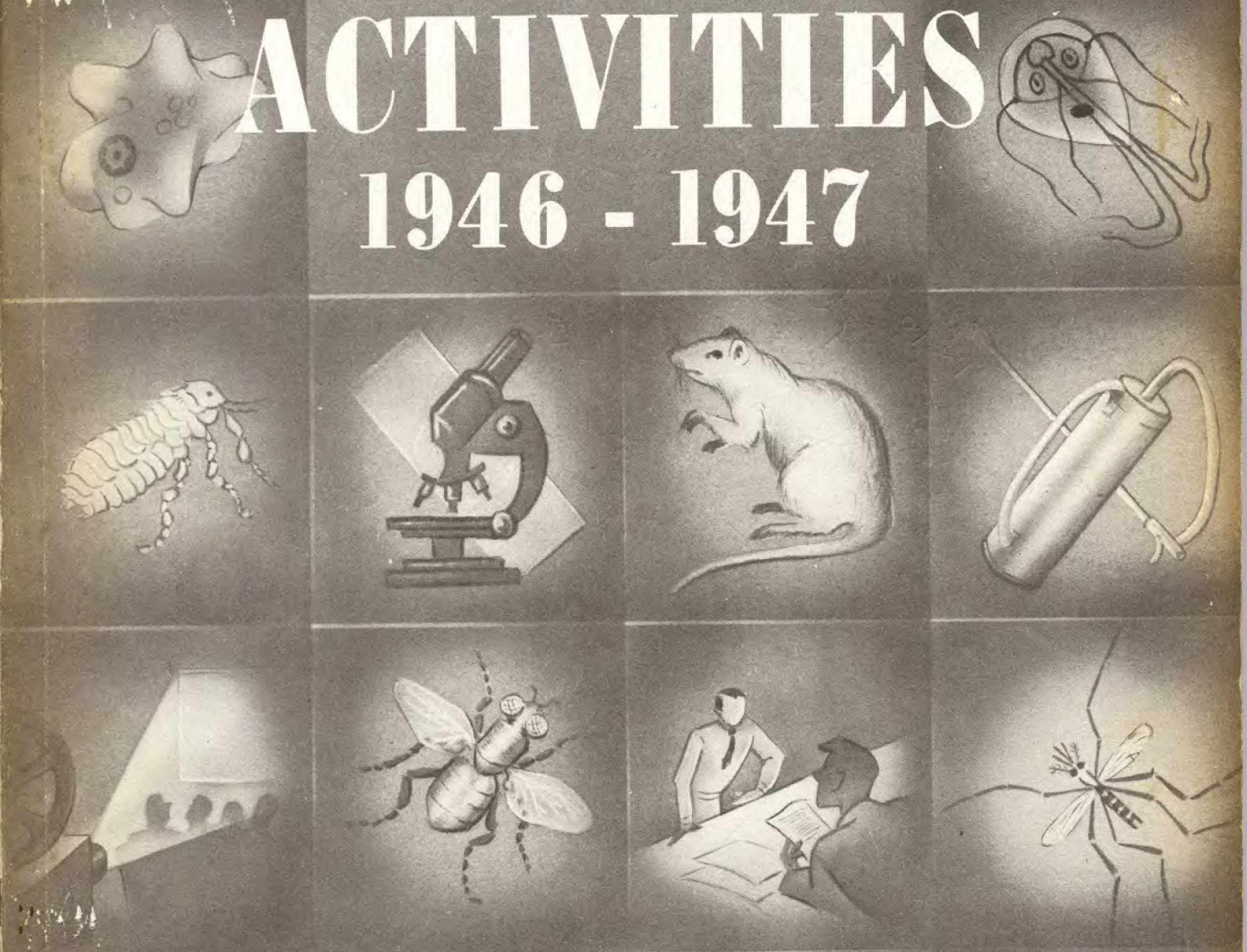
COMMUNICABLE DISEASE CENTER ACTIVITIES

1946 - 1947



FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA

COMMUNICABLE DISEASE CENTER ACTIVITIES

1946 - 1947

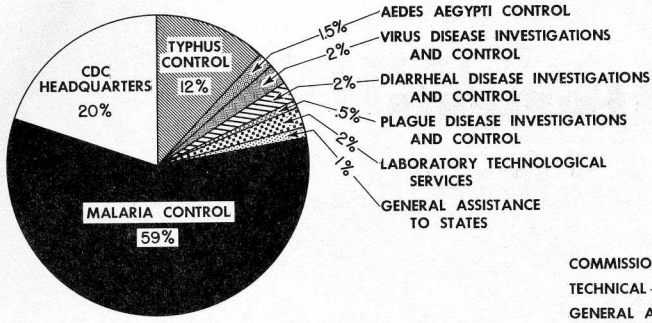
FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA

Contents

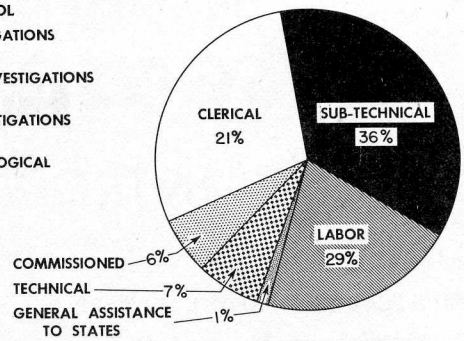
Material in this report is not for publication.

PERSONNEL

(Total 1,950)



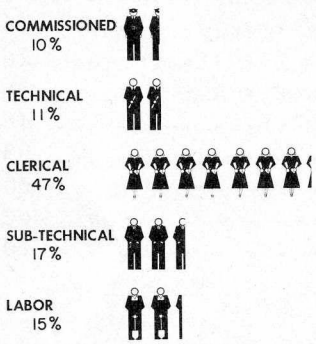
BY PROGRAM



BY CLASSIFICATION

OPERATION OF CDC HEADQUARTERS *

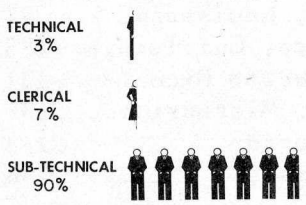
Each symbol represents 25 people



* INCLUDES TRAINING

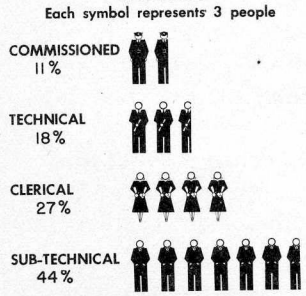
AEDES AEGYPTI CONTROL

Each symbol represents 4 people



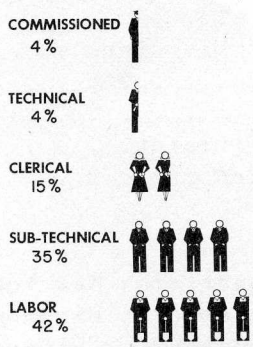
LABORATORY TECHNOLOGICAL SERVICES

Each symbol represents 3 people



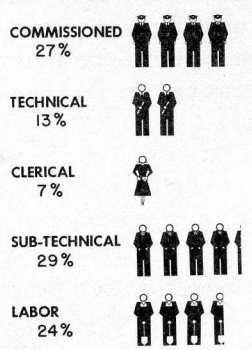
MALARIA CONTROL

Each symbol represents 100 people



VIRUS DISEASE INVESTIGATIONS AND CONTROL

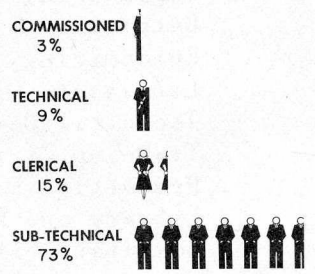
Each symbol represents 3 people



FEDERAL SECURITY AGENCY
U. S. PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA
F. Y. 1947

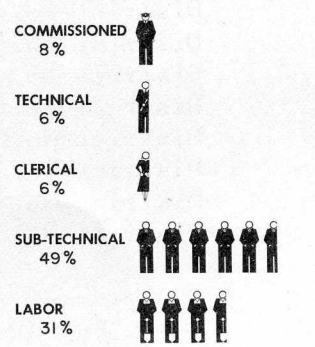
TYPHUS CONTROL

Each symbol represents 25 people



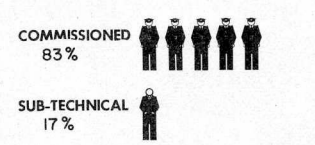
DIARRHEAL DISEASE INVESTIGATIONS AND CONTROL

Each symbol represents 3 people



PLAGUE INVESTIGATIONS AND CONTROL

Each symbol represents 1 person



The Communicable Disease Center

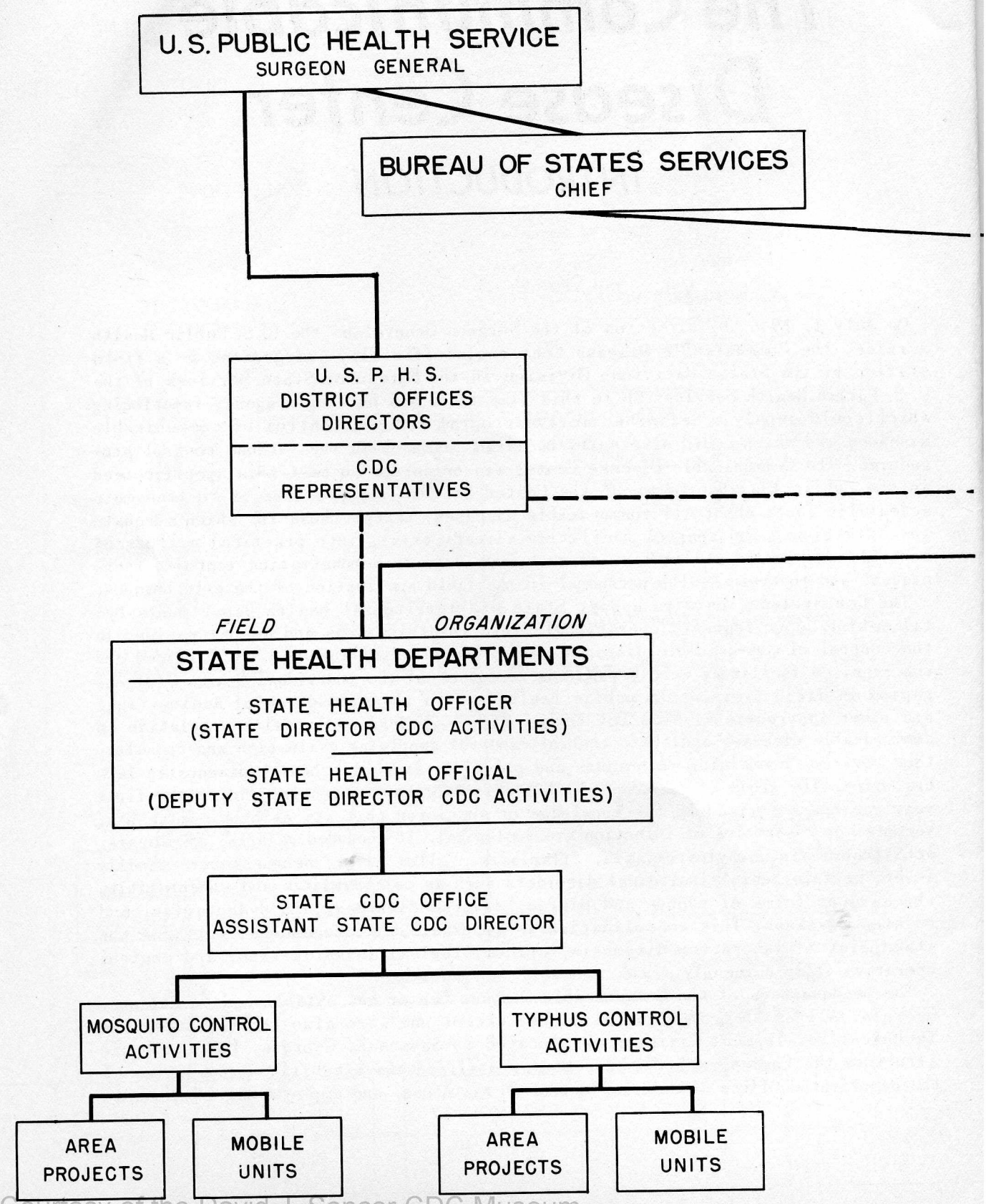
INTRODUCTION

On July 1, 1946, by direction of the Surgeon General of the U. S. Public Health Service, the Communicable Disease Center was officially inaugurated as a field station of the States Relations Division in the Bureau of State Services of the U. S. Public Health Service. Up to this time there was no single agency functioning which could supply a definite, active program for the control of communicable diseases and which could also carry on field research in the various control procedures. The Communicable Disease Center was organized to meet this specific need in the public health program of the United States—its province is to transmute scientific facts about all communicable diseases, except those for which adequate investigational and control facilities already exist, into practical methods of control; to promote utilization of such knowledge by demonstrating improved techniques; and to train health personnel in the field application of these techniques.

The Center functioned to assist State and Territorial health departments by: (1) making, upon request, operational field investigations and demonstrations in the control of communicable diseases where Federal assistance was not provided and the required facilities were beyond the resources of the individual States; (2) engaging in field training in public health and in the production of audio-visual and other instructional aids for technical and professional training relative to communicable diseases and their control; and (3) supplying evaluation and consultation services concerning techniques and practices in public health diagnostic laboratories. The group of diseases which received primary attention during the first year was characterized by the knowledge or suspicion that its etiological agents, vectors, or reservoirs of infection are zoological. It included malaria, amoebiasis, schistosomiasis, ancylostomiasis, filariasis, yellow fever, dengue fever, sandfly fever, certain neuro-virological disorders such as poliomyelitis and encephalitis, the various forms of typhus and plague, diverse diarrheas and dysenteries, and related diseases. This consolidation is clinically heterogeneous, but from the standpoint of laboratory diagnosis, epidemiological investigation, and control operation it is eminently sound, sensible, and workable.

The headquarters of the Communicable Disease Center was established in Atlanta, Georgia. All of the component divisions except one were also located here; the Technical Development Division was located in Savannah, Georgia. For its basic structure the Communicable Disease Center utilized the established facilities of the deactivated Office of Malaria Control in War Areas, and employed the physicians,

