part of the activities of the Centro de Erradicación de la Bilharzia, another snail Thiara granifera exists in the Dominican Republic. This snail is believed to act as biological control agent in Puerto Rico. T. granifera, an operculate melanid, originally from Asia has been accidentally introduced in several Caribbean islands. It is believed that T. granifera was introduced in the Dominican Republic in 1968, in the vicinity of Nisibón, and was later reported by Alvarez and Mena (1973) in the widely separated regions of the Dajabón river in the extreme west, and in La Altagracia Province in the east. A recent study by the SAT (1980) demonstrated the existence of T. granifera in the Cotuí-Fantino-Pimentel areas, and indicated that it probably exists in other regions of the country.

Physical Control

As far as we know, no attempt has been made until the present, as to the application of engineering measures to control the snail hosts of schistosomiasis in the Dominican Republic.

## VI RECOMMENDATION FOR AN INTERVENTION STRATEGY

### INTRODUCTION - REVIEW OF 1980 ASSESSMENT TEAM RECOMMENDATIONS

The 1980 SAT made two classes of recommendations: those advocating a revamped schistosomiasis control program and those proposing field research needs. The team concurred that the program must aim toward control as stated in the following synthesis of their recommendations: (1) revival of the Schistosomiasis program establishing it as a control program with the intent of protecting as many people as possible in the endemic areas and interrupting extension to non-endemic (but receptive) areas; (2) enhancement of case detection and treatment with attention to surveys of randomly selected houses in suspect-endemic areas; (3) use of a modern, sensistive and qualitative means of case detection: (4) replacement of hycanthone with oxamniquine; (5) training for cadres of epidemiologic and malacologic field personnel; (6) a search for, characterization, and control of all transmission foci; (7) modification of snail control to focus on localities with infected snails and to diversify snail control methodology; (8) integration with other elements of local health care including health education and sanitation; (9) use of health promoters to assist with case finding, aidtin locating transmission foci, and engage in health education. These will comprise the basis for the control program detailed herein and will necessarily be supported by training and evaluation.

The second group of recommendations concerned specific field research topics. In general, the 1980 SAT advised that whenever possible financial support be given to Dominican institutes to conduct appropriate studies.

Individual topics included: (1) the full range of Biomphalaria glabrata in the country; (2) the effect of Thiara granifera on sympatric populations of B. glabrata; (3) the susceptibility of Biomphalaria havanensis to Schistosoma mansoni; (4) the role of rodents as reservoir hosts; (5) field evaluation of the intradermal reaction. The aforementioned topics appeared to begin simultaneously. We would discourage evaluation of the intradermal test as it has been exhaustively evaluated elsewhere and is of minimal value in low prevalence situations. Instead, interested parties should await the development of an easily administered immunologic test (serologic, intradermal, or other) which has a sensitivity and specificity, appropriate for the low prevalence and intensity of infection in the Dominican Republic. In general, the research projects should be designed with attention to support of schistosomiasis control operations.

Other miscellaneous recommendations proposed an international symposium on schistosomiasis and suggested that Marisa cornuarietes be deemphasized as a biological control agent. The purpose of the sympusium was to heighten the interest and update the perspective of Dominican professionals in schistosomiasis. To this end, the "Universidad Autónoma de Santo Domingo" has produced a series of postgraduate lectures which has had good attendance. This activity could be continued, but attention to training of health personnel in the endemic area is of utmost priority.

Several of the aforementioned recommendations have been adopted by the CEB when funds and supplies were either available or unnecessary. The program is now called a control program, Centro de Control de Bilharzia (CCB). They use oxamniquine for treatment. While materials were available,

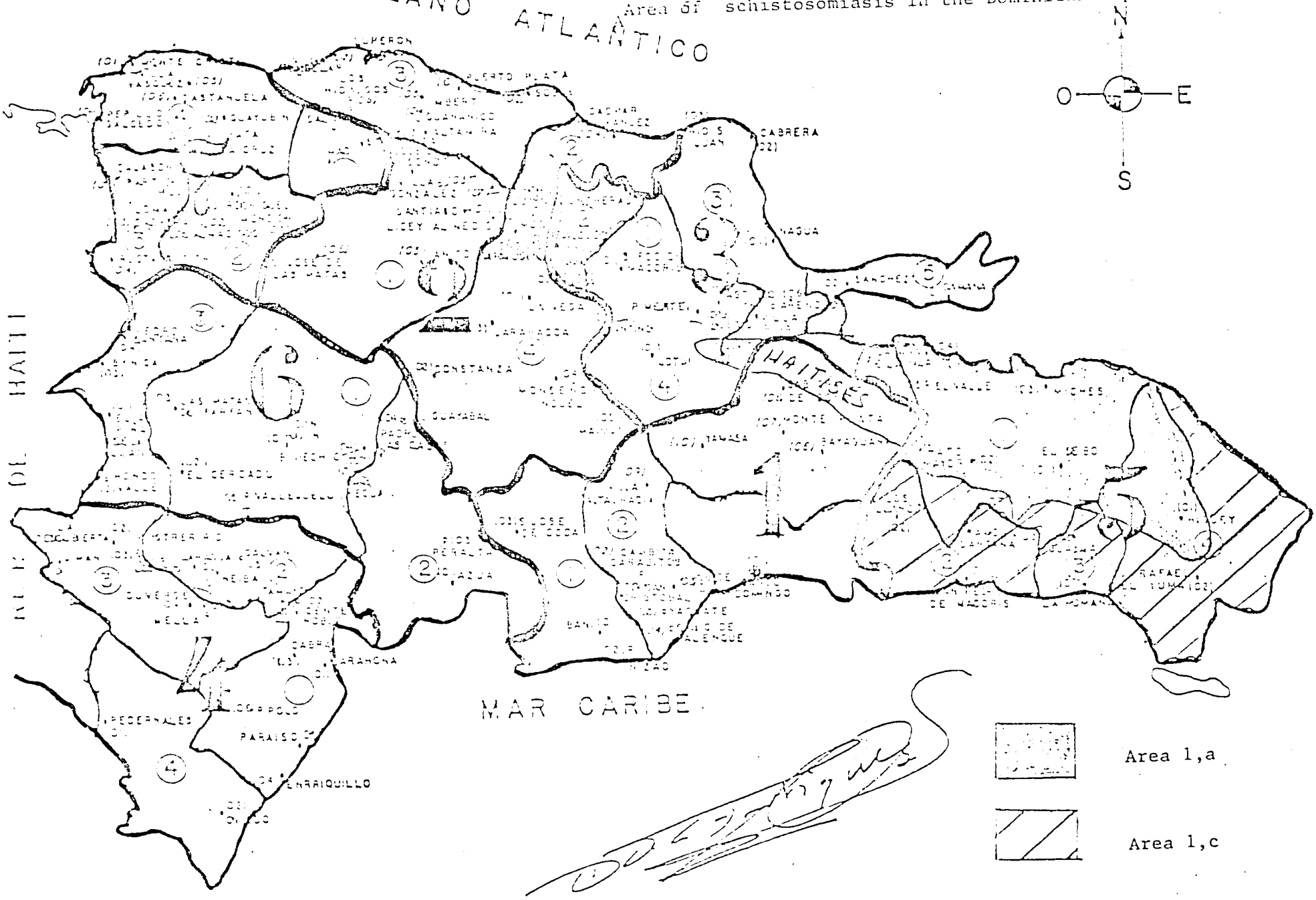
they used the MRCT for stool examination. Also, the director of the CCB submitted a budget requesting materials and manpower to fulfill several recommendations, but these could not be approved. Nevertheless, there appears a willingness to restructure the CEB and improve its operations given adequate support.

A. Determination of the endemic area

The most immediate need of the CCB is for a more accurate and representative measurement of endemicity. According to these data, it can plan and evaluate control efforts. Obviously the disease is not severe or extensive enough to warrant island-wide surveys. Yet information is poor. Even within the suspect endemic area of the eastern provinces, present data does not adequately describe the disease. Previous work focused on a few limited urban settings. Routine coprologic examinations by government medical services cannot detect any cases but those with the greater egg excretion. Representation by different age groups is unknown. The present need is for a systematic, representative, and progressive survey, albeit limited, of the suspect endemic area.

Available information suggests that endemic schistosomiasis involves the northern protion of the eastern peninsula (figure 1). It has had the greatest density of confirmed and anecdotal case reports. It corresponds to a characteristics geophysical area (Reconocimiento y Evaluación de los Recursos Naturales de la República Dominicana, 1967) which is well segregated from the remainder of the country and has features allowing for a relatively large number of snail habitats. These include a relatively impermeable volcanic substrata and overlying soil types

Figure 1: Health Regions with the Endemic Area of schistosomiasis in the Dominican Republic



which range from slight to moderate permeability. In combination with the high rainfall, surface water tends to be abundant despite rapid run-off from the rugged terrain. To the west lies a very sparsely populated area of Karst topography, Los Haitises, which is virtually devoid of surface water. Here the rainfall is heavy but the ground is so permeable that streams entering the area disappear. It is a formidable hinderance to schistosomiasis spread. To the south and east the rainfall is lower and the soils and substrata are highly permeable. Surface water is present here but less frequent than in the endemic area. Many streams and rivers traverse this area via canyons and subterranean channels, but few originate in it. Other areas of the country may have similar conditions as the suspect endemic area. While some have been shown to have B. glabrata there is no evidence for schistosomiasis transmission.