COMMUNICABLE



DISEASE CENTER

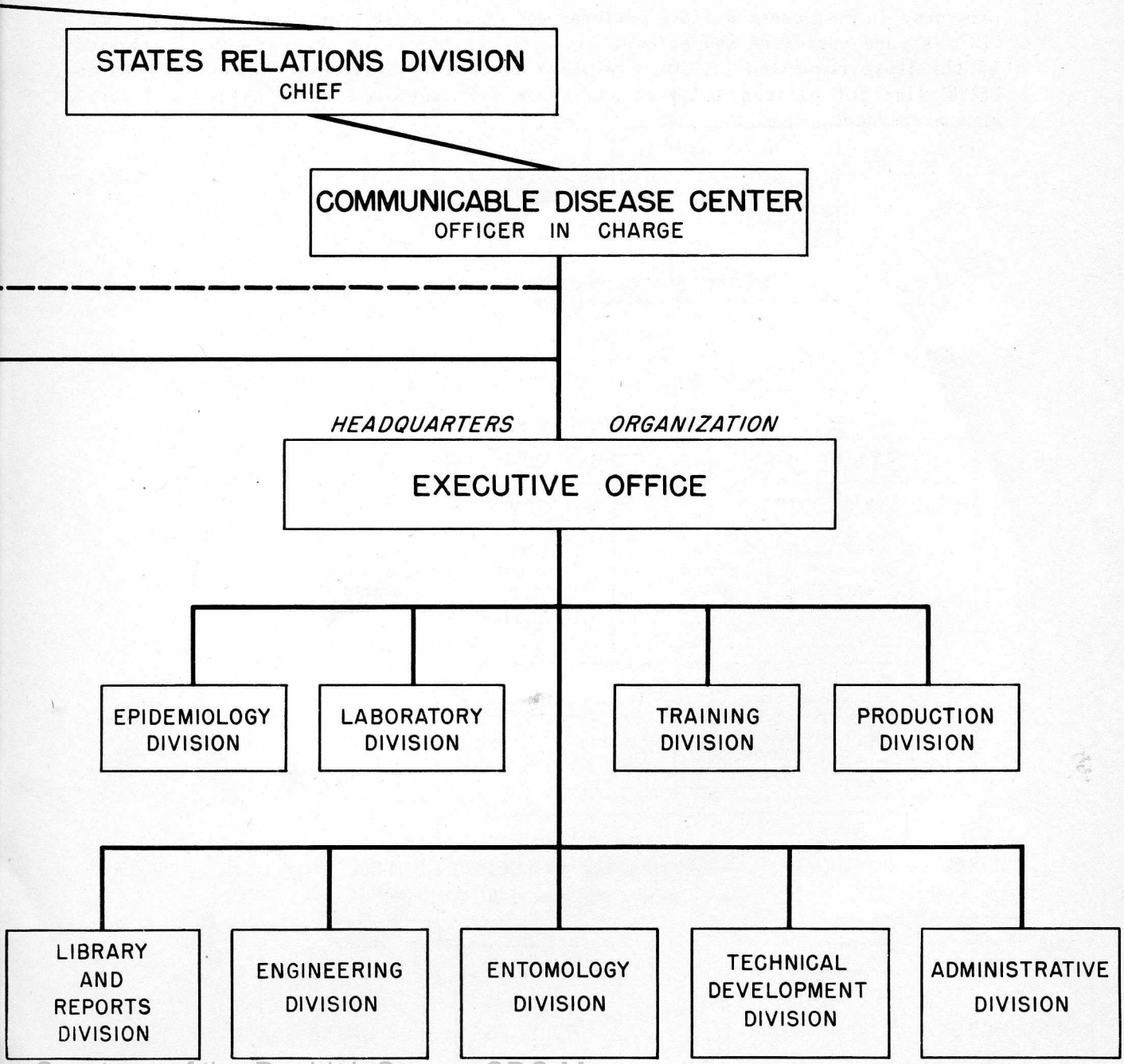
CHART I

FEDERAL SECURITY AGENCY
U. S. PUBLIC HEALTH SERVICE

COMMUNICABLE DISEASE CENTER

ATLANTA, GEORGIA JANUARY 1, 1947

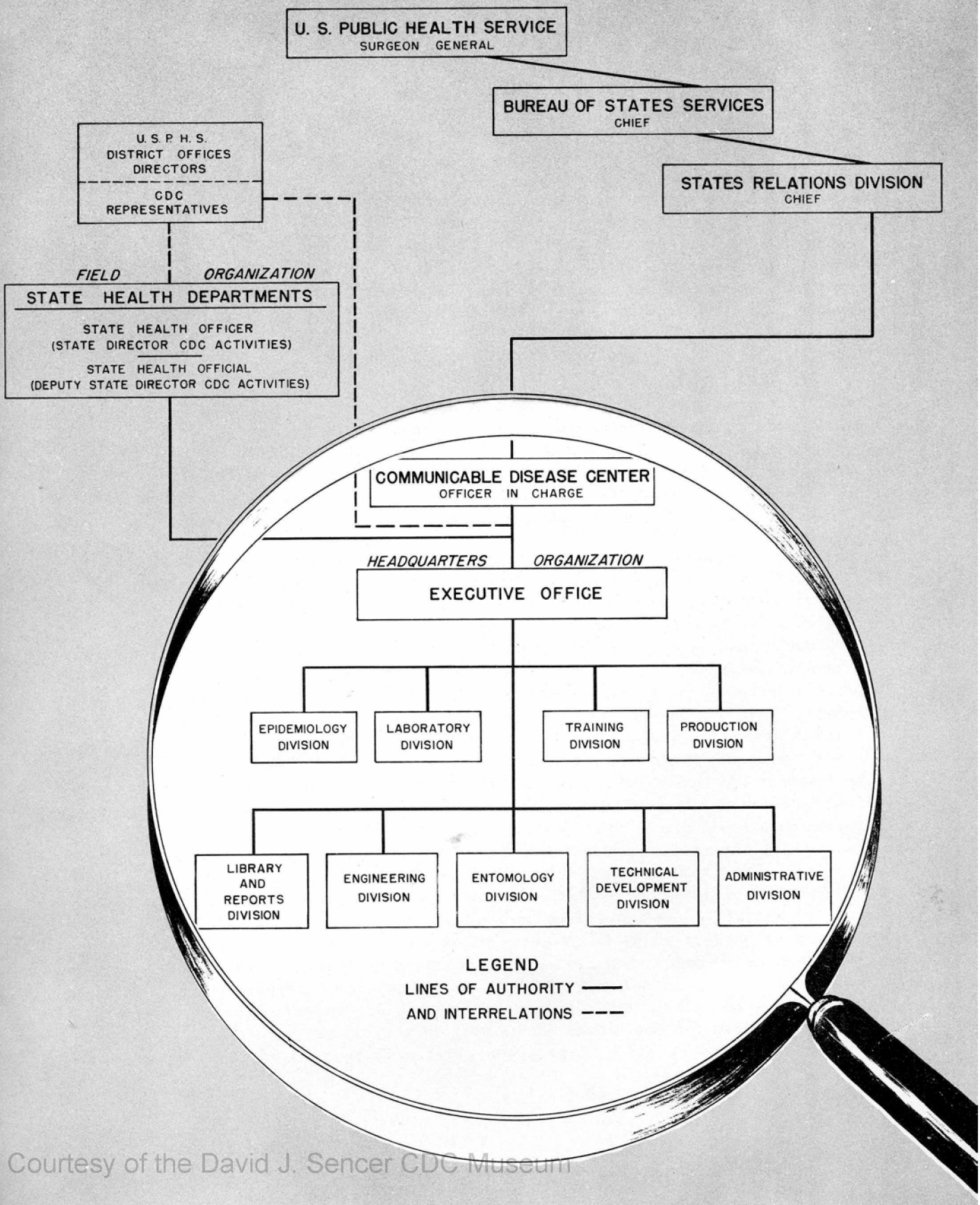
LINES OF AUTHORITY ———
AND INTERRELATIONS — — —



engineers, and biologists who had obtained training and skill with that organization in the control of insect- and rodent-borne diseases. Experience had shown the wisdom of attacking communicable disease problems with teams of specially trained and equipped scientists whose activities are coordinated within a single organizational unit.

Chart I shows the lines of authority of the administrative head of CDC and the interrelationships of the headquarters and field organization in the various States. Functional interrelationships were developed with the National Institute of Health and with other USPHS components, including the divisions of Commissioned Officers, Foreign Quarantine, Public Health Methods, and Sanitary Engineering, and with State and Territorial health departments through USPHS district offices. Within the States a director of CDC activities was responsible for over-all supervision of State programs. In most cases a State engineer and entomologist supervised the field work; CDC assigned engineers and entomologists to the State for supervision of programs if the State requested it. CDC engineers and entomologists were also assigned to USPHS district offices and were available for technical consultation and guidance as needed.

HEADQUARTERS ORGANIZATION

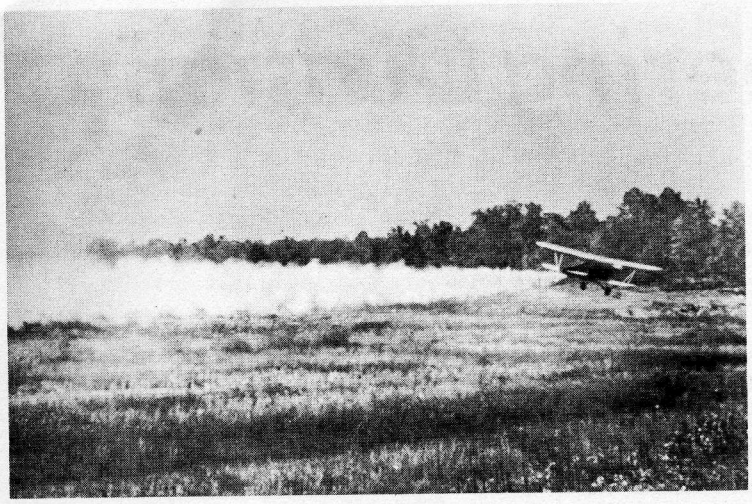


Engineering Division

The Engineering Division directs and coordinates the operation of the insect and rodent control programs of the Communicable Disease Center. It secures the cooperation of State health departments, assigns necessary professional personnel to State CDC programs, makes available needed materials and equipment, and maintains the equipment in use. The Division is responsible for keeping operation costs at a minimum by conducting continuing analyses of operational data and encouraging economical practices, and by keeping informed of the progress of investigations and anticipating for field application any newly-developed control principles. The supply of available professional personnel is closely checked for the purpose of guiding such personnel toward vacancies in State health department organizations. An important phase of the Division's activities is the determination of those Federal, State, and local agencies which may benefit by CDC assistance or consultation, and arranging for cooperative procedures to be set up. Four component branches carry out the activities of the Engineering Division: the Mosquito Control Branch, the Typhus Control Branch, the Impounded Water Branch, and the Equipment and Construction Branch.

● DIVISION ACTIVITIES. The two major activities of the Engineering Division during the fiscal year continued to be the operation of the malaria control program in 13 southern States and the typhus control program in nine southern States. The plague suppressive measures project in Texas was carried on during the year to determine the feasibility of such control measures. The Muscogee County project was undertaken in cooperation with the Muscogee County Health Department and the Georgia State Department of Public Health to determine whether community-wide insect control operations were necessary for satisfactory disease vector control. The project was operated in two phases: (1) to determine the feasibility of community-wide insect control by application of DDT residual spray to resting places; and (2) to determine the most economical method of reducing insect populations. The 1946 season DDT residual spray operations resulted in good control of flies and mosquitoes, with incidental control of such other household insects as roaches, bedbugs, and fleas. These data corroborated to some extent results which were obtained by the Neurotropic Virus Disease Insect Control Project at Montgomery, Alabama, in its community-wide fly control operations. Having determined the most desirable method for securing insect control, during the 1947 season a reduction in cost of operations was attempted by entomological direction of treatment and by reducing areas to be treated to a minimum. Entomological evaluation of spraying operations was undertaken by an entomologist assigned by the Georgia State Department of Public Health.

The Engineering Division, in cooperation with the Mississippi River Commission, carried on an airplane larviciding project at the Sardis and Arkabutla reservoirs in Mississippi for the control of malaria mosquitoes. A CDC plane equipped for the



Dispersing DDT thermal aerosol by airplane.

dispersion of DDT thermal aerosol and a pilot were made available to the Commission on a reimbursable basis for the spraying. It was not contemplated that this project will be continued by CDC after June 30 since future work will be done on a contract basis. In this connection, the Commission was furnished with pertinent data regarding airplane larviciding contracts by the Engineering Division. In response to a request from the Arkansas CDC program, emergency airplane larviciding with DDT thermal aerosol was initiated in flooded areas in Arkansas at Forrest City, Helena, West Memphis, and Marianna late in June. Careful entomological checks of the results of this larviciding will be made. Inquiries from the Netherlands, China, and Saigon were answered by furnishing detailed plans for the conversion of airplanes for the dispersal of thermal aerosol, and by other information on CDC operations.

At the request of the Engineering Division, specifications were prepared for DDT concentrate, solvents, emulsifiers, and ten percent DDT dust by the Technical Development Division. After review, the specifications were forwarded to the Procurement Branch for utilization in the future when bids are solicited for these materials for CDC operations. Similar specifications were furnished for spraying nozzles. Information regarding extent of CDC operations for residual spraying, dusting, and ratproofing activities during the calendar years 1945, 1946, and 1947 was requested from the States in order to determine whether or not there is any correlation between CDC control operations and the prevalence of malaria, typhus, poliomyelitis, dysentery and enteritis, and other communicable diseases. This survey project was undertaken with the assistance of the Epidemiology Division.

● DISTRICT ACTIVITIES. Among the activities of district CDC representatives was included demonstrations in DDT spraying on Indian reservations, continued in New Mexico (District 9) during October. With the completion of these demonstrations, this activity was discontinued until the next season. District CDC representatives also assisted in malaria surveys on impoundments of the U. S. Engineering Department, and further assisted various States participating in the CDC program in planning future operations. A conference of State CDC directors and district CDC representatives was held at headquarters in November also to discuss past and further operations. The meeting provided an excellent opportunity for the State directors to exchange ideas and plan for better operation of the program. A point emphasized was the need for each State to provide more adequate local contributions in order to extend the area of operations to all counties requiring malaria control work, with the local authorities eventually being in a position to assume responsibility for financing the entire program, if necessary. A cooperative rickettsialpox survey in New York City

was undertaken by CDC representatives in the District 1 office and the New York City Health Department. The purpose of this project was to determine to what extent mice from selected areas over the entire city were infected with rickettsialpox; whether other hosts, such as rats, were involved; and whether there were other vectors of the disease in addition to the mite, *Allodermanyssus sanguineus*. From the data obtained an attempt will be made to predict the possibilities of the further spread of rickettsialpox in New York City and vicinity, and to recommend control measures. The CDC representative in District 8 worked closely with the Fish and Wildlife Service on the rodent control problem of States in the District. Valuable service was rendered to a number of communities in making recommendations for correction of the improper garbage disposal methods now in use.

MOSQUITO CONTROL BRANCH

The over-all functions of the Mosquito Control Branch include: (1) directing the operation of malaria control programs, consisting of the control of adult mosquitoes by DDT residual spraying, and the control of mosquito breeding by minor drainage or larviciding, in cooperation with State health departments in areas where funds are specifically allocated; and (2) providing consultant services in general insect control operation to other CDC divisions, other Federal agencies, State and local health departments, and special investigational projects. This Branch also carries on evaluations of methods to secure local participation in cost of operations with the ultimate aim of having such activities as malaria and *Aedes aegypti* control included as a permanent part of State public health programs. Assistance is given other divisions in the development, improvement, and field testing of equipment for the dispersion of insecticides and larvicides, and, in situations where laboratory facilities cannot readily duplicate all of the variable factors involved in an investigation, this Branch secures the incorporation of investigational procedures on selected operating projects.

● MALARIA CONTROL. During the first two quarters of the fiscal year malaria control operations were pre-approved in 188 counties having malaria death rates of ten or more per 100,000 population. The increased contribution to the over-all program from local sources during the last two quarters permitted expansion of malaria control operations to include counties having a mortality rate of five or more per 100,000 population during the period 1938-1942. By June 1947 operations had taken place in 297 counties on the extended malaria control program.

Military establishment and Veteran Administration malaria control work was conducted throughout the year, but in a greatly reduced number of areas. At the end of the fiscal year control measures were being carried out in only 30 military areas and in the vicinity of six Veteran Administration facilities. Surveillance was conducted in 43 military areas and around 34 V. A. facilities. Military establishment malaria control operations in Puerto Rico were continued pursuant only to specific requests for such operations by the military authorities.

The residual spraying method of control was limited to rural homes and small communities. Larviciding and minor drainage was used to provide control for larger communities since ordinarily it was the more economical method where population concentrations of more than 2,500 were involved. A total of 35 areas received malaria protection by larviciding, minor drainage, and related work during the fiscal year. How-

ever, a number of larger cities in the 2,500-10,000 population group contributed sufficient additional funds for residual house spraying treatment; this type of work in larger cities was done entirely with local funds.

SUMMARY OF CDC CLEANING ACTIVITIES
FISCAL YEAR 1947

STATE	LIN. FT.	MAN HOURS		
		CDC	LOCAL*	TOTAL**
Alabama	58,200	720	—	2,233
Arkansas	450,575	768	3,321	13,214
California	1,400	—	--	22
Florida	111,636	--	--	3,518
Georgia	330	—	--	28
Louisiana	52,900	98	—	1,845
North Carolina	639,370	5	641	1,078
South Carolina	130,862	—	—	4,502
Tennessee	136,304	2,266	3,936	10,715
Texas	141,070	108	3,105	3,751
Virginia	112,364	3,537	--	4,452
Sub-total	1,835,011	7,502	10,976	45,358
Puerto Rico	525,095	8,070	20,445	42,219
GRAND TOTAL	2,360,106	15,572	31,421	87,577

* Second half of fiscal year only.

** Total fiscal year.

SUMMARY OF CDC DRAINAGE AND MAINTENANCE ACTIVITIES
FISCAL YEAR 1947

STATE	LIN. FT.	CU. YDS.	MAN HOURS		
			CDC*	LOCAL*	TOTAL**
Arkansas	7,315	9,337	147	75	678
Florida	2,380	440	—	—	546
Georgia	660	100	—	--	120
Louisiana	200	7	960	—	970
North Carolina	6,665	1,377	2	128	949
Tennessee	3,344	596	2,047	4,144	6,191
Texas	—	10,000	—	280	280
Virginia	30,631	230	888	—	976
Sub-Total	51,195	22,087	4,044	4,627	10,710
Puerto Rico	813,905	480	9,800	119,000	129,428
GRAND TOTAL	865,100	22,567	13,844	123,627	140,138

* Second half of fiscal year only.