Within the endemic area, rural communities far outnumber the small urban communities already enumerated. Moreover, they constitute 2/3 of the population of the endemic area. Yet in all previous work they were ignored. To identify all communities of significant prevalence among this widely dispersed population would require 30,000 or more stool samples. Furthermore, the ratio of potential transmission foci to population is expected to be far greater than the urban communities. But, actual transmission foci may be sparse. The infested rural area would consume far more control resources per capita than the urban. We would recommend a limited methodical approach to the rural area designed to estimate overall prevalence and identify risk factors to aid in selection of communities where future control efforts should be focused. Only after careful assessment of epidemiologic, water contact, and snail survey data should any attempt be made to extend control to the rural area.

Recommendations

1) The country should be divided into four epidemiologic areas for planning schistosomiasis control.

a) Suspect endemic area of the northern portion of the eastern peninsula (figure 1).

b) Areas where agriculture, reservoirs, other water use, and population movements could allow for the establishment of new endemic foci. This area will have to be better defined but could include any area of the country.

c) The eastern tip and southern portion of the eastern peninsula where importation is frequent but transmission potential is probably low (figure 1).

d) Areas of unlikely occurrence of S. mansoni. Like area 1, this will need better definition.

2) A survey of occupants of randomly selected houses in the endemic area (1) should be carried out. This should be the responsibility of the CCB and will serve as the basis for future control activities. Two survey technicians will be needed and each should visit about 20 houses per day.

a) Six urban areas need to be evaluated using a 10% sample of houses, detailed as follows:

| Town | Population | | Houses | |
|---|---|---|---|---|
| | Total | Sample | Total | Sample |
| El Seibo | 13,511 | 1,351 | 2,861 | 285 |
| Hato Mayor | 17,858 | 1,786 | 3,483 | 350 |
| Higuey | 33,501 | 3,350 | 6,519 | 651 |
| El Valle | 3,675 | 367 | 805 | 81 |
| Miches | 7,308 | 731 | 1,475 | 148 |
| Sabana de la Mar | 9,983 | 998 | 2,080 | 208 |
| Total | 85,837 | 8,583 | 17,223 | 1,722 |

Selection of houses will be at random from previously prepared census malaria program lists, or health promotor records.

b) The rural area poses a more complicated problem. House selection will be the same but all rural communities cannot be surveyed. Thus, a sample of communities should be selected at random from each of two categories: (1) concentrated communities such as those that are found along the highway along the north cost; (2) dispersed populations. Using a total sample of 5,000 people in the ratio of 3000:2000 respectively, and knowing the total population in each class, the overall rural prevalence may be estimated while focusing on areas of population concentration where per capita control costs will be less.

c) Each person surveyed will be asked to provide a stool specimen and answer a series of simple questions: age, sex, occupation, residence, history of previous infection with/and treatment for schistosomiasis. Data will be recorded on a line listing (appendix A). Each will be assigned a number which will identify his stool specimen.

d) Periodic assessment and evaluation of the methods and data will be a necessary part of the program.

3) Area 1, B and 1, C need improved laboratory detection of schistosomiasis infection clinical laboratories. Training of technicians and provision of materials is needed in area 1,C. CCB technicians can later help by training other technicians in area 1, B and screening selected stool specimens. Future evaluations should determine the need for surveys in these areas.

4) Detection of cases through other government medical facilities should be enhanced in area 1, A. Case detection in clinics should not be

an activity of the CCB. The CCB will be responsible only for monitoring case detection in clinics, tabulating appropriate epidemiologic data and providing drug and guidelines for treatment.

5) Physicians and other personnel involved in curative medicine in area 1, need a review of schistosomiasis.

6) An assessment of schistosomiasis morbidity is needed. However, the present procedure of screening all S. mansoni positive patients with a battery of tests can be discontinued. Such tests and medical examinations would be more appropriately done on a sample of positives and negatives from the survey.

B. Laboratory Diagnosis

The drawbacks of the currently used Hoffmann sedimentation, direct smear, and saline flotation are in the record. For schistosomiasis in the Dominican Republic a test which is sensitive and can accurately quantitate low egg excretion (20 eggs per gram) is necessary. For these reasons we recommend the MRCT. Any test of poorer sensitivity, besides contributing inaccuracies by underestimating prevalence and overestimating intensity of infection, would require a far larger number of samples to allow reliable statistical comparisons of communities in the survey. While the MRCT requires more equipment and training than less sensitive tests (such as the Kato-Katz), these equipment are already in use in many regional laboratories throughout the Dominican Republic and CCB technicians have demonstrated their capacity to learn and apply the MRCT.

1) The MRCT should be used to process all stools collected by the survey. The CCB will need reagents and equipment to effectively

process about 15,000 stools over 18 months. All intestinal parasites found will be recorded. S. mansoni eggs will be quantitated as eggs per gram.

2) Additional technicians to be hired for the survey and all technicians currently processing stools for clinics in the endemic area should be trained to use the MRCT.

3) The CCB technicians should maintain quality control by processing unknowns among their survey specimens and by splitting 200 of their survey specimens and exchanging them with an established reference laboratory. Proficiency evaluation derived from these controls will be for all intestinal parasites.

4) The MRCT should replace saline flotation for routine cropologic examination in all Health Region 5 laboratories. (Areas 1, and 1). Some miscellaneous materials and reagents need to be provided.

5) The present laboratory space for CCB is highly inadequate (about 3x10 feet). At least 3 times as much space is required.

C. Chemotheregy

The CCB is already using oxamniquine for treatment as previously suggested. Besides its mild and infrequent side-effects, it can be administered orally. Accordingly, it may be administered by health promoters and rural clinics allowing for decentralization of treatment.

Case treatment

1) All confirmed infection found by the survey or in clinics will be treated with oxamnicuine (15 mg/kg). Patients with a history of convulsive disorders and pregnant females should not be routinely treated.

In the unlikely event that any communities or "barrios" are discovered with more than 30% prevalence, either the entire community in should be treated or stool specimen should be taken from everyone and those found positive should be treated. In large communities this action should not be targeted at lightly infected barrios. In communities with 10-30% prevalence some enhancement of routine case detection though local clinics would be advised. When prevalence is below 10%, no supplimental treatment would be advised at the present time. However, future considerations may dictate a revised program.

2) Infections may be treated by local health promoters or rural clinics. The CCB should dispense drug sending the dose to administer via existing channels of communication to local health care providers. Thus, they will work through the supervisor of the health promoters and rural clinics.

3) Local health promoters, rural clinics or health centers will be responsible for submitting a follow-up stool specimen to the CCB at 3 months post-treatment on all survey cases. CCB will be responsible for obtaining, accumulating, tabulating and analyzing reports of treatment and follow-up. Cured cases must be recorded for analysis of future surveys.

4) If other drugs with better cure rates and fewer side-effects than oxamniquine became available, they should replace oxamniquine.

D. Snail Control

Choice among control strategies for preventing or controlling schistosomiasis transmission requires consideration of both epidemiological and economic conditions. Information about the epidemiological situation

helps determine appropriate physical measures for control. The use of transmission models enables the decision maker to decide which single control measure, or combination of measures, would be most effective in reducing infection in the population, thus limiting transmission. Control measures may be compared for their costs and effectiveness in reducing schistosomiasis. The strategy of intervention which we are recommending for the Dominican Republic involves combined control measures, because results of conducting transmission models by some investigators to demonstrate the effectiveness of the various measures showed that combined controls are most effective in reducing incidence of the disease. Moreover, combined measures such as chemotherapy, mollusciciding and engineering measures of control have been very effective in several endemic areas.

1. Chemical Control of Snails

Chemical control of snails through the use of molluscicides has been accomplished with some success in various endemic areas of the world. In such projects they were used alone or in combination with other control measures, such as chemotherapy or environmental measures or health education. Control of schistosomiasis through the use of molluscicides can be a rapid and efficient means of reducing or eliminating transmission. Snail control procedures, including mollusciciding, must therefore remain among the methods of choice for the control of schistosomiasis. With the use of molluscicides cost effectiveness can be very satisfactory. There are several examples of endemic areas where the use of molluscicides has been cost-effective, namely the Philippines, Brazil, Egypt, Ghana,

Zimbabwe, and Tanzania. Two recent projects where molluscicides were used deserve some comments, namely: St. Lucia and Brazil. In St. Lucia a four-year focal molluscicide program (using Bayluscide) caused considerable reduction of transmission of Schstosoma mansoni. The monthly application of molluscicide gave good control of the snail populations in the streams and marshy areas. (Prentice et al. 1981). In Brazil the use of Bayluscide in addition to chemotherapy by oxamniquine has been successful in several parts of the country. This is the National Control Programme in Brazil known as "Programa Especial de Controle de Esquistossomose" (PECE), and is carried out by a special division of the Ministry of Health, known as "Superintendencia de Campanha da Saude Publica" (SUCAM).

The cost-effectiveness of molluscicide is greatest where the volume of water to be treated per capita at risk is small. Even in large flowing bodies of water, or static waterbodies, the application of molluscicides is also cost-effective, now that it is generally recognized that schistosomiasis transmission tends to be focal rather than widespread. During the last few years there was a switch in strategy from area wide tofocal and seasonal control of the snail hosts and of transmisssion based on the realization that, in most endemic areas, even including large irrigation schemes, transmission of the infection is mainly seasonal and takes place at limited water contact sites.