** Total fiscal year.

SUMMARY CDC LARVICIDING ACTIVITIES

HAND AND POWER OPERATIONS

FISCAL YEAR 1947

STATE	OIL (GALS.)	ACRES OILED	HUNDRED FEET TREATED 1/	PARIS GREEN (POUNDS)	ACRES DUSTED	HUNDRED FEET TREATED 1/	DDT-OIL* MIST (GALS.)	ACRES* TREATED	HUNDRED* FEET TREATED 1/	MISC. GALS. 2/	ACRES TREATED 2/	AIRPLANE* LARVICIDING (GALS.)	ACRES* TREATED	MAN-HOURS FIRST HALF F.Y.	MAN-HOURS** SECOND HALF F.Y.			MAN-HOURS** TOTAL F.Y. (CDC & LOCAL)
															CDC	LOCAL	SUB-TOTAL	
Alabama	920	29	—	—	—	—	—	—	—	—	—	—	—	533	—	—	—	533
Arkansas	32,238	2,088	11,713	765	199	—	10,183	1,901	206,074	17,422	5,441	556	338	37,335	1,854	14,035	15,889	53,224
California	3,295	281	—	—	—	—	—	—	—	245	269	—	—	1,486	—	—	—	1,486
Florida	3,633	130	—	92	38	—	—	—	—	365	20	—	—	1,422	—	—	—	1,422
Georgia	—	—	—	319	328	—	—	—	—	—	—	—	—	987	—	—	—	987
Kentucky	—	—	—	—	—	—	—	—	—	70	76	—	—	607	—	—	—	607
Louisiana	39,737	1,655	—	—	—	—	—	—	—	141	21	—	—	13,262	—	—	—	13,262
Missouri	—	—	—	2,477	1,890	—	365	20	2,988	849	295	—	—	4,398	1,400	—	1,400	5,798
N. Carolina	1,995	44	4,553	—	—	—	—	—	—	—	—	—	—	—	45	1,416	1,461	1,461
Oklahoma	2,047	86	—	99	50	—	—	—	—	—	—	—	—	809	—	—	—	809
S. Carolina	459	7	1,050	—	—	—	—	—	—	—	—	—	—	62	35	474	509	571
Tennessee	44,707	22	49,495	—	—	—	4,843	2,434	31,728	13,925	1,985	—	—	13,210	7,657	4,260	11,917	25,127
Texas	3,546	175	406	302	180	—	14,712	2,851	472,348	11,762	442	600	650	3,532	8,696	7,760	16,456	19,988
Virginia	9,445	229	3,076	555	378	—	—	—	—	65	26	—	—	3,049	2,029	—	2,029	5,078
Sub-total	142,022	4,746	70,293	4,609	3,063	—	30,103	7,206	713,138	44,844	8,575	1,156	988	80,692	21,716	27,945	49,661	130,353
Puerto Rico	8,679	845	—	25,069	11,382	17,681	9,081	1,464	644,377	4,534	1,705	—	—	57,224	51,937	5,970	57,907	115,131
TOTAL	150,701	5,591	70,293	29,678	14,445	17,681	39,184	8,670	1,357,515	49,378	10,280	1,156	988	137,916	73,653	33,915	107,568	245,484

* Second half of fiscal year only

** Includes supervision and miscellaneous time for second half of fiscal year only.

1/ Represents ditches less than ten feet wide.

2/ Represents DDT larviciding, thermal aerosol spraying, etc., for first half of fiscal year only.

The 1946 season control operations were terminated by October 31, and all except key personnel were discontinued or transferred to other activities. In view of the critical shortage of equipment, personnel retained on the program during the winter months were used to the greatest advantage possible in the repair and reconditioning of all types of equipment. Every State having a residual spray program had facilities for at least minor repairs. Residual spray activities were resumed again early in March 1947 and house spraying activities were well underway in most States by April 1. In order to extend operations to the greatest number of areas possible, investigational projects were inaugurated during the last two quarters of the fiscal year to determine the feasibility of using a single annual DDT spray application instead of the present system of an average of 1½ spray applications per year. Emulsion concentrates leaving DDT residuals of between 250 and 400 milligrams of DDT per square foot had been recommended and it was considered desirable to try a variety of trial applications under actual field conditions. One county in each of several States was operated in this manner during the 1947 season. A careful entomological check is being made to determine the length of time that the single application retains its insecticidal potentialities. If a single spray plan is found to be satisfactory, it is estimated that the ultimate saving in cost will be from 25 to 35 percent.

Consideration is also being given to the possibility of complete premise spraying instead of the present system of house and privy spraying. The State of Tennessee initiated the so-called "premise" program this year, similar to that carried on by

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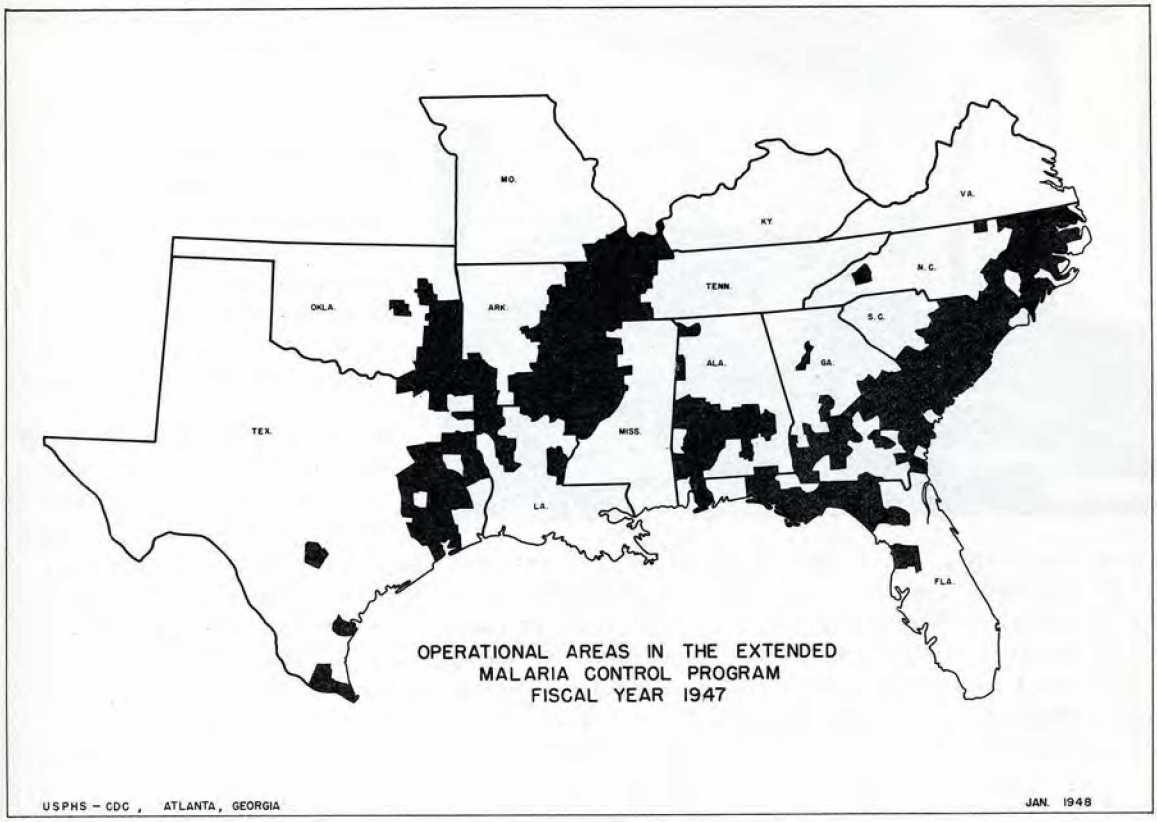
SUMMARY OF
CDC RESIDUAL HOUSE SPRAYING ACTIVITIES
FISCAL YEAR 1947

STATE	MAX. NO. COUNTIES OPERATING	NO. HOUSE SPRAY APPLICATIONS	POUNDS DDT PER SPRAY APPLICATION*	MAN-HOURS PER SPRAY APPLICATION*	UNIT COST	PERCENT LOCAL CONTRIBUTION*
Alabama	22	135,856	0.80	1.23	$3.12	20
Arkansas	38	179,332	0.88	2.02	3.43	22
Florida	27	60,010	0.90	1.49	4.80	19
Georgia	51	189,486	0.77	1.27	2.69	34
Kentucky	9	18,171	0.89	2.87	5.77	33
Louisiana	12	74,950	0.88	1.78	3.35	15
Mississippi	18	186,098	0.69	1.36	2.78	15
Missouri	7	71,040	0.62	1.17	3.10	14
North Carolina	34	58,829	0.68	1.30	3.87	36
Oklahoma	11	35,279	0.98	2.47	5.44	32
South Carolina	31	127,273	0.93	1.62	3.32	39
Tennessee	12	40,315	1.20	1.77	5.05	36
Texas	35	101,350	0.90	2.40	4.63	29
TOTAL	297	1,277,989				
(average)			0.82	1.62	$3.48	26%

* Second half of fiscal year only. (Man-hours include CDC and local; supervision and miscellaneous time included for second half of fiscal year only.)



Tennessee Valley Authority. All buildings occupied by humans and animals after nightfall were given one residual treatment per season. Data on cost and results indicated further consideration of this procedure. Tennessee is also utilizing a one-man crew, which apparently is proving to be very effective in certain sparcely settled areas, as evidenced by the low man-hours expended per pound DDT.

During this fiscal year, 1,278,000 DDT residual house spray applications were made in the 297 counties of the 13 operating states. In spraying this number of houses, approximately 1,046,000 pounds of DDT were used, or an average of 0.82 pound per house application. This is considerably less than the desired application rate of 200 mg. per square foot. In order to obtain a heavier deposit of DDT on the sprayed surfaces, it is felt that the DDT concentration in the spray should be increased to approximately 7½ percent. The expenditure in man-hours per house application for residual spray operations was considerably reduced during the current year as compared to the 1946 fiscal year. In the event that only one spray application is adopted for the next fiscal year, involving complete treatment of backs and under-sides of furniture as well as walls and ceilings, any additional reduction in man-hours per house can hardly be expected. However, as pointed out above, the one house spray application per season should constitute a saving in over-all cost of from 25 to 35 percent.

In reviewing operations during the year it was noted that contributions from tax sources for county-wide operation provided more complete coverage — 85 to 90 percent of the homes — as compared with 30 to 75 percent coverage when funds were collected on an individual fee basis. Where local contributions were obtained from tax sources, it was possible to furnish labor and transportation at roughly $1.00 per house spray

Spraying DDT in a school room in Dyersburg, Tenn.

from local funds, and use Federal and State funds only for supervision and chemicals. The cost per house spray application was from $1.00 to $2.00 more when funds were obtained from individual charges to the householders.

● *AEDES AEGYPTI* CONTROL. Operation of the *Aedes aegypti* projects was conducted in 16 areas in Alabama, Florida, South Carolina, and Texas. A total of 135 persons was employed on the program, of which 85 were locally paid and the remainder were Federal. The program continued as a combined *Aedes aegypti* and general sanitation activity, with local health departments furnishing over 50 percent of the funds. By the end of the fiscal year the transfer of personnel and control functions to local health departments was completed. CDC participation next fiscal year will consist only of the loan of automotive and other equipment and consultative services; in the future, wherever the prevalence of the vector constitutes a health hazard, *Aedes aegypti* control will be a part of the general sanitation program in the local health department.

AEDES AEGYPTI OPERATIONS
FISCAL YEAR 1947

STATE	PREMISES INSPECTED	PREMISES BREEDING	INDEX
Alabama	98,556	1,169	1.19
Florida	225,253	17,538	7.79
South Carolina	34,604	1,368	3.95
Texas	304,772	28,085	9.21
TOTAL	663,185	48,160	7.26

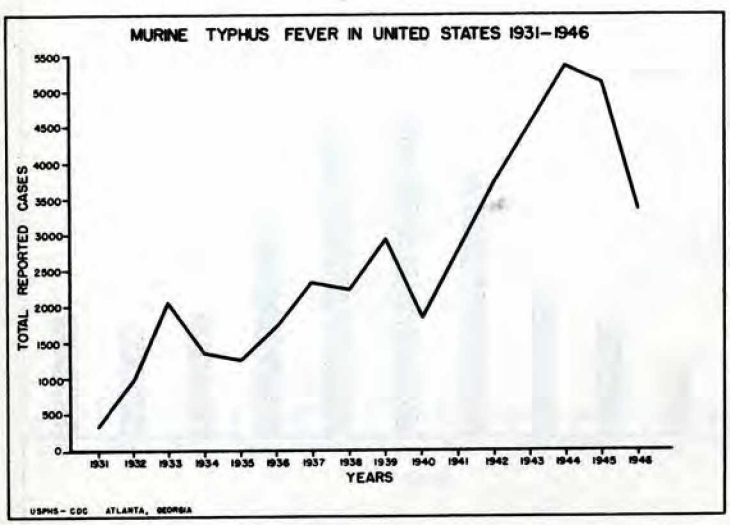
TYPHUS CONTROL BRANCH

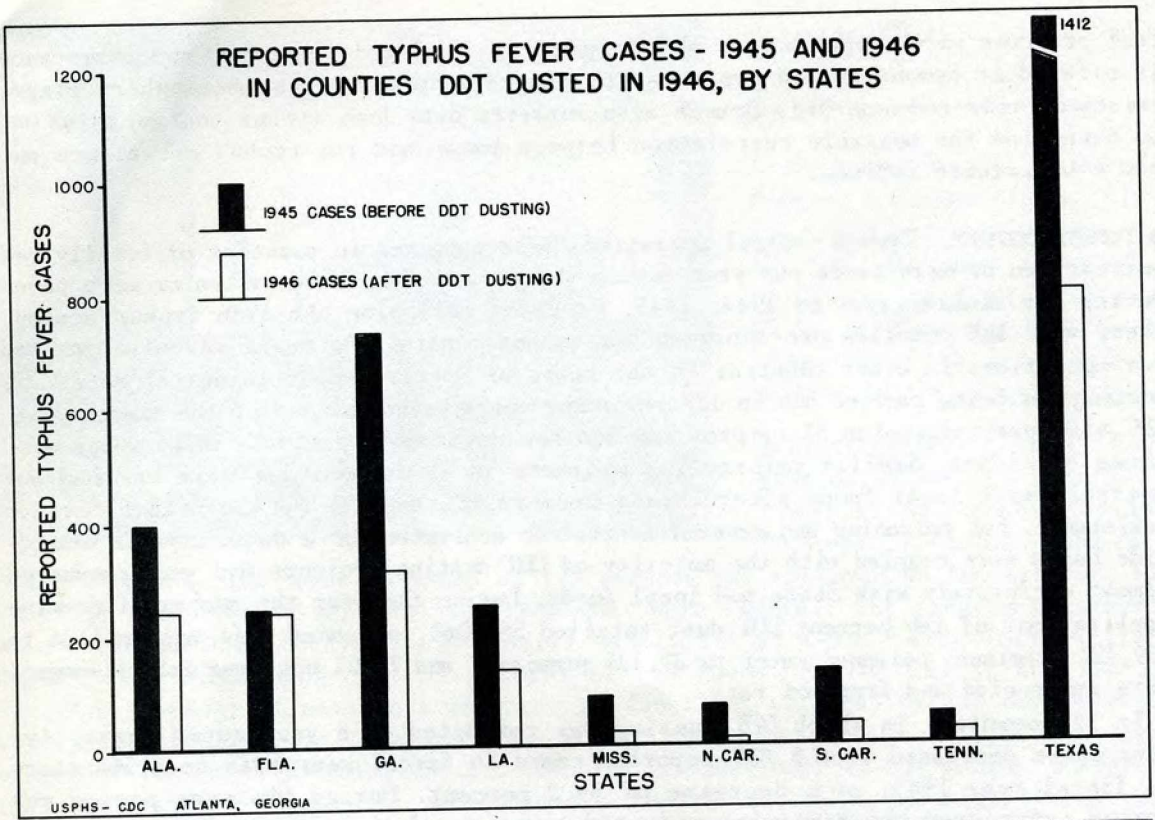
The Typhus Control Branch directs the operation of the typhus control program, consisting of ratproofing, DDT dusting for ectoparasite control, rat poisoning, and general sanitation activities, in cooperation with State health departments in areas approved for control by reason of sufficiently high endemicity of the disease. This Branch cooperates with health officials, Federal agencies, and private industries in the development of rat control activities, and assists in the training program for rodent control personnel. Direction is given to investigational projects designed to determine methods of more economical and more efficient operations, including the field testing of newly developed rodenticides and insecticides and their application to operational programs. Promotional and consultative services are provided to rat con-

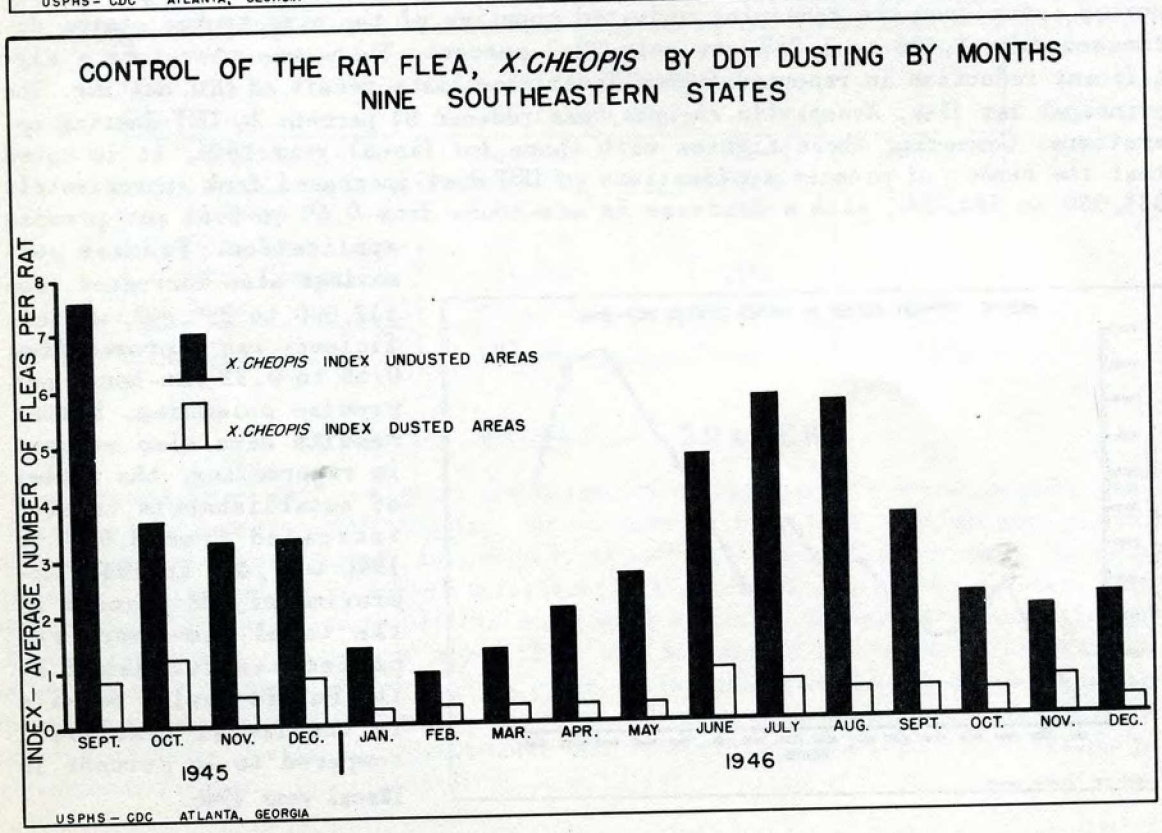
trol programs in marginal States where typhus is not highly endemic, and assistance is offered in demonstration projects for plague suppression in areas where plague exists in wild rodents. This Branch also analyzes data from typhus control programs to determine the possible correlation between human and rat typhus prevalence and rat ectoparasite indices.

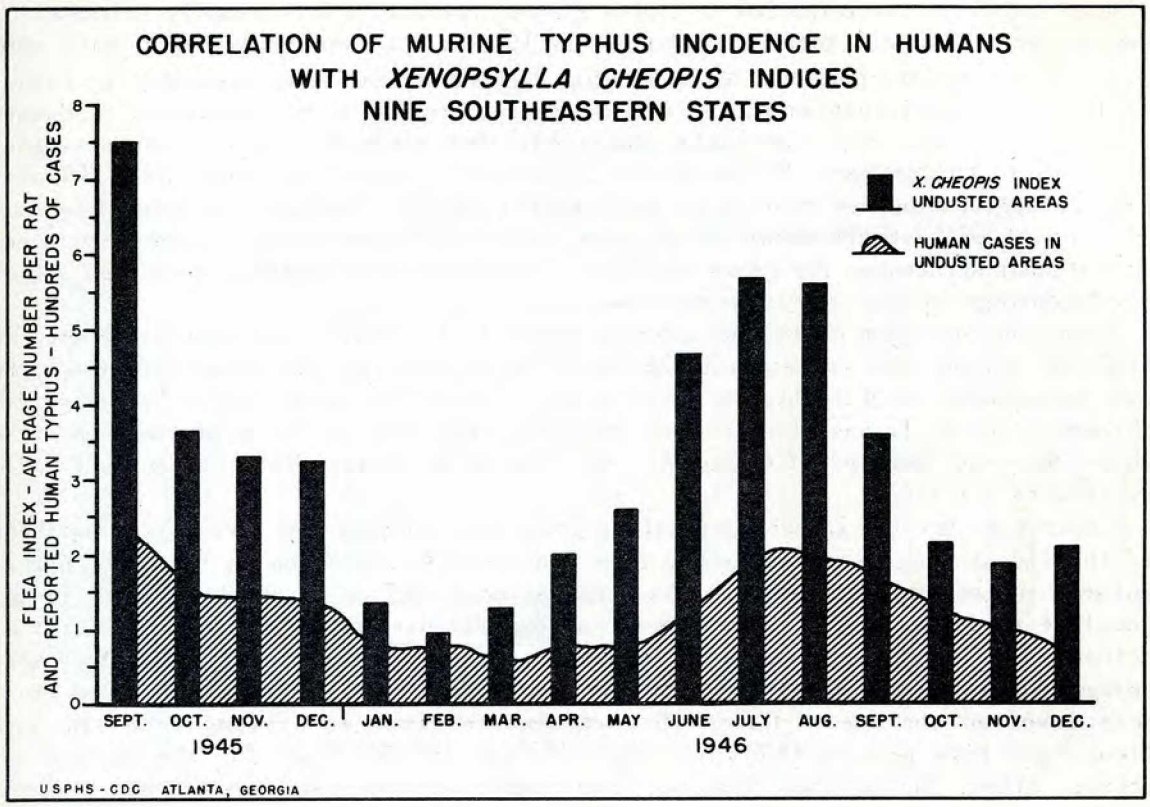
● TYPHUS CONTROL. Typhus control operations were approved in counties officially reporting ten or more cases per year during the period 1940-1944, or ten or more cases during the single years of 1944, 1945, or 1946. Following the 1946 typhus season, there were 188 counties pre-approved for typhus control. Approval was also granted for operations in other counties on the basis of special epidemiological data. DDT dusting was being carried out in 123 reporting counties at the end of the fiscal year. CDC also participated in 57 ratproofing and rat eradication projects in business sections of cities. Similar ratproofing projects in 79 communities were carried out entirely with local funds after having been initiated with Public Health Service assistance. Rat poisoning and general sanitation activities on a community- or county-wide basis were coupled with the majority of DDT dusting projects and were conducted almost exclusively with State and local funds. During the year the number of premise applications of ten percent DDT dust totalled 584,067; poisoned bait was applied to 239,127 premises; poisoned water to 39,135 premises; and 7,401 business establishments were ratproofed and freed of rats.

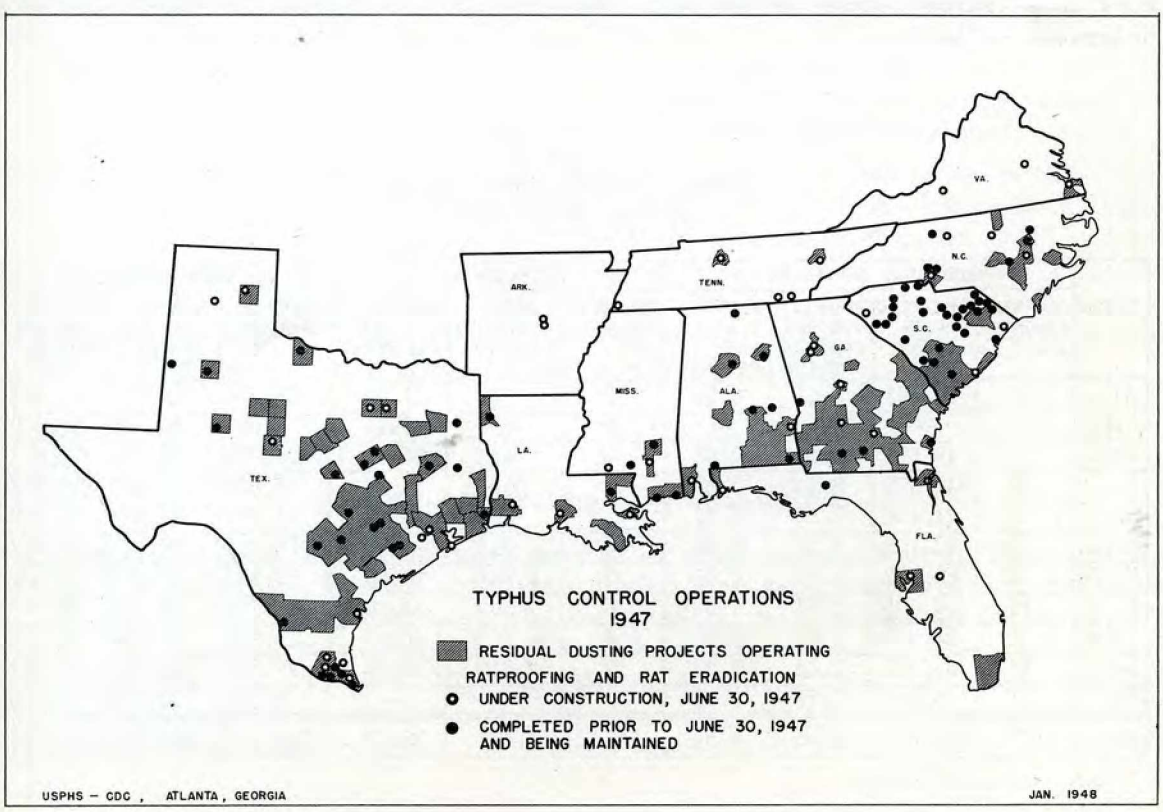
In 122 counties in which DDT dusting was conducted on a year-round basis, typhus cases decreased from 3,837 reported cases in fiscal year 1945 to 1,564 cases in fiscal year 1947, or a decrease of 59.2 percent. During the same period reported cases from the remaining undusted counties of the nine typhus states decreased from 1,626 to 1,257, or only 22.7 percent. There was therefore a significant reduction in reported typhus fever cases as a result of DDT dusting. The principal rat flea, *Xenopsylla cheopis*, was reduced 84 percent by DDT dusting operations. Comparing these figures with those for fiscal year 1946, it is noted that the number of premise applications of DDT dust increased from approximately 333,000 to 584,000, with a decrease in man-hours from 0.69 to 0.51 per premise application. Premise poisonings also increased from 112,000 to 239,000, and efficiency was improved from 0.58 to 0.32 man-hours per premise poisoning. Better results were also evident in ratproofing; the number of establishments treated increased from 3,920 in 1946 to 7,401 in 1947. Approximately 38 percent of the total man-hours reported was furnished by the Public Health Service in the fiscal year 1947, compared to 46 percent in fiscal year 1946.











State and local participation in typhus control operations has steadily increased to over 63 percent of the total cost during the last half of the fiscal year, with over 1.4 million dollars per year of other than Federal funds being expended for typhus control. CDC participation in the typhus control program in the Territory of Hawaii consisted of furnishing materials, equipment, and funds for some of the personnel assigned to the project. By improved efficiency the total unit cost of a DDT dust premise application was reduced to approximately $1.00. Premises are defined as consisting of one establishment in the case of business premises, one residence and appurtenant structures for urban residences, and one rural dwelling including all of the buildings in the case of rural premises.

After consideration of the adequacy of control of rodent ectoparasites secured by limiting dusting work to seasonal operations as compared to year-round operations, it was recommended to State typhus projects that dusting be carried on only during May through October. It was also recommended that operations not be undertaken in areas where adequate sampling of ectoparasites revealed an average index of less than 0.3 *X. cheopis* per rat.

A number of special investigational projects were inaugurated during the last half of the fiscal year. Since there had been considerable objection in the past, particularly in residential areas, to the application of DDT dust, which resulted in incomplete coverage of the areas worked, an experimental project for the control of ectoparasites by the application of DDT residual spray to rat runs, burrows, and harborages was initiated in selected counties in several States. Other experimental projects involved the use of DDT-ANTU dust mixture aimed at killing both rats and fleas; and five percent DDT spray and five percent DDT dust for the control of ectoparasites. All of these special investigations were designed to test procedures on a limited number of projects for possible utilization in the future on a program-wide basis.

SUMMARY OF
TYPHUS CONTROL OPERATIONS
FISCAL YEAR 1947

STATE	RESIDUAL DUSTING				RATPROOFING			MAN HOUR SUMMARY		
	COUNTIES REPORTING	PREMISE DUSTINGS	POUNDS 10% DDT DUST PER PREMISE	MAN HRS. L.& LF* PER PREMISE	PROJECTS REPORTING	ESTABLISHMENTS TREATED	MAN HRS. L.& LF* PER ESTAB.	USPHS MAN HRS. WORKED	OTHER MAN HRS. WORKED	TOTAL MAN HRS. WORKED
Ala.	10	58,071	3.67	0.56	3	20	21.00	45,144	46,637	91,781
Ark.	—	—	—	—	2	605	27.96	5,802	26,616	32,418
Fla.	5	49,658	2.57	0.68	4	446	35.80	27,385	47,426	74,811
Ga.	32	241,670	2.54	0.37	7	623	50.57	76,828	112,446	189,274
La.	6	41,190	2.83	0.37	5	694	46.26	31,472	47,328	78,800
Miss.	3	32,116	1.27	0.41	4	214	17.62	19,382	5,111	24,493
N. C.	5	69,072	1.25	0.26	5	1,847	18.58	14,843	51,479	66,322
S. C.	10	8,605	2.91	1.89	6	359	55.20	26,295	34,448	60,743
Tenn.	2	24,910	1.65	0.31	4	253	48.68	15,997	9,198	25,195
Tex.	49	53,391	2.75	1.22	17	2,340	51.19	99,797	213,880	313,677
Va.	1	5,384	3.71	0.83	—	—	—	5,248	4,722	9,970
TOTAL	123	584,067	2.45	0.51	57	7,401	38.77	368,193	599,291	967,484

* Labor and Labor Foremen

SUMMARY OF
TYPHUS CONTROL OPERATIONS
FISCAL YEAR 1947

STATE	RAT POISONING						
		FOOD BAITS			1080 WATER		
	COUNTIES REPORTING	PREMISE POISONINGS	POUNDS PER PREMISE	MAN HOURS L & LF* PER PREM.	ESTAB. POISONINGS	PINTS PER ESTABLISHMENT	MAN HOURS L & LF* PER ESTAB.
Ala.	10	38,271	1.10	0.47	6,415	1.81	0.50
Ark.	1	511	3.86	6.47	1,376	3.73	5.22
Fla.	5	4,165	0.70	0.79	1,482	0.64	2.19
Ga.	32	137,540	0.43	0.26	864	2.93	3.45
La.	6	41,827	0.19	0.20	3,774	2.21	1.45
Miss.	3	104	1.81	2.22	671	1.41	1.50
N. C.	5	10,608	0.90	0.34	909	0.67	3.89
S. C.	10	62	2.25	6.29	1,120	1.41	4.77
Tenn.	2	20	0.70	5.4	58	1.05	6.00
Tex.	53	6,019	0.65	0.52	22,466	0.85	1.70
Va.	—	—	—	—	—	—	—
TOTAL	127	239,127	0.53	0.32	39,135	1.30	1.80

* Labor and Labor Foremen

Representatives of the Typhus Branch prepared a bulletin, "Evaluation Data for Murine Typhus Fever Control Activities, 1946," consisting of 37 figures and 15 tables showing the effect of DDT dusting on the various ectoparasites, typhus in rats, and typhus in humans for 1945 and 1946. An "Atlas of Rodent Ectoparasites" was also prepared, containing illustrations, keys, and descriptive biological and distribution notes. This Atlas was issued in loose-leaf form so future plates can be added. Several conferences were also attended by Typhus Branch personnel.