Recommendations

a) Determination of transmission foci will require input several sources.

i) Health promoters already survey their respective communities annually for water and sanitation. These data have yet to

be tabulated or analyzed. Before and during the snail reconaissance the CCB and SESPAS should review these data to characterize water contact and defecation habitats of each community in area 1.

ii) Health promoters in area 1, will complete a questionnaire (Appendix B) about the general nature of water contact and specific, heavily used sites in their communities. During visits for snail reconaissance or epidemiologic surveys CCB personnel will further refine their information by observing use of reported water contact sites. All sites will be registred and then plotted on 1:50,00 (urban areas) or 1:50,000 (rural areas) scale topographic maps.

iii) Data from snail reconaissance will also be plotted on the same maps and the CCB with the healp of consultants should assess the importance of sites by comparing snail densities and infection rates with corresponding water contact.

b) Before the application of the molluscicide, a preliminary reconnaisance of snail habitats must be completed. Sites surveyed will be determined by review of water contact information already obtained. It should last one year; data should be recorded on a standard form (Appendix C) and should include:

i) Occurrence and distribution of the snail intermediate host in the habitat;

ii) Natural infection rates among these snails;

iii) Physico-chemical qualities of the water;

iv) Presence or absence of aquatic vegetation in water body;

c) We recommend the use of Bayluscide (niclosamide, Bayer) for the control of the schistosomiasis vector in the Dominican Republic. Its

efficacy has been demonstrated in other countries, and it is the only effective molluscicide available commercially at the present time. Niclosamide comes in two formulations: (1) 70% wettable powder; (2) 25% emulsifiable concentrate of clonitralide (Bayer 6076). The emulsifiable concentrate is usually applied at a target dose of 8 mg/liter for one hour in streams or canals by constant flow drip cans. Treatment is usually repeated every month. If during the dry season streams cease to flow and pool out, their course can be sprayed with a standard concentration of Bayer 6076.

d) We expect that a limited number of transmission sites, will be identified. If so, then the molluscicide should be applied to these sites only, i.e., focal control.

e) A period of evaluation of 6 months is necessary after the molluscicide activity to determine the failure or success of the control operation. If snails, especially infected ones, still exist after molluscicide was applied, then a decision should be made to repeat the molluscicide application.

2. Environmental Control of Snails

Environmental control of snails is designed to upset snail habitats and make them untenable and unsuitable for snail existance and propagation. In general, the measures include habitat management through engineering methods. The latter methods are designed to straigthen canal banks and increase water veolocity in irrigation systems or natural streams, drainage of swamps and swampy embankments of rivers, and removal of mud and aquatic vegetation, among other measures. Such measures were

demonstrated to be effective, when applied alone or when they precede molluscicide application. They should be implemented for identified transmission foci only where appropriate and should complement molluscicide application and biological control.

In the endemic area (1,A) it is believed that B. glabrata can be controlled by engineering measures in the irrigation systems west of Miches, those south of Sabana de la Mar and those close to El Valle. It is also feasible to control the snails by engineering measures in the several natural streams which exist in the endemic area (1,A). B. glabrata can also be controlled in swampy areas by drainage and filling, such as the swamp in Hato Mayor, close to the Paña Paña river. In the case of the latter, swamp drainage and removal of aquatic vegetation are sufficient to eradicate the snails, without any need for use of molluscicides. Some cattle-watering ponds in the vicinity of Hato Mayor are so shalow and full of vegetation that removal of this vegetation and picking up of the snails would help tremendously in reducing or eradicating the population of B. glabrata which exists there. Naturally, all this is predicated on the demonstration that the site actually contributes to transmission.

It is recommended that environmental snail control measures should be used in the endemic areas, whenever feasible. Only simple equipment will be required because the methods necessitate the use of hand and hoe by agricultural or other laborers in rural areas. The entire operation will accordingly be inexpensive.

3. Biological Control of Snails

Among the biological control measures of medically important snails have been the interspecific competition and/or erradication by other nonvector snails. The snail Thiara granifera (family Thiaride = Melanniidae) has not been given attention as a potential biological control agent. T. granifera, an Oriental snail, has been introduced in many parts of the world, probably with aquatic weeds and tropical fish. In Puerto Rico, there have been some incidental observations that since the snail was introduced in the island, populations of the snail Biomphalaria glabrata have decreased where it occurs together with T. granifera.

In the Dominican Republic, T. granifera was introduced about 1968 in the vicinity of Nisibón and was later reported in the widely separated regions of the Dajabón river in the extreme west and in La Altagracia province in the east. A report by a USAID Schistosomiasis Assessment team (1980) indicated that T. granifera is found in extraordinary large numbers in some localities where B. glabrata once existed.

Recommendations

a) We recommend that a small research project be set up for 3 years to evaluate, in the Dominican Republic, the phenomenon of competitive exclusion using T. granifera and B. glabrata as a model. It should be noted that although T. granifera is the first intermediate host of the lung fluke Paragonimus westermani in the Far East, it is not likely that the advocation and introduction of T. granifera will result in any risk of creating foci of the Oriental lung fluke in places where T. granifera is to be introduced. Moreover, T. Granifera is already widespread in the Dominican Republic and some other Caribbean Islands. It should also

be noted that species of lung flukes in the Americas utilize hydrobiid snails only and not melaniids. Thus it seems that there is also no danger of introduction of these latter lung flukes.

b) Description of Methodology and Evaluation

Eight habitats with Biomphalaria glabrata are to be selected these may be either natural streams, irrigation canals or drainage ditches. The snail population density in each water course is to be determined, monthly for 12 months, on the basis of how many snails are collected per man hour and/or per collecting scoop. Any aquatic vegetation and associated snails will be recorded, and physico-chemical measurements of the water will be determined.

The snail Thiara granifera is to be collected from certain rivers and streams where it is abundant. The snails are to be introduced in 4 of the selected habitats, and the other 4 habitats are to be considered as comparison water courses. Regular monthly collections to be made over 24 months and the density and age (size) structure of both B. glabrata and T. granifera will be recorded to learn about the possible competitive effect of T. granifera on B. glabrata.

The field investigations will be supplemented with limited studies in the laboratory and in big tanks and concrete ponds simulating field conditions.

This is a 3-year project which is expected to be [illegible] done by Dr. José Gómez and Dra. Mercedes Vargas, both from the "Universidad Autónoma de Santo Domingo." They both showed interest in the work.

A consultant and participant in the project can be recruited from the United States and it is expected that he comes to the Dominican Republic for 2 to 3 week periods every six months.

## E. TRAINING

Any public health program requires initial training and periodic retraining of personnel as new methodologies of control become available. In this regard, there are three striking needs for initial training in the CCB: epidemiologic assessment, snail control methods, and diagnostics. Therefore, the following training schedule is proposed.

1) Before any survey is begun, program personnel must be trained in the basic principles and practices of epidemiology and public health. They should learn the difference between incidence and prevalence and the way these are calculated; they need to be instructed on the rationale and methodology of population based surveys' This training will include field practice. Physicians in health region V will be invited to attend for one day for a review of clinical schistosomiasis and its epidemiology. The training will be done in the endemic area (e.g. in Hato Mayor) by a consultant epidemiologist and will involve 3 weeks' work.

2) Laboratory technicians need training in the MRCT and parasite identification. These technicians should include all from areas 1, and 1. Technicans from selected laboratories in area 1, could also attend. Training will be done in the endemic area concurrently with the epidemiologic training by a consultant technician and will require 1 week.

3) Before the snail survey and control parts of the project are carried out, the supervisor of the control team and his assistants should be trained on the proper methodology of the survey, reading topographic and hydrographic mpas, identifying and studying human water contact sites and control. For these functions, we recommend that the supervisor and one of the assistants should be sent to a training center in an endemic area where survey and control projects are in operation. Such a center exists in Venezuela: Ministry of Health, Division of Ancylostomiasis and other Helminthiases, Maracay. The division in Maracay has specialists in control and there will be no language problems. Alternatively, instructors could be brought to the Dominican Republic to give on-site training as well as to establish procedures suited to the local situation.

## F. Evaluation

The evaluation of the program will serve to maintain attention to careful practices, analyze data, assess progress and help plan appropriate action.

1) Survey Evaluation

a) After work for each community is complete, a tabulation of the data is required.

i) numbers of positives and negatives and percent positive by age group and sex,

ii) geometric mean egg excretion,

iii) percent positive among these with and without history of previous treatment,

iv) localization of positives on a map,

v) refusal rate

b) A consultant epidemiologist will do an on-site review of techniques operations, and data at six months and when the survey is completed. This will include field visits to previously surveyed communities.

c) During the mid-survey (6 months) visit and data review, an assessment of schistosomiasis morbidity will be planned. Resulting data will be analyzed during the final survey assessment.

2) Chemotherapy

Cure rates and reports of side-effects should be reviewed during the survey and final evaluations. However, in-depth evaluation of oxamniquine is already complete and need not to be repeated in the Dominican Republic.

3) Case Detection in SESPAS Clinics

Again, no specific evaluation except data review is necessary.

4) At 3 years the program should be reviewed during a site visit. Second survey needs to be planned at 5 years to assess the effects of control measures. Also plans to survey additional communities in the rural area 1,A; areas 1,B and 1,C need to be made.

5) Snail Survey

Snail survey records will be evaluated by a consultant during on site visits. He will choose a couple of recorded sites and visit these to compare his finding with those recorded. Visits should also be made to cheke communities where no transmission sites were recorded.

6) Snail Control

After the second year of the project the chemical and environmental control measures should be evaluated. Continued snail surveys should be emphasized, and a decision can then be made on repeating the molluscicide operation in transmission foci which still harbor the snail intermediate host. Records should also be made of any infected snails

## H. OUTLINE OF RECOMMENDATIONS

## VII PERSONNEL AND MATERIALS

### A. Personnel

An increase of 5 employees will be required to complete the proposed project. SESPAS currently salaries employees for 6 hr. days. For field work this would consume an inordinate amount of travel time and would not allow good continuity of daily laboratory or field work. Thus, we are also proposing a salary suppliment for an 8 hr. day.

| Position | Present Employees | Proposed Employees | Salary Suppliment |
|---|---|---|---|
| Medical Director | 1 | 1 | 0 |
| Statistician | 1 | 1 | 1 |
| Secretary | 2 | 1 | 0 |
| Laboratory technicians (microscopists) | 2 | 4 | 4 |
| Epidemiologic survey technician | 0 | 2 | 2 |
| Field workers | 4 | 6 | 6 |
| Total | 12 | 17 | 15 |

The above personnel are required for the initial part of the project. The epidemiologic survey technicians will only be required for about 12 weeks assuming that they can survey about 20 house per day. Subsequently, they could be used as microscopists, doing snail survey work, and doing supplimental epidemiologic surveys in other suspect areas (e.g., 1,B; 1,C). Alternatively, they could be hired temporarily or loaned from another section of SESPAS. Microscopists and the statistician should participate occasionally in epidemiologic surveys and snail reconaissance so they will better understand the nature of the data they are collecting as well as the cost of collecting it. The same applies

to the survey technicians. They should be trained to do and occasionally perform microscopy and should be able to recognize and sample vector snails. Finally, some work will require evening and early morning observation and other work will be at an excessive distance from Hato Mayor. Thus, under these circumstances preserve vehicles and gasoline and improve work per diem should be paid by SESPAS.

B. Materials

The following list of materials will be required for the program. Almost all are readily available in Santo Domingo. Some major equipment is more expensive than in the United States but many small items and supplies are actually cheaper locally.

FOR MODIFIED RITCHIE CONCENTRATION TECHNIQUE

Major Equipment

| | Amount | Local Purchase* |
|---|---|---|
| 4 compound microscopes | 4 | A |
| 1 vacuum pump | 1 | B |
| 1 centrifuge - heavy duty, low-speed | 1 | B |
| 1 trip balance | 1 | B |
| **Reagents for MRCT for 15,000 Stools** | | |
| 1. Ether | 60 l | B |
| 2. Alcohol | 75 l | A |
| 3. Distilled water | 900 l | A |
| 4. Sodium chloride | 8 kg | A |
| 5. Dibasic sodium phosphate | 3 kg | A |
| 6. Formaldehyde (40% solution) | 45 l | B |
| 7. Citric acid | 3 kg | A |
| **Glassware and Miscellaneous** | | |
| 1. 5 gal carboys with spigot | 2 | B |
| 2. graduate (15 ml in oilme divisions) glass centrifuge tubes | 120 | B |
| 3. 1 liter side arm Erlenmeyer flasks | 2 | B |
| 4. 1 liter graduate cylinder | 2 | B |
| 5. Rubber tubing | 20 feet | B |
| 6. Pasteur pipettes | 15,000 | B |
| 7. PH papers | 5 rolls | B |
| 8. Applicator sticks | 20,000 | B |
| 9. Pliofilm | 10 rolls | B |
| 10. Graduated (15 ml in oilme division) plastic screwcap centrifuge | 15,000 | B |

*A = Available locally at low cost
B = Not available locally or available only at excessive cost.

| | | | |
|---|---|---|---|
| 11. | Test tube racks | 10 | A |
| 12. | Microscope slider | 20,000 | A |
| 13. | Coverslips a) 15 x 50 mm | 20,000 | A |
| | b) 15 x 15 mm | 5,000 | |
| 14. | Trigger spray bottles - 1 liter | 4 | A |
| 15. | 3 in diameter plastic funnels | 20 | A |
| 16. | Course (50 mesh) screen | 1 m2 | A |
| 17. | Fine 200 mesh stainless steel screen | 1/3 m2 | A |
| 18. | PVC tubing | | A |
| 19. | Forceps | 5 | B |
| 20. | Scissors | 5 | B |
| 21. | Beakers 50 ml | 5 | B |
| | 100 ml | 2 | B |
| | 250 ml | 2 | B |
| 22. | Label tape | 10 rolls | A |
| 23. | Disposable plastic gloves | 5,000 | B |

For Epidemiologic Survey

| | | | |
|---|---|---|---|
| 1. | Stool containers | 15,000 | A |
| 2. | Data forms (Appendix A) | 5,000 | A |
| 3. | Indelible markers | 20 | B |
| 4. | Clip boards | 4 | A |
| 5. | Knapsacks | 4 | A |
| 6. | Ice chests | 2 | A |

For Snail Reconaisssance and Snail Control

| | | | |
|---|---|---|---|
| 1. | Stool container for snails | 5,000 | A |
| 2. | 50 ml beakes | 40 | B |
| 3. | Large forceps | 5 | B |
| 4. | Water contact forms | 500 | A |
| 5. | Habitat data forms | 2,500 | A |
| 6. | Topographic maps 1:50,000 scale, series E-723 Sheets: 6371 I, IV; 6372 I, II, III, IV; 6373 III; 6471 I, IV; 6472 I, II, III, IV. | 3 sets | A (FREE) |
| | 1:5000 scale, series E-931: Hato Mayor Higuey, Miches; El Seibo; Sabana de la Mar; El Valle | 3 sets | A (FREE) |
| 7. | Dissecting microscopes | 2 | B |
| 8. | Disposable plastic gloves | 1,000 | B |
| 9. | Rubber boots | 12 pair | A |
| 10. | Rubber gloves | 12 pair | A |
| 11. | Uniforms and coveralls | 12 | A |
| 12. | Helmets with face shields | 6 | A |
| 13. | Machetes | 10 | A |
| | Shovels | 10 | A |
| | Picks | 10 | A |
| 14. | Steel drums (25 x 50 gal) | 4 | A |
| 15. | Heavy gauge rubber hose and nozzle | 30 mts. | A |

| | | |
|---|---|---|
| 16. 1 liter and 5 liter measures | 2 | A |
| 17. Various valves and pipe | | A |
| 18. Assorted bolts nuts and washers | | A |
| 19. Niclosimide | | B |

Vehicles

| | | |
|---|---|---|
| 1. Jeep for epidemiologic survey | 1 | B |
| 2. Double cab pick-up truck for snail reconaissance and snail control | 1 | B |

Office Equipment and General Supplies

| | | |
|---|---|---|
| 1. Pencils, pens, paper, chalk | ? | A |
| 2. Graph paper | ? | A |
| 3. Blackboard | 1 | A |
| 4. Bulletin board | 1 | A |
| 5. Map table with storage drawer | 1 | A |
| 6. Indelible markers | 20 | A |
| 7. Calculator with printer | 1 | B |
| 8. Clipboards | 20 | A |
| 9. Folders | 72 | A |

## VIII TIMETABLE

The following three tables include dates and duration suggested for all major activities. By no means should any activities begin before the initial training and partial completion of the epidemiologic survey and snail reconaissance.

TABLE 1 Epidemiologic and Chemotherapeutic Activities During a 3 years Schistosomiasis Control Program

| ACTIVITY | DURATION | SUGGESTED STARTING DATE | REMARKS |
|---|---|---|---|
| Training of Laboratory and Survey technicians | 3 weeks | October 1982 | Should be done in Hato Mayor and several field sites |
| Survey | 18 months | November 1982 | Visits to communities will require only about 12 weeks |
| Evaluation of Survey | 2 weeks<br>2 weeks | April 1983<br>April 1984 | |
| Chemotherapy | Entire length of program | October 1982 | |
| Extension of survey and case finding to areas 1 and 2. | 18 months | May 1984 | Will depend on final survey results and reports from SESPAS clinics |
| Final Assessment of control | 2 weeks | October 1985 | |

TABLE 2 Activities to be Carried out during a 3-year Snail Control Programme in the Endemic Area of Schistosomiasis in the DR

| ACTIVITY | DURATION | SUGGESTED STARTING DATE | REMARKS |
|---|---|---|---|
| Explaining the program to the people - Health Education | 1 month | October 1982 | In Hato Mayor, El Valle, Higuey, El Seibo, Nisibón, and rural areas |
| Sending technical staff for training | 1 month | November 1982 | |
| Precontrol studies | 12 months | December 1982 | To determine snail distribution, snail infection; human water-contacts, transmission sites |
| Control: | | | |
| Engineering snail control if necessary | 4 months | December 1983 | |
| Application of* molluscicide | 12 months | | |
| Evaluation of snail control | 6 months | January 1985 | |

* Starting date to be determined later to avoid heavy rains.