● PLAGUE CONTROL. Arrangements were made with the Plague Suppressive Measures Laboratory and the Texas State Health Department to assist in efforts to control plague in the Texas Panhandle. Plague had been found in several species of field rodents in Cochran County, but it was suspected that it might also be present in other counties in this vicinity. CDC participation was limited to rodent and ectoparasite control in the area east and west of Lubbock under a joint typhus-plague program of the State Health Department, supervised by a USPHS sanitarian.

IMPOUNDED WATER BRANCH

The Impounded Water Branch conducts studies of water impoundments to determine the mosquito-borne health hazards which may result from such impoundments, and makes recommendations for control of mosquito-borne diseases such as malaria and encephalitis on impoundments. This Branch provides consultant service on a reimbursable basis to the War Department Corps of Engineers and other Federal agencies in the study of malaria and encephalitis control problems on existing and proposed impoundments, and submits recommendations covering the factors which should be considered in the con-

struction, maintenance, and management of impoundments in order to control the breeding of vectors of these diseases. Assistance is also given to CDC and other agencies in the mosquito-control training of personnel concerned with the construction and operation of impoundments.

● ACTIVITIES. During the fiscal year surveys of the malaria control problem at existing and proposed impoundments under the direction of the War Department Corps of Engineers were conducted and 54 reports were prepared for utilization in planning construction and control operations. Cooperation was given to the International Boundary and Water Commission in a study concerning field investigations of the malaria control problem involved in the construction of certain reservoirs on the Rio Grande watershed. Negotiations were carried on to develop a reimbursable project for Bureau of Reclamation impoundments similar to the type of service offered to the Corps of Engineers on their impoundments. Of particular interest to CDC at the present time are the proposed Bureau of Reclamation impoundments in the Missouri River Valley.

Personnel of the Branch attended a training course provided by the Tennessee Valley Authority during June. New and improved methods of malaria control on impoundments were observed, such as airplane application of DDT thermal aerosol, airplane applica-

A pond under construction in Wake County, North Carolina. The trees in the pond will be removed.

tion of 2,4-D for the control of terrestrial and aquatic vegetation, residual premise spraying, filling, diking, dewatering, and restricted land use in areas where breeding is difficult and expensive to control. Field trips were made to observe control methods applicable to impoundments. Work on the Soil Conservation Service Bulletin on malaria control for small impoundments was completed and the final draft forwarded to the SCS. An outline for training courses for SCS personnel in mosquito control methods for small impoundments was undertaken also at the request of the Soil Conservation Service.

EQUIPMENT AND CONSTRUCTION BRANCH

The Equipment and Construction Branch is responsible for the procurement and distribution of all materials and equipment for operational projects and for other activities of the Communicable Disease Center. It secures information as to material and equipment needs of disease control programs; solicits specifications from dealers, manufacturers, and producers; procures necessary materials and tools; and samples and tests materials and equipment delivered in quantity to operational projects to determine conformance with specifications. Arrangements are made with the Technical Development Division for construction of special equipment and for the development of new and improved design. This Branch also carries out construction activities incident to the changing space needs of the divisions of CDC.

● ACTIVITIES. Information regarding modification of aircraft for the dispersal of larvicides and thermal aerosols, together with detailed drawings of such equipment, was furnished to authorities in Turkey and Egypt, and to USPHS District 6. A request from the American University in Bierut, Lebanon, for information on the method of application of DDT residual spray was also received. Samples of nozzles used in spraying operations were forwarded to the University for use in their program of DDT house spraying for malaria mosquito control. A new dusting apparatus was obtained and experiments conducted, which resulted in the development of an improved knapsack duster capable of taking the place of both the rotary and hand pump dusters. A number of obsolete power dusters were converted for use as mist-type power larvicide and and insecticide distribution units. This device was very effective in fly control work and other units were converted for use in the Dysentery-Fly Control Project in Pharr, Texas. Additional units were being used in expanded fly control operations of the Neurotropic Virus Disease Insect Control Project in Montgomery, Alabama. Applicability of the device for larviciding operations is being investigated.

A tool was designed to permit the cutting of rubber tips from shut-off valves used on spray cans. This tool cuts the cost of tips from five cents to one-half cent each. All tips needed by the field will be made at headquarters in the future. During May and June, field operational projects were surveyed for their chemical requirements, both for materials needed for the remainder of this fiscal year and 1948, and component chemicals were purchased for mixture of the concentrates by State programs. The Branch also completed major electrical work in the laboratories in Savannah, Thomasville, and Montgomery, and assisted in construction and alteration of office and warehouse space for headquarter's units.

Entomology Division

With the official inauguration of the Communicable Disease Center, the operational activities and aims of the Entomology Division were increased to meet the need for those services in combating the additional arthropod-borne communicable diseases with which the Center is to be concerned.

The activities of the Division include field surveys of disease-carrying insects and other arthropods to determine their abundance and the need for control work, recommendations regarding control measures to be used, evaluation of the effects of control work, and the determination of the causes of any unsatisfactory results. While these services are rendered primarily in connection with CDC operational and investigational projects, personnel of the Division as well as those entomologists assigned to U. S. Public Health Service districts and State health departments, are available for health services to any other agencies requesting them. The Entomology Division works in close cooperation with other divisions at the headquarters level and with operational personnel at the district, State, and local levels so that the activities of all control programs may be integrated to the fullest possible extent.

During the fiscal year the work of the Entomology Division included: (1) the evaluation of the extended and war malaria programs in the continental United States and Puerto Rico; (2) entomological evaluations of the typhus control program (a summary of this report is included in the Engineering Division section); (3) the diarrhea-dysentery fly control program at Pharr, Texas; (4) cooperative encephalitis studies with the Hooper Foundation of the University of California; (5) malaria bionomics studies at Emory University Field Station, Newton, Georgia; (6) cooperative work with the War Department, Corps of Engineers, on impounded waters; (7) cooperative work on water-hyacinth eradication investigations with the Corps of Engineers, the Fish and Wildlife Service, and the U. S. Department of Agriculture; (8) miscellaneous surveys of insects and other arthropods which carry disease or cause annoyance to man, such as cooperation with the Georgia Department of Public Health in field studies on malaria and Rocky Mountain spotted fever; and (9) preparation of papers and reports for scientific publication and presentation at meetings of scientific societies. The Division also offered consultative services to the Epidemiology Division on the experimental fly-polio project at Montgomery, Alabama, and the typhus dusting project at Thomasville, Georgia.

EXTENDED AND WAR MALARIA PROGRAMS

The war malaria program was designed to protect military and essential war industry personnel from indigenous malaria. While the extended program was originally aimed at protecting the civilian population from the malaria hazard created by returning

service personnel who had contracted malaria overseas, it has been expanded to include an attempt to reduce malaria transmission over the country as a whole and to eliminate or so reduce transmission that malaria will become a public health problem of little significance. Malaria control programs are divided functionally into mosquito larvicidal projects and mosquito adulticidal projects. On larvicidal projects, areas are surveyed to determine breeding places of *Anopheles* mosquitoes, and results of control work are evaluated by regular inspections of treated areas and by maintaining indices of adult malaria-mosquito populations. When control work is unsuccessful, careful surveys are made to determine causes. New larvicides used on special projects are evaluated to ascertain their practical value for operational programs. On adulticidal projects, control areas are surveyed to determine the efficiency of DDT residual spray in keeping houses free of mosquitoes, and particularly its effectiveness in killing malaria mosquitoes which have taken blood meals. These projects involve collecting blood-engorged malaria mosquitoes and making precipitin tests to determine the source of the blood. When it appears desirable to test changes in procedure, careful evaluations are made on special investigational projects.

Entomologist collecting Anopheline mosquito larvae.

● EXTENDED PROGRAM. The principal method of malaria control used on the extended program is that of treating houses with DDT for the destruction of adult malaria-transmitting mosquitoes. Anopheline mosquito control by larvicidal methods was substituted for residual spraying in centers of concentrated human population included within the extended program operational areas where these methods resulted in economy of operation. Usually, cities of over 2,500 population were protected by larviciding. The extended malaria program work was carried out in 297 counties in 13 States during the fiscal year. On the basis of epidemiological mortality statistics for recent years, all of the principal endemic malarious areas were included within the scope of this year's extended program.

The effectiveness of residual house spraying in decreasing the hazard of malaria transmission was measured in two ways. The first of these was accomplished by making inspections of a small percentage of the treated houses selected at random at specific intervals after spraying to determine results of the treatment in keeping sprayed houses free of *Anopheles quadrimaculatus*. Table I gives the results of such inspections during 1946, together with comparative over-all figures for the previous year. It should be noted that the rate of spraying in 1945 effected a residual DDT deposit of 100 mg. per square foot of treated surface, while in 1946 the rate was increased to 200 mg. per square foot. During 1946, 99.19 percent of the sprayed

Table I

HOUSE INSPECTIONS ON RESIDUAL SPRAY PROGRAM IN 1945* AND 1946**
TOTAL TREATED HOUSES INSPECTED AND PERCENT FREE
OF *A. QUADRIMACULATUS* IN AFTERNOON

MONTHS AFTER SPRAYING	1946			1945
	NUMBER HOUSES INSPECTED	HOUSES FREE OF *A. QUAD.*		PERCENT OF HOUSES FREE OF *A. QUADRIMACULATUS* (FOR COMPARISON)
		NUMBER	PERCENT	
0 - 1	6,018	5,969	99.19	98.9
1 - 2	6,739	6,673	99.02	98.3
2 - 3	5,321	5,271	99.06	95.7
3 - 4	2,974	2,935	98.69	94.7
4 -	899	883	98.22	94.2
TOTAL	21,951	21,731		
PERCENT			99.00	97.2

* 1945 — Sprayed at rate of 100 mg. of DDT per square foot of treated surface.
** 1946 — Sprayed at rate of 200 mg. of DDT per square foot of treated surface.

houses were totally free of malaria mosquitoes for one month after spraying; for the succeeding four months the percentages were, respectively, 99.02, 99.06, 98.69, and 98.22. Thus, the records indicate that over the entire program during the 1946 season, 99.00 percent of the treated houses were kept free of mosquitoes. This was only an increase of 1.8 percent in mosquito-free houses over the 1945 season and superficially does not appear to justify the heavier DDT application rate which was used in 1946. However, during 1946 the residual applications continued at near maximum effectiveness over the whole five-month period, whereas in 1945 the decrease in effectiveness with age was rather marked, as shown in Figure 1. The increased duration of effectiveness gained by the use of the heavier DDT application is considered highly significant from the standpoint of operations since it indicates the possibility that a single spraying with DDT at the 200 mg. rate should provide protection from anophelines for the entire mosquito season in the more northerly malarious areas, and not more than two applications should be necessary anywhere in the United States.

The second method of evaluating control results was based on the supposition that *quadrimaculatus* feeds on man princially while indoors. If the DDT were having the desired effect in killing these mosquitoes which have taken human blood meals, then the *quadrimaculatus* population about sprayed premises should contain fewer human-fed specimens than populations about unsprayed premises. To provide data for this evaluation, precipitin tests were made of blood meals from a large number of engorged *quadrimaculatus* to determine the blood source. The results of this work are included in Table II. The data show that the number of mosquitoes which have fed on human blood and persisted about sprayed premises is 81.8 percent less than about unsprayed premises. This is believed to be highly significant as indicating

a reduced hazard of malaria transmission.

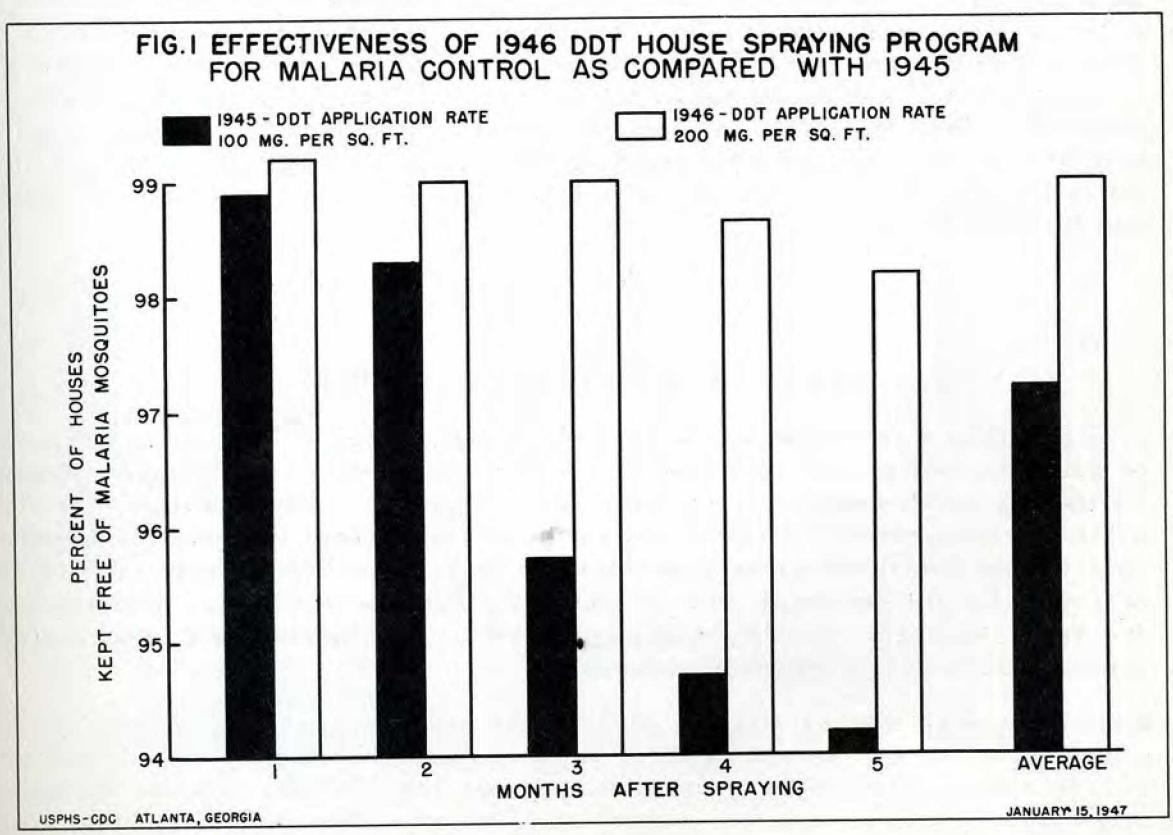
Table II

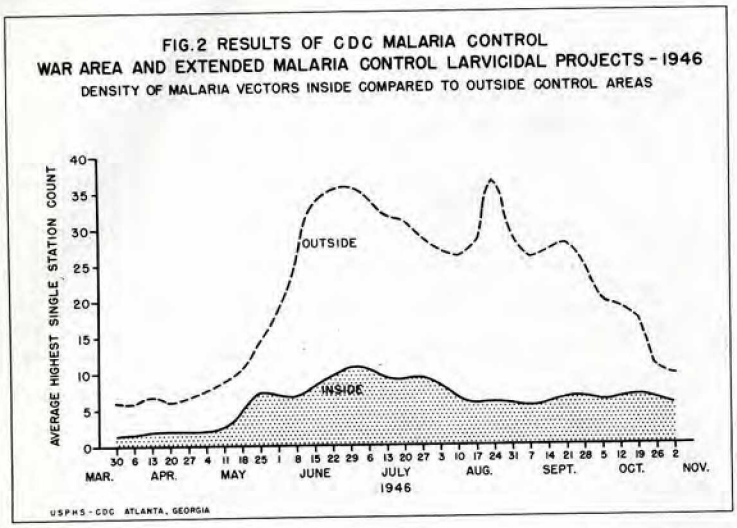
RESULTS OF PRECIPITIN TESTS — 1946
(INCOMPLETE FOR SEASON)
COMPARISON OF SPRAYED AND UNSPRAYED AREAS

	NO. SPECIMENS TESTED	NO. POSITIVE FOR HUMAN BLOOD	PERCENT
Sprayed	25,798	40	0.2
Unsprayed	6,509	74	1.1
Difference			81.8

● WAR MALARIA PROGRAM. The war malaria program, for which the office of Malaria Control in War Areas was organized, has decreased sharply since the end of the war. During 1944, the year of maximum MCWA operational activities, protection against malaria was afforded to a total of 2,067 war establishments grouped in 917 operational zones. These numbers dropped somewhat in 1945, and by the end of 1946 only 125 war establishments in 114 operational zones were receiving protection. Larvicidal measures have been used almost exclusively on the war malaria program.