TABLE 3 Research Project on the Possible Biological Control of *Biomphalaria glabrata* by *Thiara granifera*

| ACTIVITY | DURATION | SUGGESTED STARTING DATE | REMARKS |
|---|---|---|---|
| Selection of 8 habitats of *Biomphalaria glabrata* | 1 month | October 1982 | Selection of a variety of habitats, streams, irrigation canals, ponds, etc. |
| Studies on Ecology and Population Dynamics of *B. glabrata* | 12 months | November 1982 | |
| Laboratory Studies on Possible Competition | 12 months | October 1982 | Use of large tanks and concrete ponds to similate natural habitats |
| Introduction of *T. granifera* in 4 habitats of *B. glabrata* and later observations on, and evaluation of competitive exclusion | 23 months | November 1982 | |

# BUDGET

## 1). Epidemiological Survey and Diagnosis

| | 1st Year | 2nd Year | 3rd Year | Total |
|---|---|---|---|---|
| Laboratory | | | | |
| Major Equipment | 5,200 | | | 5,200 |
| Supplies | 5,786 | 1,333 | 1,333 | 8,452 |
| Supplies for other eastern laboratories | 300 | 200 | 200 | 700 |
| Personnel, Salary Suppliment for 6 technicians and 1 statistician | 6,720 | 6,720 | 6,720 | 20,160 |
| | | | | 34,512 |

# BUDGET

## 2) Chemotherapy

| | 1st Year | 2nd Year | 3rd Year | Totai |
|---|---|---|---|---|
| Drug, oxamniquine (Vansil) | 4,650 | 4,650 | 2,000 | $11.300 |

# BUDGET

## 3) Snail Reconaissance and Control

| | 1st Year | 2nd Year | 3rd Year | Total |
|---|---|---|---|---|
| Salary for 4 field workers (CODR $145, USAID $45) | 2,160 | 2,160 | 2,160 | 6,480 |
| Salary for Supervisors (GODR $240, USAID $80 | 3,840 | 3,840 | 3,840 | 11,520 |
| Salary Agricultural Laborers when needed | 3,000 | 3,000 | | 6,000 |
| Equipment and Supplies (molluscicide) | 2,000 | | | 2,000 |
| Equipment and Supplies (engineering) | 2,000 | | | 2,000 |
| 2 Dissecting Microscopes ($1,000ea) | 2,000 | | | 2,000 |
| Protective clothing | 500 | | | 500 |
| Molluscicide Niclosamide (at $18.85/Liter) | 50,000 | 80,000 | | 130,000 |
| | | | | $160,500 |

# BUDGET

## 4) Training

| | 1st Year | 2nd Year | 3rd Year | Total |
|---|---|---|---|---|
| Training for snail survey and control. Trip and Per Diem for two. | 4,100 | | | 4,100 |
| Laboratory training. Travel, per diem and fees for instructor | 1,545 | | | 1,545 |
| Epidemiologic, clinical and field survey training travel, per diem and fees | 4,335 | | | 4,335 |
| Materials | 500 | | | 500 |
| | | | | $10,480 |

# BUDGET

## 5). Evaluation

| | 1st Year | 2nd Year | 3rd Year | Total |
|---|---|---|---|---|
| Consultant for evaluation of precontrol studies (2 weeks) | 3,200 | | | 3,200 |
| Consultant for evaluation of control (2 weeks) | | | 3,200 | 3,200 |
| Consultant for mid-survey evaluation (10 days) | 2,300 | | | 2,300 |
| Consultant for final evaluation of survey (10 days) | | 2,300 | | 2,300 |
| Consultant for final evaluation of control program and design of 5-year follow-up survey | | | 4,435 | 4,435 |
| | | | | $15,435 |

# BUDGET

## 6) General

| | 1st Year | 2nd Year | 3rd Year | Total |
|---|---|---|---|---|
| Pick-up truck | 10,000 | | | 10,000 |
| Jeep | 7,000 | | | 7,000 |
| Records and formulation | 1,000 | | | 1,000 |
| Office supplies | 500 | 500 | 500 | 500 |
| Gasoline, insurance, repairs | 10,000 | 10,000 | 10,000 | 30,000 |
| Audio-visual/Promotional aids/Fees for radio | 2,000 | 500 | 500 | 3,000 |
| | | | | $ 52,500 |

# BUDGET

## 7) Biological Control Research Project

| | 1st Year | 2nd Year | 3rd Year | Total |
|---|---|---|---|---|
| One Field Laborer | 1,200 | 1,200 | 1,200 | 3,600 |
| One Technician (laboratory and field) | 3,000 | 3,800 | 4,400 | 11,200 |
| Minor equipment and supplies | 800 | 800 | | 1,600 |
| Water chemical analyses apparatus | 1,000 | | | 1,000 |
| Tanks and concrete pond | 300 | 200 | | 500 |
| Barb wire for isolation of snail habitats | 700 | | | 700 |
| Used car and insurance | 4,500 | 500 | 500 | 5,500 |
| Gasoline | 4,000 | 4,000 | 4,000 | 12,000 |
| Round trip to Santo Domingo for Consultant | 1,000 | 1,000 | 1,000 | 3,000 |
| Per diem and consultation fees for Consultant | 5,000 | 5,000 | 5,000 | 15,000 |
| Honorarium (J. Gómez) | 2,000 | 2,000 | 2,000 | 6,000 |
| | | | | $60,100 |

## SUMMARY BUDGET

| | |
|---|---|
| 1) Snail Reconaissance and Control | $ 160,500 |
| 2) Epidemiological survey and diagnosis | 34,512 |
| 3) Chemotherapy | 11,300 |
| 4) Training. | 10,480 |
| 5) Evaluation | 15,435 |
| 6) General | 52,500 |
| 7) Biological Control Research Project | 60,100 |
| GRAND TOTAL | $ 344,827 |

## CONCLUDING REMARKS

The strategy described herein contains plans covering many but not all of the 1980 SAT recommendations. The 1980 SAT advocated several field research projects. We have tried to select form these topics of more immediate need and utility. The first topic, determination of the distribution of B. glabrata in the country, is partially covered by the snail reconaissance portion of the control strategy. Since biological measures could aid the control effort, we have included the research project proposal on T. granifera. This appears to be a promising biological control agent as it will not serve as an intermediate host for other trematodes nor is there any known ecologic or economic significance of this snail in the Dominican R ublic. We would also supplment previous recommendations in suggesting a project involving the search for native plants with molluscicidal properties. However, to retain a modest control proposal we have chosen to defer this and the remaining research projects for later consideration.

The principal 1980 SAT recommendations for a population-based survey and snail reconaissance are the basis for the recommendations. In fact without such a preliminary evaluation we would discourage any expansion or even continuation of the present control work. To avoid/a continuing drain/of resources the training and surveys should begin as soon as possible. Only then can details of an effective control program be executed.

Admittedly, we have made more generalized recommendations for the post-survey control period. Without knowing the true epidemiologic state detailed planning is not possible. Contingency planning for a variety of situations might include an appropriate action but on the other hand

could just as easily fail. Whatever the programed schedule of control, methods should follow the general guidelines set forth in the recommendations. Therefore, we strongly advise that details of the control measures be reviwed when the epidemiologic and malacologic situation is clear. Finally, the program should be extended for two additional years pending a carefully considered evaluation. A final evaluative survey at the end of 5 years will be in order.

In this strategy we have allowed for the absorbtion of several previous CEB functions into the general health care system. The availability of a relatively safe drug which is easily administered precludes the need for the formerly centralized (in Hato Mayor) treatment. The previous centralization of treatment probably hindred move than helped control of schistosomiasis by chemotherapeutic measures. By training other Region 5 SESPAS laboratories to do the MRCT, the basic framework for diagnosis and chemotherapy of schistosomiasis will be greatly extended. Furthermore, this system will allow greater utility of the existing medical services. Nevertheless, for control the CEB will be left with a number of chemotherapeutic functions including population-based medication where indicated and assessment of treatment by the SESPAS clinics.

There does exist a need for schistosomiasis control in the Dominican Republic. While the present impact of the disease appears mild, it really is unknown. Of the other intestinal helminths in the Dominican Republic it has the potential of producing the most severe morbidity and suffering. If it were to spread to certain receptive agricultural areas it could additionally be of economic significance. Furthermore, the

present program acts as a small drain of SESPAS resources and it would be of great help to improve the functioning of this unit. Because of the present perception of schistosomiasis, we have proposed a modest program which will be helpful to other health services and in proportion to the apparent importance of the disease in the Dominican Republic.

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# ENCUESTA DE ESQUISTOSOMIASIS

EBLO _____ FECHA _____

| SA O. | NOMBRE | EDAD | SEXO F | SEXO M | AÑOS VIVIENDO EN EL AREA DE 1 KLM. | OCUPACION | TRATAMIENTO SI | TRATAMIENTO NO | TRATAMIENTO FECHA | MUESTRA ENTREGADA |
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APPENDIX A

APPENDIX B

Community Water Contact Observation Record

Community & Barrio_____ Date_____ Time_____

Provence_____ Observer_____

| Water Source | Map Code | Sw | Pl | Ba | WH | WA | WL | Ir | Fi | AM | Fo | Dr | Other |
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| Defacation Sites | Map Code | Comments |
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Key; Sw=swimming
Pl=Playing
Ba=bathing
WH= washing hands face or legs
WA=washing animals
WL=washing laundry
Ir=irrigating
Fi= fishing
AM= alluvial mining
Fo= fording
Dr= drinking

# APPENDIX C

## SNAIL COLLECTION RECORD*

Date:_____

Name of Collectors:_____

Province:_____ Town:_____

Type of Habitat: River____ Stream_____ Irrigation Canal_____ Drainage

Ditch (cañada)_____ Swamp_____ Other_____ Approximate Width_____

Depth_____.

Nature of Substratum: Mud____ Sand_____ Rocks_____ Gravel_____ Humus

_____ Decaying Vegetation _____ Other_____.

Sun Exposure of Habitat:_____

Snails Absent:_____

Snails Present:_____ Species_____ Size_____

Egg Masses:_____ Present_____ Absent_____

Aquatic Vegetation:_____ Absent_____

Aquatic Vegetation: Present_____ Absent_____

Use of Habitat by Human Population_____

Temperature:_____

$p^H$_____

Free $CO_2$:_____

In the Laboratory

Schistosoma mansoni Infection in Biomphalaria:_____

Other Trematode Infection in Biomphalaria:_____

Dissolved Oxygen:_____

Hardness:_____

Salinity:_____

*To be filled out in the field and completed in the laboratory.

# HEALTH SECTOR LOAN II AMENDMENT
## WATER SUPPLY AND SANITATION COMPONENTS
## RECOMMENDATIONS in $ 000

| Component Description | % Coverage of Region I, II, III SBs | # of SBS Promoters Served | Population Served (000's) | U.S GRANT $ | U.S. LOAN $ | U.S LOAN R.D. | Dom. Rep. R.D. | Comm. Part. R.D. | Total $ | WASH Proj. T.A. $ | GRAND Total $ | D.R./U.S. RATIO | $/capita served by component |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Wells - 2300 | 32.5 | 803 | 321.2 | 0 | 0 | 3450 | 207 | 34.5 | 3691.5 | 0 | 3691.5 | 0.445 | $12.65 |
| 2. HAND Pumps - 2346 | 32.5 | 803 | 321.2 | 0 | 0 | 1027 | 94 | 282.0 | 1403.0 | 0 | 1403.0 | " | $ 7.07 |
| 3. LATRINES 20000 | 30.1 | 745 | 298.0 | 0 | 0 | 788 | 132 | 1380.0 | 2300.0 | 0 | 2300.0 | " | $11.62 |
| 4. WATER Containers 30000 | 40.3 | 1000 | 400.0 | 0 | 0 | 1600 | 160 | 80.0 | 1840.0 | 0 | 1840.0 | " | $8.61 |
| 5. Qual. Control Tech. Asst. | 100.0 | 2473 | 989.2 | 130 | 0 | 0 | 0 | 0 | 130.0 | (40) | 170.0 | " | |
| 6. O&M BACKSTOPPING | 100.0 | 2473 | 989.2 | 0 | 90 | 517 | 120 | 20.0 | 747.0 | (25) | 772.0 | " | |
| 7. TRAINING | 100.0 | 2473 | 989.2 | 630 | 313 | 854 | 4540 | 0.0 | 6337.0 | (100) | 6437.0 | " | |
| 8. Tech TRANSFER | — | — | — | 260 | 25 | 90 | 75 | 15.0 | 465.0 | (80) | 545.0 | " | |
| 9. OBSERVATION AND DEMONSTRATION AREA | — | — | — | 630 | 90 | 15 | 60 | 12.0 | 807.0 | (160) | 967.0 | " | |
| 10. DATA MANAGEMENT | 100.0 | 2473 | 989.2 | 86 | 34 | 12 | 28 | 0 | 160.0 | (60) | 220.0 | " | |
| 11. SAN. ENGR Prof. Serv. - 2½ yr | 100.0 | 2473 | 989.2 | 145 | 12 | 43 | 0 | 0 | 200.0 | (15) | 215.0 | " | |
| 12 TRAINER Prof. Serv. - 2½ yr. | 100.0 | 2473 | 989.2 | 145 | 12 | 43 | 0 | 0 | 200.0 | (15) | 215.0 | " | |
| 13. PHC/W DECADE PLANNING | — | — | — | 180 | — | — | — | — | 180.0 | (40) | 220.0 | " | |
| 14. WASH T.A. | — | — | — | — | — | — | — | — | — | (100) | 100.0 | " | |
| Totals | — | — | — | 2206 | 576 → 9015.0 | 8439 | 5416 → 7239.5 | 1823.0 | 18460.0 | (635) | 19095.5 | " | |

→ $16,254

# COMPONENT 1

## 1.- DRILLED AND DUG WELLS

A.- For providing drilled and cased wells and protected dug wells under HSL II Amendment in Regions I, II and IV to supplement those being provided under HSL Loan II.

B.- For a population of 321,200 which represents 32.5% of the population covered by the 2,473 SBS promoters in those three regions.

C.- This will provide coverage for the people served by 803 SBS promoters.

D.- This Component provides for:

1) Drilling 2,300 producing wells of 6-inch diameter;

2) Casing the wells with steel or PVC casing as may be required;

3) Developing the well;

4) Furnishing a log of the well.

5) Capping the well until the handpump installation team comes.

E.- The estimated cost breakdown is:

| | | |
|---|---|---|
| 1) US Loan | RD$ | 3,450,000 |
| 2) GODR | RD$ | 207,000 |
| 3) Community participation | RD$ | 34,500 |
| 4) Total | | $3,691,500 |

COMPONENT 2

2.- HANDPUMPS

A.- For providing durable handpumps, manufactured in the Dominican Republic, under the HSL II Loan Amendment, to be mounted on the wells provided under Component 1.

B.- For the same population and SBS coverage included under Component 1.

C.- This Component provides for:

1) the finishing of 2,300 handpumps plus 46 spare handpumps to include the pump complete with drop pipe, strainer, etc.

2) constructing a protective concrete apron for each well with an outer rim and sloping to drain to a paved ditch to carry the waste water away from the well area, and with a concrete base for mounting the pump.

3) installing and testing the pump and well.

4) disinfecting the well

5)turning the well and handpump over to the local committee with instructions on its use, maintenance and protection.

D.- The estimated cost breakdown is:

| | |
|---|---|
| 1) US Loan | $1,027,000 |
| 2) GODR Matching | RD$ 94,000 |
| 3) Community Participation | RD$ 282,000 |
| 4) Total | $1,403,000 |

COMPONENT 3

3.-LATRINES

A.- For providing simple sanitary latrines using components manufactured or available in the country under HSL II Loan Amendment to provide for the sanitary disposal of human excreta.

B.- For a population of 298,000 which represents 30.1% of the population covered by the 2,473 SBS promoters in Regions I, II, and IV.

D.- This Component provides for 23,000 latrines including:

1) The concrete slab, riser and cover, or for an improved water seal latrine model;

2) For digging and lining the hole for the latrine (to be done or furnished by the beneficiary);

3) For setting the slab;

4) For providing the protective shelter(to be done or furnished by the beneficiary)

5) Assisting in siting the latrine and providing instruction for its value, use and maintenance.

E.- The estimated cost breakdown is:

| | |
|---|---|
| 1) US Loan | $ 788,000 |
| 2) GODR | RD$ 132,000 |
| 3) Community Participation | RD$1,380,000 |
| 4) Total | $2,300,000 |

COMPONENT 4

4.- WATER CONTAINERS

A.- For providing sanitary containers, one to carry the water from the water source to the house and the other to store the water in the house to avoid contamination on the way and in the house, the containers to be manufactured in the country, under HSL II Amendment.

B.- For a population of 400,000 which represents 40.3% of the population covered by the 2,473 SBS promoters in Regions I, II, and IV.

C.- This will provide protection for the people served by 1,000 SBS promoters and is in addition to the coverage already provided under Loan II.

D.- This Component provides for furnishing:

1) 40,000 containers of 5-gallon capacity for carrying the water.

2) 40,000 containers of 20-gallon capacity for storing the water in the home. (Both with protective covers, attached to the containers so they cannot be misplaced).

3) A simple stand for use in the home to keep the containers off the floor.

4) Instructions for the use, cleaning and maintenance of the containers.

E.- The estimated cost breakdown is:

| | |
|---|---|
| 1) US Loan | $1,600,000 |
| 2) GODR Matching | RD$ 160,000 |
| 3) Community Participation | RD$ 80,000 |
| 4) Total | $1,840,000 |

COMPONENT 5

5.- QUALITY CONTROL TECHNICAL ASSISTANCE TO PRIVATE SECTOR CONTRACTORS MANUFACTURING ITEMS FOR HSL II AND HSL II AMENDMENTS AND FOR IMPROVEMENT OF O&M PROCEDURES

A.- Cost Aspects

| | |
|---|---|
| 1) US Grant | $130,000 |
| 2) Wash TA | 40,000 |

B.- Nature of Assistance

1) Providing TA manpower to set up and stabilize quality control procedures in local private sector manufacturers, making products for use on HSL II and amendment activities;

2) Setting up and stabilizing quality control procedures and approaches to training in installation, O&M of devices constructed or manufactured under HSL II and Amendment to HSL II;

3) Eleven (11) person-months of TA over first 2 years of HSL II Amendment to support HSL II and Amendment implementation.

C.- Grant funds placed by USAID/DR PIO/T face sheet into WASH level of effort contractor. WASH contractor will mobilize quality control personnel to perform agreed upon scope of work between GODR, USAID/DR, and S&T/HEA as in all USAID/DR requests for WASH technical assistance.