● RESULTS OF LARVICIDAL PROGRAMS. The over-all results of larvicidal programs in both extended and war malaria areas in the continental United States during 1946 are shown in Figure 2. This graph shows the extent to which anopheline mosquitoes were reduced by CDC operations by a comparison of average mosquito densities occurring outside protected areas with those found inside protected areas.



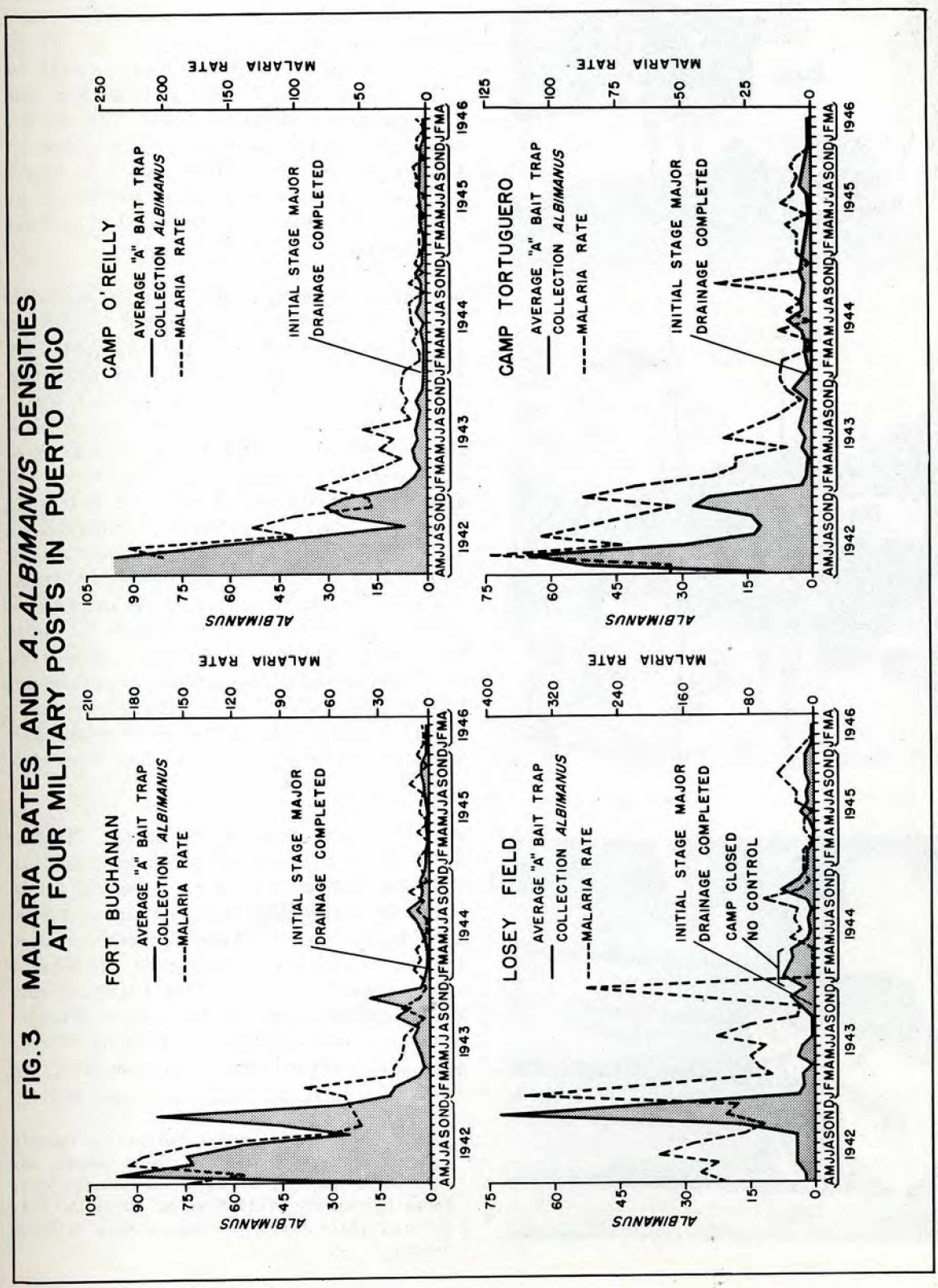


PUERTO RICO PROGRAM. In addition to the malaria control program in the continental United States, projects have been operated in Puerto Rico, where malaria is much more prevalent. There is a tremendous congestion of human population on the island and the socio-economic level is low, which results in poor housing conditions. These factors, combined with a tropical climate and the enormous densities of *Anopheles* mosquitoes produced in the numerous swamps and irrigation systems, make conditions exceedingly favorable for malaria transmission. Control work around military bases on the island began in 1942. Initially a considerable amount of drainage was necessary in order to reduce and localize mosquito breeding areas so that larvicides could be applied effectively and economically. The control work resulted in a great reduction in the abundance of *Anopheles albimanus*, the principal malaria vector of the island, as measured by animal bait trap records at the military establishments. This reduction was reflected in a rapid decrease in malaria transmission among troops. Figure 3 illustrates graphically the decrease in malaria rates and *albimanus* densities at four of the military establishments protected by MCWA operations in Puerto Rico from 1942 through 1945. Similar results were obtained in other protected areas on the island. A summary of the malaria control activities in Puerto Rico for this fiscal year is given in the section dealing with District No. 6.

MALARIA BIONOMICS STUDIES

To maintain observations of factors which might culminate in the transmission of malaria, studies were continued at the Emory University Field Station, Newton, Georgia, supported cooperatively with Emory University. Data obtained from this project permits current, critical evaluation of the malaria transmission potential in a representative malarious area which has experienced high endemic rates. Field observations are concerned with (1) detecting malaria in man, (2) evaluation of *Anopheles* densities, and (3) studies of physical, biological, and other factors which may influence malaria occurrence.

● HUMAN MALARIA SURVEYS. Regular visits were made to homes of residents in the experimental area to detect cases of human malaria. On these visits, which were made by nurses experienced in malaria symptomatology, careful clinical histories were taken to discover symptoms suggestive of malaria. When indicated, blood films were obtained for laboratory examination. Periodical blood-film surveys also were



made. No case of clinical or laboratory-diagnosed malaria was detected this year, making this the third consecutive year of a zero malaria rate. In years prior to 1944, 20 percent of the inhabitants of the area had positive blood films. This marked reduction in the malaria rate occurred in the absence of any control measures. Observations were directed toward evaluation of the factors which may be related to this phenomenon.

● STUDIES ON MOSQUITOES. Routine measurements of *Anopheles* larvae and adults at established collecting stations failed to indicate any variations from previous years. Records on these stations now cover more than five years, during which time populations of *Anopheles* have been uniform with regard to comparative densities and areal extent. Observations did indicate, however, that longevity of individual generations may vary considerably during any given season or between different seasons. To obtain more precise information on this point, efforts were made to colonize local stains of *A. quadrimaculatus* for intensive laboratory study under controlled conditions. Late in the year studies were begun to determine the natural feeding habits of the *Anopheles* species in the area.

● PHYSICAL AND OTHER OBSERVATIONS. Climatic data which may be related to mosquito longevity were obtained at regular adult mosquito collecting stations and at breeding places. Information secured was used in connection with *Anopheles* population studies and as a basis for planning work with mosquitoes in the laboratory. Studies were also made on the relation of hydrology; i.e., ground water, stream flow, and

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(TOP) Public health nurse collecting malaria data during a home visit in Baker County, Ga. (CENTER) Gaging station in Putney Pond, Emory University Field Station. (BOTTOM) Collecting adult *Anopheles* from stable in Baker County.

precipitation to the occurrance of *Anopheles* breeding places. Data collected during the past several years were analyzed in an effort to determine formulae for predicting the development of optimum conditions for *Anopheles* breeding. Hydrologic data were collected with the cooperation of the Water Resources Branch of the U. S. Geological Survey.

ENCEPHALITIS PROJECT

The CDC is cooperating with the Hooper Foundation of the University of California in a study on the epidemiology of Western equine and St. Louis encephalitis. Two full-time CDC personnel have been assigned to this work, an entomologist and an ornithologist. Field studies have been carried out in Kern County, California, an endemic area for encephalitis, with a laboratory located at Bakersfield.

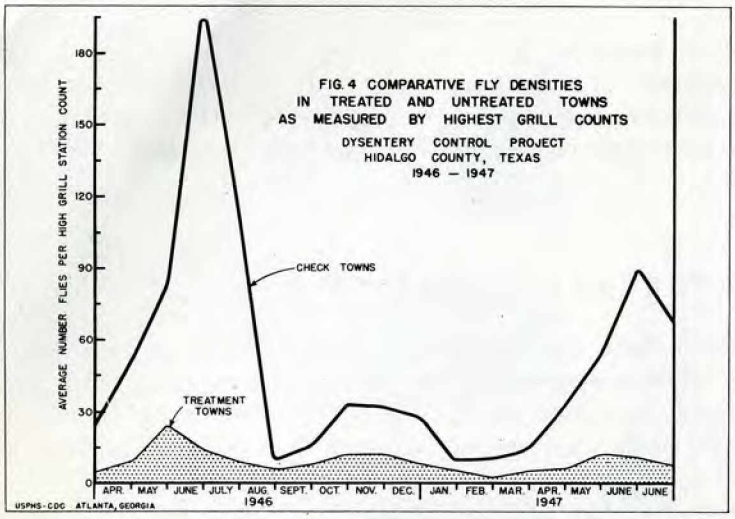
The investigations of the encephalitis project included studies on the habits and biology of several species of mosquitoes considered as potential vectors, and the relationship of these mosquitoes to the more common species of wild birds which may be potential reservoirs of encephalitis. At least two species of mites collected from the nests of wild birds were found infected with encephalitis and point to the possible importance of these mites in maintaining the infection reservoir in birds. From wild-caught *Culex tarsalis*, four strains of Western equine encephalitis have been isolated. Continual observations of the wild birds in Kern County were made during the year including studies on population, seasonal migration, local movements, habitats, nesting, and feeding habits. Studies are being made to find out those mosquitoes which commonly feed on both birds and man and thus may be potential vectors of encephalitis to humans. To determine which birds are regularly fed on by mosquitoes, blood smear examinations and subinoculations into canaries were made and show that malaria infections are relatively common in the wild birds of Kern County and indicate the habit of mosquitoes feeding on birds. A relatively high percentage of wild-caught *Culex tarsalis, C. stigmatosoma,* and *C. quinquefasciatus* contained Plasmodium infections.

The biological work on the mosquito vectors of encephalitis have included studies on flight range (*C. tarsalis* may fly as far as 2 1/2 miles but usually its range is less than 1 mile), and precipitin tests to determine feeding habits on humans (*C. tarsalis* fed about 1/3 of the time on humans and 2/3 of the time on birds). An insectary for colonizing *C. tarsalis* and other mosquito species has been constructed.

DIARRHEA–DYSENTERY FLY CONTROL PROJECT

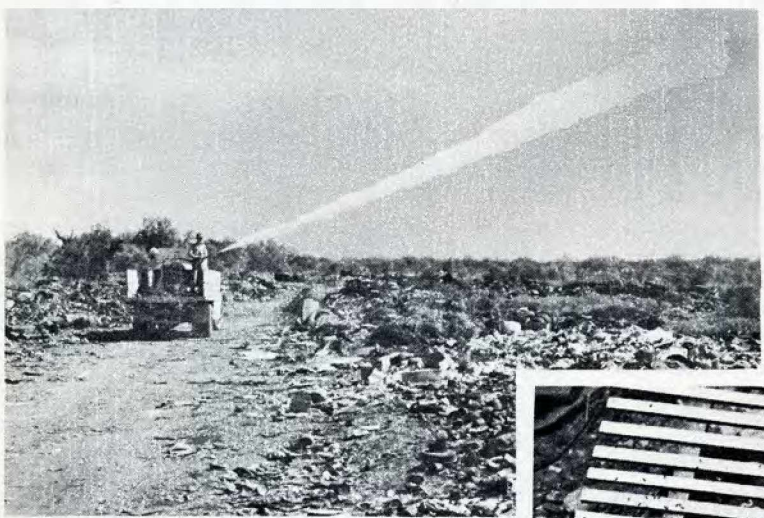
The diarrhea-dysentery control project, started in 1945 in cooperation with the National Institute of Health, is designed to study the effect of controlling fly populations on the incidence of dysenteric diseases in the highly endemic area of Hidalgo County, Texas. In this county nine towns were chosen for the investigation; five towns were treated with DDT for fly control and four were left untreated. The headquarters for this project is in Pharr, Texas.

It became apparent early in this work that the reduction in fly populations effected through the control work was correlated with a decreased dysentery rate, as indicated



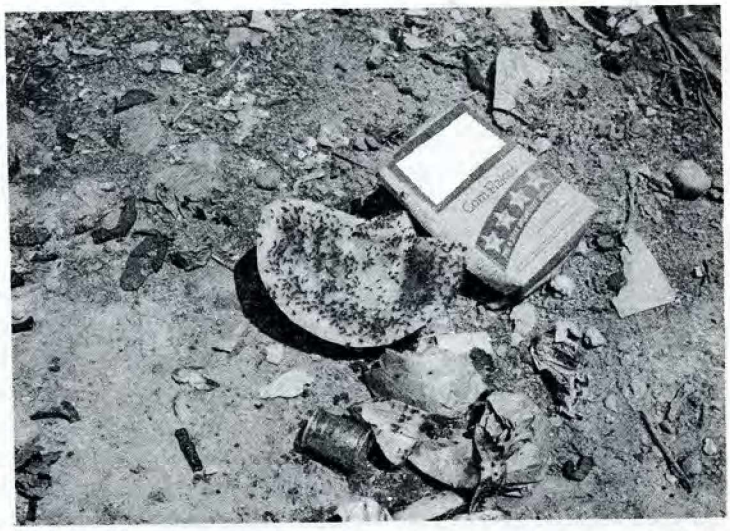
by a comparison of data from treated and untreated towns. Further refinements of control measures and evaluation procedures have been carried out. For example, spot retreatment of those areas showing high fly indices has proven as effective as total area retreatment. This procedure has eliminated unnecessary work and reduced operational and material costs. Good control of flies was obtained in treated towns, compared to untreated towns, as shown in Figure 4. In studies made on the duration of effectiveness of DDT residuals on outdoor surfaces, it was found that DDT emulsions were more efficient than the suspensions tested. Also, in these tests, *Phaenicia* spp. were shown to be more resistant to DDT than *Musca domestica*. Further studies along this line are underway.

It was not possible to completely evaluate the several types of control equipment used as to the degree of control obtainable with each because the outcome of the epidemiological studies was dependent upon maintaining effective fly control. However, information on the adaptability of the equipment to field conditions was



(LEFT) Space spraying at Edinburg, Texas, city dump, using Beau Royal 35 sprayer.

(RIGHT) Grill used to count flies, placed on garbage in dump at Mission, Texas. Note flies on the grill.



Fly Control -- Mission, Texas. Flies on garbage at small dump inside untreated town.

obtained. The space spray equipment tested thus far has required supplemental hand-applied residual spraying in order to maintain good fly control. Hand spraying is most dependable, but operational costs of this type of application are heavy. During the coming year further evaluations of individual items and combinations of equipment and of methods will be made. Outdoor fly grill counts and indoor fly survey methods were modified to adapt the records to IBM analysis.

Special studies to discover the possible relationship of other insects to the spread of dysentery are under way. These include investigations on the migratory habits of roaches since preliminary data indicate a significant reduction of roach populations in privies in treated towns. The habits of the eye gnat, *Hippelates* in relation to possible transmission of disease also is receiving consideration.