D.- Program backed up by central office of Health in S&T/Bureau.

COMPONENT 6

## 6.- OPERATION AND MAINTENANCE BACKSTOPPING

A.- For providing under HSL II Amendment facilities and training for the backstopping necessary for wells and handpumps installed under HSL II and Amendment in Regions I, II and IV, as well as training to be applied nationwide.

B.- For a population of 969,000 in those regions with extension of training and manuals on a nationwide basis for a population of 2,108,000.

C.- This will provide backstopping, training and facilities for the people served by the 5,400 SBS promoters in Regions I, II, III, and IV and V.

D.- This component provides for furnishing:

1) Three-wheel motorcycles for the O&M brigades to be established in the three regions plus one truck for each region, with tools and equipment necessary for making minor repairs and maintenance in the field.

2) Fuel and maintenance for those vehicles.

3) Additional manpower needed to provide continuing backstopping for the O&M of equipment installed under HSL II Loan and Amendment.

4) Training on installation and O&M of the equipment for both the O&M brigades and the local committee members charged with O&M of their facilities in Regions I, II, and IV. Manuals for the brigades and for the local O&M people.

5) This component provides for extending the training and manuals to other regions of the country as O&M brigades are established.

6) Funds for O&M activities in Regions I, II, IV during the life of HSL II Loan and Amendment.

7) Technical assistance in establishing and training the O&M brigades, and developing procedures and manuals.

E.- The estimated cost breakdown for the services to be provided:

| | REGIONS I, II, IV | NATIONWIDE | TOTAL |
|---|---|---|---|
| 1) US Loan | | | |
| US$ | $ 90,000 | | $ 90,000 |
| RD$ | RD$ 480,000 | RD$ 37,000 | RD$ 517,000 |
| 2) DR Matching | RD$ 112,000 | RD$ 8,000 | RD$ 120,000 |
| 3) Community Participation | RD$ 20,000 | | RD$ 20,000 |
| 4) Total | 702,000 | 45,000 | 747,000 |
| 5) WASH TA | ( 20,000) | ( 5,000) | ( 25,000) |
| 6) Grand Total | $ 722,000 | $ 50,000 | $ 772,000 |

COMPONENT 7

7.- TRAINING OF SBS SUPERVISORS AND KEY SBS HEALTH PROMOTERS IN PRIMARY HEALTH CARE/ENVIRONMENTAL HEALTH IN ASPECTS OF TRAINING OF TRAINERS PROGRAMS USING TASK AND PERFORMANCE ORIENTED TRAINING/EDUCATION APPROACHES

A.- Development of Task Assessment and performance standards for SBS health promoters, health educators, community participation personnel, operation and maintenance brigade personnel for upkeep of facilities.

B.- Development of training curriculum based on 7.A above.

C.- Development of training materials and manuals for training of trainers for 7.A above.

D.- Training of trainers.

E.- Development and field testing of health educational materials and manuals to be given to SBS personnel and left with SBS or family units in SBS areas of responsibility.

F.- Follow-up training/health education to SBS promoters/installation brigade personnel as appropriate with emphasis on organization of the community to be able to effectively accept the training/health education.

G.- Training of SBS supervisors, community participation personnel and selected health promoters in setting up and continuing community mothers clubs to discuss weekly or monthly topics of child health, nutrition, or family environmental matters.

H.- Cost Aspects:

| | |
|---|---|
| 1) US Grant | $ 630,000 |
| 2) US Loan | $ 313,000 |
| 3) US Loan | RD$ 854,000 |
| 4) RD Funds | RD$4,540,000 |
| 5) Total Loan/Grant | $6,337,000 |
| 6) WASH TA | $ (100,000) |

I.- Program impacts most heavily on SBS personnel at national level and in Regions I, II and IV but will also dramatically effect health regions III and V.

J.- Approximately $460,000 of US Grant component is projected to be placed by USAID/DR PIO/T face sheet into WASH level of effort contract for purposes of obtaining professional services in guidance of the entire training of trainers and training/health education program. S&T/HEA will provide $100,000 from its central funds to assist on the training trainers/health education effort. Much of the remaining US grant and loan funds will be used in-country for expatriate technical assistance in this effort for training AIDs, for equipment for setting up a training center probably in Azua, and for initiation of various training pilots in small areas on an experimental basis. There will be approximately $30,000 of grant funds used, for providing vehicles for training activities.

K.- Much of the cost to the government contribution will involve personnel costs for participating in training, paying for the development and printing of training/health education materials, developing and supporting a training cadre and many miscellaneous support/transportation costs.

L.- This is an extremely important part of the HSL II Amendment because training/health education is not actually being accomplished on a major or recuring basis. The SBS personnel are out there being paid, and working, but considerably much more can be accomplished with reasonable inputs of training/health education at this time to improve the quality of SBS and O&M brigade personnel.

COMPONENT 8

8.- THE INTRODUCTION OF LOW COST, LOW O&M, APPROPRIATE TECHNOLOGIES (EQUIPMENT, DEVICES AND METHODOLOGIES) INTO OPERATIONAL PROGRAMS OF THE DOMINICAN REPUBLIC THROUGH LOCAL MANUFACTURE TECHNICAL ASSISTANCE AND DEVELOPMENT OF SMALL DEMONSTRATION PILOTS TO DEMONSTRATE, MONITOR AND ADAPT DEVICES OR METHODOLOGIES TO DR

A.- Cost Aspects:

| | | |
|---|---|---|
| 1) US Grant | $ | 260,000 |
| 2) US Loan | $ | 25,000 |
| 3) US Loan | RD$ | 90,000 |
| 4) RD Funds | RD$ | 75,000 |
| 5) Community Participation | RD$ | 15,000 |
| 6) Total | $ | 465,000 |
| 7) WASH TA | $ | ( 80,000) |

B.- Nature of Program

1) Emphasis on local private sector production of equipment to support DR operational programs.

2) WASH technical assistance in local manufacture and quality control, field pilots. US grant funds placed by USAID/DR PIO/T into WASH level of effort contract to obtain professional technology transfer services from WASH contractor to implement project component.

3) Emphasis on low cost, low O&M devices and methodologies of operational significance to DR.

C.- Transfer of following technologies to include but not be limited to:

1) Simple cable tool well drilling rigs to stimulate ground water private sector with training included for 20 rigs.

2) Low cost home treatment, disinfection and storage units for individual households. Approximately 100 units with field pilot.

3) SEA wave powered water pumping and desalination unit for coastal villages or areas currently having brackish water (Delbuoy system)- 20 units in local manufacturing and field demonstration pilot.

4) Riser type, water seal latrine toilets to improve over pit latrine now being used. Includes local manufacture and pilot of 600 units.

5) Community health/water committee procedures for establishing and maintaining appropriate self-finaning structure in community for O&M of devices going into field under HSL II and HSL II Amendment field pilot for 25 communities.

6) Hydraulic ram and siphon activated hydropneumatic pump (pumpless pump) local manufacture and field pilot for 50 units for DR.

7) Solar distillation device local manufacture and field pilot for 100 units for desalting brackish water for individual homes in high salinity areas of DR - low cost approach.

8) Introduction of the no plumbing recycling toilet for urban situations where no sewage exists - 20 units.

9) Multiple air lock accumulator and pressure relief valve for local manufacture and field pilot of 20 devices.

10) Field pilot of 200 individual family robovalves and Fordilla valves (evaluation) for field testing. Robovalves made in Ecuador under S&T/HEA TA program. Fordilla valves bought from US.

D.- Close working relationship with ST/HEA envisioned on this component.

E.- US Loan funds ($ and RD) to pay for local costs of devices to be manufactured and installed in DR.

F.- Emphasis of this element is to do things better with less initial capital expense and lower O&M costs to communities and to operationally introduce these devices into the mainstream of DR rural activity.

COMPONENT 9

## 9.- OBSERVATION AND DEMONSTRATION AREA CENTER FOR PRIMARY HEALTH CARE AND WATER SUPPLY AND SANITATION DEVICES AND RURAL METHODOLOGIES

A.- Cost Aspects:

| | | |
|---|---|---|
| 1) | US Grant | $630,000 |
| 2) | US Loan | $ 90,000 |
| 3) | US Loan | RD$ 15,000 |
| 4) | DR Funds | RD$ 60,000 |
| 5) | Comm Participation | RD$ 12,000 |
| 6) | Total | $807,000 |
| 7) | WASH TA | $160,000 |

B.- Nature of Activities

1) Set up an Regional Observation and Demonstration Area (ROA) center in DR using US Grant funds to fund WASH contractor to set up, operate and administer ROA Center.

2) ROA Center includes a central training facility and devices/methodologies and organizational structures in place and operating in about 30 communities within easy access to the ROA Center.

3) DR personnel as well as personnel from throughout the world will come to the ROA Center to see the devices, methodologies and organizational structures in place (operational) and discuss cost and procedural aspects of devices/methodologies and organizational structures seen.

4) Annually expect 600-1000 professional personnel from third world countries to pay to attend such a site.

5) This would be the first and currently only such center in the world.

6) Curriculum would consist of 2-3 days of classroom training on what the people are about to see, the setting, the characteristics of communities and a case history on the community intervention to be looked at and discussed. Then 3-4 days in the field seeing and discussing within a community context the interventions operating in each village.

7) Initially expect 20-25 devices/methodologies to be operationally in place.

8) Funding period to be for 3 years for ROA Center.

9) Anticipate such interest and good public relations from this program with AID/W and key congressional staff, that Mission would probably want to plan for a longer center life than 3-year period envisioned here.

10) Estimate program input to DR economy at $800,000 -- $1,200,000 annually from third world participants attending center activities.

11) Center would also give special 2-week courses on PHC/ENVIR. HLTH in rural communities 4 times a year for DR or other interested third world participants. Bilateral/Multilateral and private donor officials would also probably be interested in attending.

12) Participants to ROA center would be sponsored financially by their sponsoring organizations or themselves.

13) Approximately $60,000 of US grant total will be used to purchase 3 vehicles plus one 30 person bus for operational touring of the communities. These vehicles would be owned and mantained by DR.

14) ROA center would be staffed with A WASH project field director, DR accountant, WASH training coordinator, WASH social scientist, and DR operations personnel/chauffeurs. ROA center would have telex and training facilities. A detailed concept paper on the center has been developed by WASH project personnel and is available in Washington.

COMPONENT 10

10. DATA MANAGEMENT FOR SBS/ENVIRONMENTAL HEALTH PROGRAMS IN D.R. TO SUPPORT EFFORTS EITHER IN PLACE OR PLANNED AS A RESULT OF HSL I, II AND II AMENDMENTS

A. Cost Aspects

| | | |
|---|---|---|
| (1) | U.S. Grant -------- | $86,000 |
| (2) | U.S. Loan --------- | $34,000 |
| (3) | U.S. Loan --------- | RD$12,000 |
| (4) | Dom. Rep. Funds --- | RD$28,000 |
| (5) | Total Loan/Grant -- | $160,000 |
| (6) | WASH T.A. --------- | (60,000) |

B. Nature of Assistance

(1) Teaching power of Apple II micro computer approaches to strengthening and improving implementation of complex projects.

(2) Teaching C.P.M. techniques for procurement and using computer to stay up with deadlines on projects.

(3) Imputing epidemiological/demographic information for analysis and trend/statistical analysis that has been gathered for several years by MODR health promoter personnel.

(4) Statistical/output analysis to describe quantitative impact of different objectively verifiable indicators for impact analysis.

(5) A multitude of other possibilities.

C. Grant funds placed by USAID/DR PIO/T face sheet into WASH level of effort contract. WASH contractor will mobilize data management personnel to perform agreed upon scope of work between GODR, USAID/DR and S&T/HEA as in all USAID/DR requests for WASH technical assistance.

D. Approximately $9,000 to be spent on WASH purchase of Apple II micro computer, EPSOM MX-80/FT dot matrix printer/plotter/grapher, one 13" diamter cathode ray tube video display, two disk II floppy disk drives and various programmed software and teaching software. Equipment to be left with GODR under control of Mission after training and demonstration takes place.

E. Estimate of time required - 14 person months of time over a 2 year period. In and out technical assistance. Initial technical assistance period for 4 person months duration estimated.

F. Dom. Rep. funds used to provide salary and local MODR officials with support while they are being trained in use, programming and data input/output techniques. Also pays for data coding and data input/analysis of SBS/ENVIR HLTH program data for improved management and analysis.

COMPONENT 11

11. PROFESSIONAL SERVICES - SANITARY ENGINEER
(for 2 1/2 years)

A. For providing technical expertize for guiding and counciling on the various aspects of the water supply and sanitation components of HSL II Loan and Amendment to help assure the successful implementation of those aspects of the loan according to the standards and time framework established by the loan.

B. For the population covered by the 2473 SBS promoters in Regions I, II and IV and for additional coverage as might be deemed advantageous to spread the methodology and techniques nationwide, but with priority on the activities of the loan in Region I, II and IV.

C. These professional services will assist in the development and implementation of the methodologies and techologies, during the assignment of the sanitary engineer, as a basis for the remainder of the program to provide adequate water supply and sanitation services for the people served by the 2473 SBS promoters in the Regions I, II and IV, and, as time permits, for consultation on WS&S services nationwide.

D. This component provides for:

1. The professional services (for 2 1/2 years) of a competent sanitary engineer, experienced in the development and implementation of rural water supply and sanitary programs and projects in developing countries.

2. Transportation, lodging and per diem, as necessary for the sanitary engineer.

3. Four trips outside the country during his assignment as required to backstop his activities under the loan.

4. Supplies and equipment he may need to carry out his assignment.

5. Assistance by the sanitary engineer in the training aspects of the program.

E. The estimated cost breakdown is:

| | | |
|---|---|---|
| 1. | U.S. Grant | $145,000 |
| 2. | U.S. Loan | $ 12,000 |
| | | RD$ 43,000 |
| 3. | Total | $200,000 |
| 4. | WASH Technical Assist. | $(15,000) |
| 5. | Grand Total | $215,000 |

COMPONENT 12

12.- PROFESSIONAL SERVICES FOR TRAINING OF TRAINERS/HRD, (for 2 1/2 years)

A.- For providing technical expertise in the development and implementation of "task and performance oriented" training programs for the various personnel involved in the water supply and sanitation elements of HSL II Loan and Amendment at all levels including national, regional, SBS promoters and community.

B.- For the training of staff needed to implement the project and programs financed by HSL II Loan and Amendment to serve the population covered by the 2473 SBS promoters in Regions I, II and IV, namely 989,200 people. The training courses and materials will be available to participants from other regions of the country as space is available. The trainers required for training the staff mentioned above will be developed with the assistance of the professionals furnished under this component.

C.- This Component provides for:

1) The professional services (for 2 1/2 years) of a competent training expert, experienced in the development and implementation of task and performance oriented training programs for rural water supply and sanitary programs and projects in developing countries.

2) Transportation, lodging and per diem, as necessary for the traning expert.

3) Four trips outside the country during his assignment as required to backstop his activities under the Loan.

4) Supplies and equipment he may need to carry out his assignment.

D.- The estimated cost breakdown is:

| | |
|---|---|
| 1) US Grant | $ 145,000 |
| 2) US Loan | $ 12,000 |
| | RD$ 43,000 |
| 3) Total | $ 200,000 |
| 4) WASH TA | $( 15,000) |
| 5) Grand Total | $ 215,000 |

COMPONENT 13

13.- PRIMARY HEALTH CARE/WATER SUPPLY AND SANITATION DECADE MASTER PLAN DEVELOPMENT FOR GODR FOR COORDINATING BI-LATERAL/MULTILATERAL INVESTMENTS IN PHC/ENVIR HEALTH OVER NEXT 10 YEARS

----------GRANT $180,000--------WASH TA ($40,000)

A.- Grant funds placed by USAID/DR PIO/T face sheet into WASH level of effort contract. WASH contractor will mobilize to perform master plan development in conjunction with GODR and USAID/DR officials as in all USAID/DR requests for WASH assistance.

B.- WASH contract will contribute $40,000 of its own funds for this effort.

C.- Aspects of master planning:

1) Review of past, present and future programs (GODR and all donors);

2) In conjunction with GODR officials, WASH team will develop GODR plan (not AID identifed plan);

3) Manpower development and training data collection, analysis and planning;

4) Ground water/water resources assessment and planning;

5) Technology transfer assessment and planning;

6) Infrastructure analysis and planning;

7) Social analysis and planning;

8) Targets of opportunity identification and planning with regard to national bi-lateral/multi-lateral and private sector investments in these sectors.

9) GODR/Donor resource analysis, assessment, and planning;

10) Development economic and financial analysis.

D.- Prior experience by WASH on similar master plans for decade in Sri Lanka was - highly successful - GOSL adopted the plan and presented it to UNDP for donor coordination. GOSL currently using plan.

E.- Estimate of time required = 18 person-months of effort over a 3 to 5 month period for final report.

F.- Effort backstopped by WASH contact Coordination and Information Center (CIC) in Arlington, Virginia, and by S&T/HEA.

G.- Effort useful if only priority investment areas and priority targets of opportunity identified.

COMPONENT 14

14.- WASH PROJCT (S&T/HEA) MULTIDISCIPLINARY TECHNICAL ASSISTANCE OVER LIFE OF PROJECT FOR SUPPORT OF HSL II AND HSL II AMENDMENTS ------($100,000)

A.- Multidisciplinary technical assistance in Water Supply and Sanitation in more PHC settings.

1) $100,000 over life of project (LOP) available to Mission to take advantage of targets of opportunity and highly professional WASH resources.

2) Nature of assistance:

(a) Senior international consultants or specialists in areas of rural water supply, sanitation, infrastructure strengthening, O&M, training, information data management, financial structure development in communities, social science, development economics, tech transfer, planning, health education;

(b) Short-term (less than 6-month duration in any one scope of work);

(c) Pay full salary, per diem and travel of consultants

(d) Short response time - from a few days to 2 weeks to place qualified consultant in DR after request from Mission;

(e) Non-loan funds (central bureau appropriated funds);

(f) Within scope of work of WASH project (See WASH brochure).

B.- WASH technical assistance managed by S&T/HEA and WASH contractor (Camp, Dresser and McKee with institutional resources of Research Triangle Institute, Univ. of North Carolina, Boston Univ., International Science and Technology Institute, Georgia Institute of Technology).