WATER-HYACINTH INVESTIGATIONS

During the year cooperative work with the U. S. Engineers Department was continued in connection with the water-hyacinth investigations started in 1945. Special reports were received from the Department of Agriculture and the Fish and Wildlife Service covering their investigations to date. Division entomologists assigned to these studies held conferences with a representative of the USPHS office of Water and Sanitation Investigations, Cincinnati, Ohio, and carried on correspondence with the several USED offices involved.

It was pointed out by USPHS personnel that the following public health problems are involved in water-hyacinth-covered areas, and in the possible eradication methods:

1. Mosquito production.
2. Taste and odor difficulties which might arise from the use of 2,4-D.
3. Toxicity of 2,4-D to humans.
4. Economic damages that have been experienced by the various surface-water supplies affected by water-hyacinth.
5. Economic losses that have resulted from the imposition of a heavy organic pollution load caused by decaying hyacinth.
6. Economic losses caused by water-hyacinth reducing the reaeration capacity of streams and lakes.

Arrangements were made for further participation of the Cincinnati laboratory in investigations of some of these problems.

Epidemiology Division

The Epidemiology Division determines the extent and relative problem of malaria, typhus, poliomyelitis, and other communicable diseases through analyses of morbidity and mortality statistics and other types of epidemiological data. From these studies, areas are recommended for control operations. The Division recommends control measures and evaluates the effectiveness of control procedures in terms of human cases and deaths from the diseases concerned. This Division also offers epidemic aid to States, upon request, by providing teams of trained scientists skilled in epidemic control. The Statistical Branch provides statistical services to other CDC divisions and keeps complete morbidity and mortality records on communicable disease in areas under control and in other areas of the United States. The other three branches of the Division are concerned with field investigations of typhus, neurotropic virus diseases, and malaria, respectively.

● CONSULTATIVE AND STATISTICAL SERVICES. Malaria mortality and morbidity data were recorded and rates calculated for selected States, counties, and cities over the period 1900-1946. Weekly and monthly morbidity reports were also recorded and kept current. An analysis of typhus fever morbidity for the Nation, individual States, and counties over the period 1941-1945 was completed during the fiscal year. Typhus morbidity data for 1946 were processed and prepared for analysis. Weekly and monthly typhus morbidity reports were also recorded and kept current by States and counties. Poliomyelitis morbidity data for the Nation, States, and counties were tabulated, and control charts for the 48 States were prepared for use in estimating the degree of epidemicity of poliomyelitis for the 1947 season. Studies were begun on the occurrences of poliomyelitis in States where epidemics had occurred in 1945 and/or 1946 in an attempt to determine whether a lower incidence of the disease had been caused in areas where DDT residual spray had been applied. The Laboratory Division was assisted in preparing record forms and sampling techniques for a study of dysentery at the Orient State School in Ohio, and consultation services were offered in outbreaks of diarrhea in Collins, Mississippi, and Pinson, Alabama. Requests for epidemic aid were also received from North Carolina, Florida, Georgia, and Tennessee. Diarrhea and ringworm of the scalp accounted for seven of the ten requests received.

Consultation services to field investigation projects included an analysis of data on rodent examinations made at the Thomasville Typhus Investigation Project during the period October 1945 to September 1946, and of data on necropsy studies of 3,144 rats. Malaria blood smear survey data from the Malaria Field Investigations project Manning and the State Hospital in Columbia, South Carolina, were analyzed. Assistance was also given on studies of malaria parasitemia prevalence and the statistical evaluation of infectivity rates of *A. freeborni* and *quadrimaculatus* mosquitoes. The full time of one consultant was required for assistance to the diarrheal disease survey at Pharr, Texas. The Entomology Division was assisted in mosquito host preference studies and in tabulating rodent data collected from the field.

At the request of other divisions and agencies, special tables for selected States by selected years were prepared for the various communicable diseases and information was given in the form of tables, graphs, charts, etc., on populations, cases of diseases, deaths, latitudes of areas, and other epidemiological data.

TYPHUS INVESTIGATION PROJECT

The purpose of the Typhus Investigation Project, operating out of headquarters in Thomasville, Georgia, is to determine the effectiveness of murine typhus fever control methods, particularly DDT dusting, as they affect such epidemiological aspects of the disease as human incidence, reservoir (rat) prevalence, and abundance of potential vectors (rat ectoparasites). These studies are an attempt to provide county-wide measurements of the epidemiological aspects of murine typhus fever in three counties in Georgia, with one county as a control check.

● PROCEDURE. Dusting operations with ten percent DDT in pyrophyllite was begun in Brooks County in April 1946. Three rounds were completed in 1946, and one in May and June 1947. The fifth round will be completed during August and September 1947. After September 1947 operations will be considerably decreased, to include only the continuation of studies pertaining to the three principal aspects of typhus epidemiology. Dusting was begun in Thomas County in May 1946, including three rounds in 1946 and two in 1947. The fifth round will be finished in June and July 1947, after which operations will be curtailed in a manner similar to Brooks County. A rat poisoning campaign was carried on during May and June 1946 in Decatur County. The Fish and Wildlife Service also promoted some rat poisoning activities in this county. Another factor which may affect the typhus picture in this county is the DDT residual spray program for malaria control, which might have incidental effects on rat ectoparasites (two rounds of residual spraying were completed in 1946 and 1947 respectively, and the fifth spray round will be completed in September 1947). Grady County was designated as the check county, and has no rat control or ectoparasite control program. Operations in this county were limited to studies of human typhus incidence, reservoir prevalence, and measurement of the abundance of rat ectoparasites.

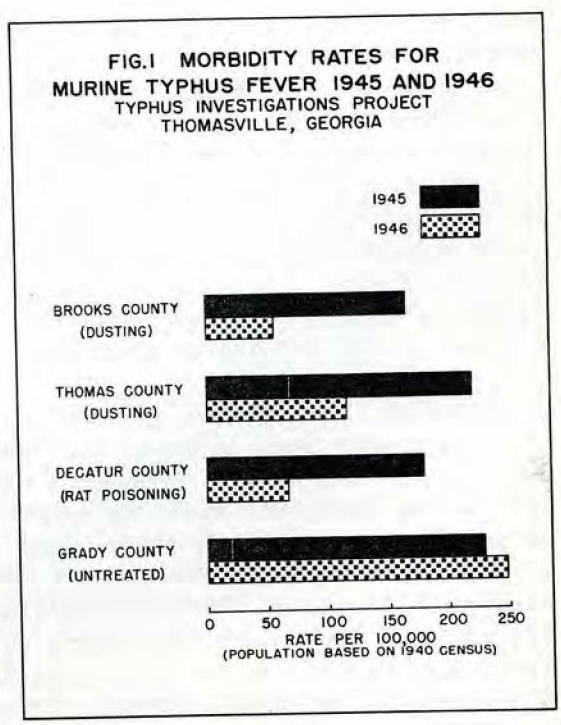


FIG.1 MORBIDITY RATES FOR MURINE TYPHUS FEVER 1945 AND 1946
TYPHUS INVESTIGATIONS PROJECT
THOMASVILLE, GEORGIA

● HUMAN INCIDENCE STUDIES. Figure 1 shows graphically a mathematically significant decrease for 1946 as compared with 1945 in Brooks, Thomas, and Decatur counties, and a slight increase in Grady County. Although the work may not be considered complete until data through March or April 1948 is obtained, similar trends seem to be present for the first six months of 1947, with no confirmed cases in Brooks

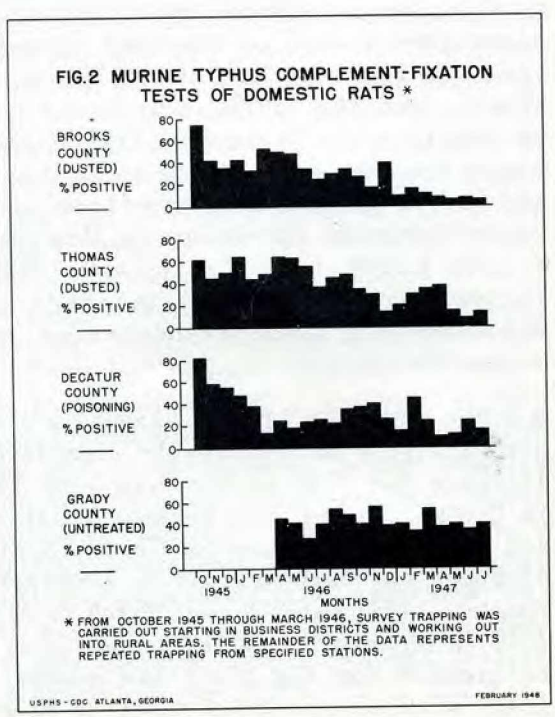
Nurse taking a blood sample from a suspected typhus fever victim. Thomasville, Ga.

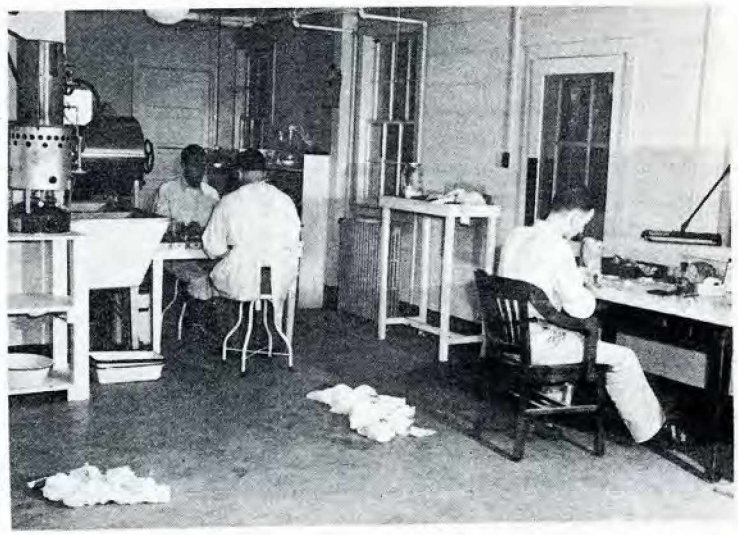
County, five in Thomas County, three in Decatur County, and ten in Grady County.

● RESERVOIR STUDIES. Figure 2 illustrates graphically the percentages of trapped rats positive to the murine typhus complement-fixation test in each of the four counties studied. The data prior to April 1946 represents survey trappings in which rats were caught in different areas each month. In general, the higher percentages represent groups of rats trapped in business districts. After April 1946, the data show the results of repeated trappings in representative stations, following a four-week trapping schedule. It will be noted that there seems to be a definite downward trend in the percent of rats positive to the typhus complement-fixation test in Brooks and Thomas counties, while Grady County remained at a fairly high level. Decatur County experienced some rather wide fluctuations. The obvious humps in the Thomas County trend of positive rats and the lesser humps in the Brooks County trend may be associated with the intermittent nature of DDT dusting operations, or there may be a connection with the normal seasonal fluctuations of the various potential ectoparasite vectors. In spite of these temporary upward swings, the over-all trend is still definitely downward in Brooks and Thomas counties.

● VECTOR STUDIES. Four species of ectoparasites represent over 95 percent of those collected from domestic rats in the area. They are: *Xenopsylla cheopis* and *Leptopsylla segnis*, fleas; *Liponyssus bacoti*, mite; and *Polypax spinulosa*, louse. The data indicate that *X. cheopis* and *L. segnis* were satisfactorily controlled in the counties dusted. Also, *L. bacoti* and *P. spinulosa* seem to have been slightly suppressed in the two dusted counties.

● DISCUSSION. The decrease in human cases of murine typhus fever in Brooks and Thomas counties can probably be credited to the DDT dusting operations. While the reduction in rat fleas is apparently the outstanding result of dusting, many other factors demand consideration. Perhaps the minor effects upon other rat ectoparasites were sufficient to disturb the chain of events which results in the maintenance of mu-





Typhus laboratory at Thomasville, Ga.

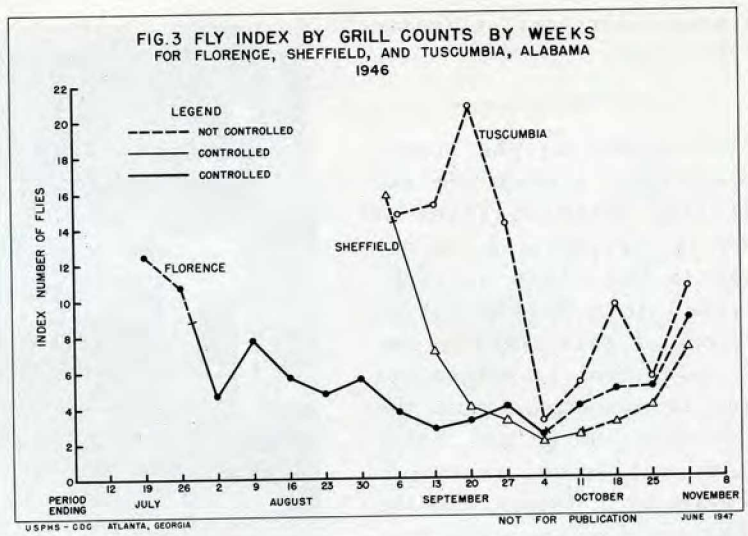
rine typhus in the rodent reservoirs. Perhaps the rat killing potentialities of DDT in pyrophyllite, as noted in the field and confirmed in a *Rattus rattus* colony at this station, may be sufficient to reduce typhus transmission within the reservoir and to man. Since human incidence, reservoir prevalence of typhus, and the abundance of ectoparasites have not deviated from expected values in Grady County, it can probably be assumed that survey rat trapping as carried out in each of the four counties cannot be responsible for any of the epidemiological changes noted in Brooks, Thomas, and Decatur counties. It is difficult to determine whether rat poisoning was the major cause of the decrease of human typhus incidence in Decatur County because DDT residual spray operations have complicated the picture. However, the data do show that the over-all populations of ectoparasites were not materially affected by rat poisoning operations. Supplementary studies conducted to determine the extensiveness of potential typhus reservoirs in other than domestic rats have yielded typhus-positive Eastern cotton rats, dogs, house mice, cotton mice, Florida opossums, Eastern cottontail rabbits, Southern fox squirrels, and blue jays.

NEUROTROPIC VIRUS DISEASE INSECT CONTROL PROJECT

A virus laboratory was established at Montgomery, Alabama, for field investigations of the control of insect-borne neurotropic virus diseases. Poliomyelitis was the first problem attacked. The accomplishment of rapid fly control in an urban community was the immediate objective, to be followed by the application of this rapid fly control technique in three cities with early poliomyelitis. The ultimate objective of this project is to investigate and control neurotropic virus diseases which are insect-borne, such as Western and Eastern equine encephalomyelitis, St. Louis sleeping sickness, lymphocytic choriomeningitis, and others.

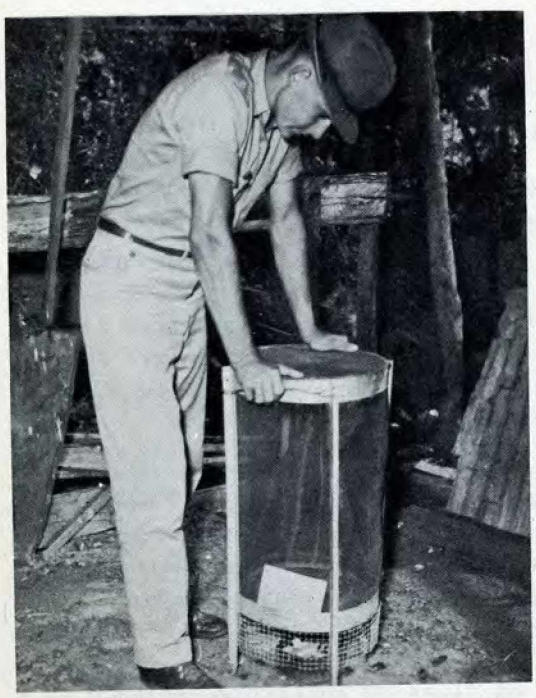
● **FLORENCE POLIO OUTBREAK.** During late May 1946 an epidemic of poliomyelitis began in Lauderdale County, in the vicinity of Florence, Alabama. Observations of the fly densities and preliminary experiments in fly control were started late in June, when the epidemic was already nearing its peak. Intensive fly control operations were not begun until late July — too late for even possible epidemiological significance. Various control measures were studied until October 2, and fly counts were continued until November 1.

DDT was selected for the emergency control of flies by adulticide methods on a



community-wide basis. Two types of DDT application were utilized: (1) residual spraying of surfaces with 200 mg. of DDT per square foot, which was abandoned as being too slow and costly; and (2) thermol aerosol space spraying from airplanes and ground equipment. A coarse particle size (200 microns mean diameter) and an application rate of 0.3 pound of DDT per acre were found to be optimum for airplane aerosols. Treatment by airplane was conducted on a weekly basis. For heavy aerosoling of alleys and dumps, 2½ to five percent DDT in xylene emulsion or fuel oil was applied by ground equipment. Open garbage dumps were treated daily at the rate of one pound of DDT per acre to cope with the daily introduction of fresh fly larvae in the collected garbage.

● **EVALUATION METHODS.** The fly index used in this study was based on the counting of flies which alighted on a yard square grill placed on areas of highest fly density. For any area the fly index was calculated by averaging the highest of nine grill counts in each city block. This weighted fly index lessened the importance of errors inherent in such a counting method. Control was considered satisfactory where the fly index was less than five. Figure 3 summarizes the season's control results evaluated by the grill method. In counting active living flies on the grill, only a generic identification was feasible. However, flies captured in traps over a variety of baits were retained for specific classifications. The principal use of these was for virus isolation from pools of a single species of flies. The remaining were to be used in museums and for teaching purposes.



Flies were captured in traps for virus isolation.

● **EPIDEMIOLOGY.** Although there was a paucity of paralytic cases, the stools of 34 cases clinically diagnosed as poliomyelitis were examined for virus by inoculation into African green monkeys and

eight cases, or 24 percent, were found to be positive. The sera from 39 patients were examined by virus neutralization procedures for evidence of infection with other neurotropic virus diseases. All sera were negative for Eastern and Western equine encephalomyelitis as well as St. Louis encephalitis. Twenty-one different lots of flies were examined for the virus of poliomyelitis, with negative results. These lots included *Musca domestica, Muscina assimilis* and *stabulans, Ophyra leucostoma, Phaenicia pallescens, sericata,* and *caeruleiviridis, Calletroga macellaria, Phormia regina, Hydrotaea houghii,* and two sub-generic pools of the *Sarcophagidae,* respectively.

● **MISCELLANEOUS ACTIVITIES.** Mosquitoes were collected for encephalitis studies from vicinities where encephalitis cases had been reported. The most common species collected in their order of abundance were *Culex quinquefasciatus, Anopheles quadrimaculatus,* and *Culex erraticus.* A large collection of mites, *Liponyssus sylviarum,* were made from an abandoned starling nest for virus studies. During the winter of 1946-47 and the subsequent spring, most activities were directed toward preparing to operate three fly control programs in the summer of 1947 in cities with early epidemics of poliomyelitis. However, during the early summer of 1947 no epidemics occurred on a scale and in a geographical location within the scope of the project.

MALARIA INVESTIGATIONS PROJECTS

● **MALARIA FIELD INVESTIGATIONS.** The Malaria Field Investigations program in Manning, South Carolina, for this fiscal year was planned as a follow-up of previous studies on the efficacy of DDT residual spraying in preventing human malaria in an endemic area. The experience during the previous year was that even with a relatively low malaria prevalence (about five percent) malaria transmission was more frequent in an unsprayed area than in one that had been sprayed. This year it was found impossible to continue to withhold spraying from the unsprayed area because of the great clamor from the people involved, who were entirely surrounded by areas in which houses had been sprayed. Therefore, it was decided to spray the entire study area, and to compare this area sprayed only one year with a similar area sprayed two consecutive years. In order to reduce the total budget of the project, monthly blood smear surveys were continued in only a part of the original study area. A population of 2,000 people was thus surveyed each month; the remaining of 1,000 people of the original study area were tested every three months.

The entomological program consisted of continuing mosquito inspections, collections, and dissections. The inspection stations chosen were natural resting places, mainly mule stables, as in the previous year. The number of inspection stations was reduced in proportion to the reduced staff. Specimens for dissection were collected from stations in which infected mosquitoes had been collected previously or from stations located near houses containing known human cases of malaria.

The parasitemia prevalence in the study area remained very low (less than one percent) throughout the 1947 fiscal year, except for a localized increase in March 1947. Reports of illness from all causes and from malaria were markedly less than in the previous year. There was very little reported use of anti-malarial drugs. The low prevalence of malaria invalidated any measure of the efficacy of DDT through comparison of the two areas. It is probable that the DDT spraying played a part in the virtual absence of malaria-carriers in the study area during the year, especially

Taking a thick blood smear.

the fall months. It is to be remembered, however, that there had been a steady decrease in malaria prevalence from October 1944 (20 percent) to the present time. This trend began to manifest itself rapidly even prior to spraying in the spring of 1945. With the exception of a small rise in prevalence during the fall of 1945, which was enough to show a small but significant difference between the sprayed and unsprayed areas, the prevalence seems to have settled down to a fairly steady level of about one-half of one percent. It is significant that the usual fall rise did not occur in 1946. In March 1947 an unusual increase in parasitemia prevalence occurred in a fairly localized area. Although many of these individuals had shown no parasitemia in two years of consecutive monthly testing, the occurrence at this time of year, with insufficient evidence of mosquito transmission, favored the possibility that the malaria being evidenced had been contracted some time in the past. A simultaneous increase in complaints of illness in this area, with symptoms of colds and flu, may have been a precipitating factor in causing relapses of latent infections acquired previously. Following this occurrence, parasitemia dropped again to the previous level.

The mosquito populations during 1946 followed the same distribution patterns of previous years, but in smaller numbers. *A. quadrimaculatus* and *A. crucians* were the predominant species. During 1947 the *A. quadrimaculatus* populations were even lower than in 1946. This was undoubtedly caused by the rapid draw-down of the reservoir in 1947, because the reservoir is the main breeding place for *quadrimaculatus* in the study area. *A. crucians* were not effected so drastically, since their breeding occurs throughout the study area.

Infected mosquitoes with sporozoites and oocysts continued to be found in small numbers, but with rates higher than the parasitemia prevalence would seem to warrant. These mosquitoes were collected from stables adjacent to houses that had been sprayed. The sporozoite infection rate for *A. quadrimaculatus* in 1946 was 0.06 percent. The rates for *A. crucians* continued to be much higher than for *quadrimaculatus*, with 0.34 percent in 1946 and 0.11 percent in 1947. Four of the 11 infected *crucians* in 1946 had oocysts as well as sporozoites, while one of the three in 1947 showed oocysts. One *crucians* not included in the adjacent table showed oocysts only. Efforts to establish a link between the infected *A. crucians* and human malaria transmission were made in cooperation with the Malaria Investigations Laboratory of the National Institute of Health, Columbia, South Carolina, by feeding wild-caught *A. crucians* on hospital patients. These measures have thus far been unsuccessful.

An avian malaria survey conducted during the winter months by shooting and trapping 220 birds showed about nine percent positive, most of these being English sparrows. Attempts at infecting 45 *A. crucians* by feeding on infected birds showed no positives on dissection of 15 surviving mosquitoes. Attempts at feeding *A. punctipennis* and *C. erraticus* were unsuccessful. Host precipitin tests on approxi-

mately 1,000 *crucians* during April — June 1947 showed only one human and two avian reactions, the majority showing equine blood reactions. Further investigations into the possible role of *A. crucians* in human malaria transmission were planned.

● COOPERATIVE STUDIES. CDC worked in close cooperation with the National Institute of Health on two phases of malaria investigations: (1) the relationship of infectivity of malarias of foreign origin to native humans and *Anopheles* mosquitoes, in cooperation with the Division of Infectious Diseases, Malaria Investigations Laboratory, Columbia, South Carolina; and (2) the chemotherapy of malaria, carried on by the Division of Tropical Disease, Bethesda, Maryland.

In regard to the first project, a field study in the Santee-Cooper area of native *Plasmodium falciparum* in Negroes showed that patients with relatively low gametocyte densities, presumably chronic infections, infected mosquitoes which fed upon them. Those with the highest gametocyte densities did not infect. These infections developed in cooler months of the year as well as in the summer. Of 143 lots of mosquitoes fed upon *P. falciparum* patients, 14.7 percent were infected. Of 6,500 mosquitoes dissected, 2.5 percent showed infections. This indicated that patients with a low-grade gametocytemia could spread the disease and that the number of gametocytes present did necessarily indicate the infectiveness of the patient.

Foreign *P. vivax* malaria induced in neurosyphilitics revealed that Mediterranean and Pacific strains were similar in parasitemia densities and febrile responses.

MOSQUITOES DISSECTED DURING 1946-47 AND NUMBER FOUND POSITIVE FOR SPOROZOITES
MANNING, S. C.

	A. QUADRIMACULATUS		*A. CRUCIANS*		*A. PUNCTIPENNIS*	
	NUMBER DISSECTED	NUMBER POSITIVE	NUMBER DISSECTED	NUMBER POSITIVE	NUMBER DISSECTED	NUMBER POSITIVE
1946						
July	4,197	4	941	5		
August	3,511	2	751	3		
September	1,444	0	254	1		
October	1,541	0	324	0		
Nov. — Dec.	93	0	854	2		
TOTAL (1946)	10,786	6	3,224	11		
1947						
March — April	58	0	609	0	51	0
May	230	0	1,204	2	5	0
June	374	0	878	1	1	0
TOTAL (1947)	662	0	2,691	3	57	0

Feeding mosquitoes on a malaria patient.

The periodicities of the tertian paroxysms averaged 44.5 hours, ranging from 43.6 to 45.1 hours. None showed a 48-hour periodicity. The maximum fevers usually preceded the maximum parasitemias. Chills were more frequently present with the first five fevers than with the later fevers. Sodium bismuth thioglycollate was reliable in changing remittent and quotidian paroxysms to tertian occurrance. Usually, the primary infections produced over ten paroxysms in white patients. The foreign malarias were satisfactory as therapeutic agents to treat white neurosyphilitic patients but not to treat Negro patients.

Relapsing foreign *P. vivax* was studied in over 700 military patients. Most of the patients showed parasites before symptoms in the relapses. The parasite level at clinical relapse was significantly higher for the Mediterranean strains (median 3,836 per cmm.) than for Pacific strains (median 2,952 per cmm.). Patients with high or low parasite counts during one relapse tended to have high or low levels, respectively, during a second relapse. Patients with low parasite levels during one relapse were as likely to relapse again as those with high parasite levels. Male gametocyte incidence was significantly higher in Mediterranean than in Pacific cases. Some patients produced gametocytes more persistently during relapses than other patients. The parasite level at the delayed primary attack was lower than at the relapse attack. About 12 percent of the patients showed a low level asymptomatic parasitemias between clinical relapses. About 25 showed asymptomatic parasitemias after the terminal clinical relapse. The asymptomatic parasitemia levels were lower than the parasitemias during symptomatic relapses. Parasites were present in the peripheral blood of Pacific patients 13 percent of the time, and in Mediterranean patients, ten percent of the time. In both groups, 75 to 80 percent of the time parasitemias was asymptomatic.

The infectivity to *Anopheles quadrimaculatus* of asymptomatic parasitemias of foreign *P. vivax* revealed that male gametocyte densities were lower in asymptomatic than in symptomatic carriers and were in proportion to the total parasite density. About 12 percent of the mosquitoes were infected when fed on asymptomatic parasitemias as compared to 25 percent infected when fed upon symptomatic parasitemias. The infection rates for cases from the Mediterranean and Pacific areas were similar.

The three types of asymptomatic parasitemias: preclinical, interval, or terminal, all infected mosquitoes. Thus, malaria patients could infect mosquitoes whenever parasites were present in the blood stream, although at a lower rate when asymptomatic. As the patient with an asymptomatic parasitemia was more likely to be exposed to mosquitoes than the ill patient, the hazard of the asymptomatic malaria carrier may be as great or greater than that of the one clinically ill.

In connection with the second project, developmental chemotherapy of malaria, 985 tests with 303 different drugs were carried out on 5,377 chicks with blood induced

Plasmodium gallinaceum infections. A total of 160 of these compounds showed some activity, and 109 were as effective against the erythrocytic parasites as an equivalent amount of quinine. The 8-aminoquinolines showed the greatest activity of any group of compounds; tests on 21 such compounds have been completed with quinine equivalents ranging from 0.5 through 64. The 4-aminoquinolines were not as highly active as the 8-aminoquinolines. All of the five 8-aminolepidinos tested were found active with quinine equivalents of 32, 16, 16, 8, and 4, respectively.

In prophylactic tests with sporozoite induced *P. gallinaceum* infections, 206 experiments were carried out with 122 different drugs on a total of 1,226 chicks. Only four compounds showed any detectable prophylactic effect; one sulpha drug (SN 3517) gave complete prophylaxis while the other three compounds produced only slight prophylaxis. Tests to determine the curative effect of pentaquine combined with quinine and other cinchona alkaloids were carried out on 23 *P. vivax* patients. Quinine alone exhibited no curative effect; pentaquine-quinine proved to be the best combination, followed by pentaquine-cinchonine, and pentaquine-cinchonidine.

Chloroquine (SN 7618) 0.3 gram once weekly was compared with paludrine (SN 12,837) 0.3 gram once weekly as a suppressant of the Chesson strain of *P. vivax* malaria. The controls developed malaria ten to 12 days after exposure; both drug regimens prevented parasitic and clinical evidence of infection in the treated subjects. At the end of six months, treatment was discontinued on five patients in each category. Malaria appeared 18 to 24 days later in those who had received paludrine, and 44 to 57 days later in those who had received chloroquine. Four patients in each drug experiment will continue to receive treatment until one year after exposure to infection. Patients on whom treatment was discontinued at the end of six months will be observed further to ascertain whether final termination of their infection may be delayed by the long period of suppression.

In experiments in 79 induced infections with *P. malariae* (USPHS and Trinidad strains), chloroquine gave the best results, followed in descending order by quinacrine, quinine, and totaquine. This species responded relatively slowly to all drugs tested; under chloroquine therapy *P. vivax* disappeared from the peripheral blood faster than did *P. malariae*.

The Texas City, Texas, disaster for which CDC provided emergency and epidemic aid.

Laboratory Division

During 1946 the Diagnostic and Training Laboratory Section of the Training and Education Division evolved into the Laboratory Division. This change was really a natural growth and development toward furnishing adequate laboratory services for CDC, and the improvement of laboratory diagnostic medicine throughout the country. The program developed to attain these objectives is made up of the following features:

● METHODOLOGY RESEARCH. Applied research toward the evaluation of laboratory diagnostic tests; determination of the optimum specificity and sensitivity of tests; devising improved and new techniques where existing ones are found to be deficient; basic research which may be indicated to assist in the solution of the above problems.

● TRAINING OF LABORATORY PERSONNEL. Short refresher courses offered for laboratory personnel of public health departments and hospitals to teach them the best techniques and use of tests at optimum specificity and sensitivity, with stress on drills to improve their performance of laboratory daignostic tests; the development of uniform practices in all laboratories by encouraging of uniform performance of whatever tests are employed and by the application of better techniques learned in the training courses, with the subsequent in-service training of subordinates and personnel of other regional laboratories in these improved methods; conducting an extension service for the monthly shipment of laboratory specimens to be studied by laboratory personnel throughout the country and to be maintained as a reference and refresher collection.

● EVALUATION OF PUBLIC HEALTH LABORATORIES. Evaluation of the laboratory diagnostic techniques and performance of the public health laboratories; encouraging these laboratories to evaluate, in turn, the other laboratories within their own State.

● REFERENCE DIAGNOSIS. The establishment of the Laboratory Division as a reference diagnostic center, offering identification services for specimens requiring tests or expert opinion which may not be available in local laboratories or which may be too expensive or impractical to do routinely except on a national basis.

● BIOLOGICAL REGISTRY. At the request of the American Society of Bacteriology, to establish a National Registry of Biological Materials which would make available to research scientists information as to sources of scarce diagnostic biological materials, or those commercially unprofitable to produce; provide materials not otherwise available, either through arrangement for production of such materials or by production in CDC laboratories; maintain stocks of type cultures, grouping and typing sera, and other diagnostic antigens.

● LABORATORY CONSULTATION. Provision of expert consultation, at the request of laboratories, on administrative problems, techniques, programs, and planning and construction; in regard to latter service close cooperation is being maintained with the architectural staff of the Hospital Facilities Division, which has developed in its

staff architects especially qualified to advise on the planning and construction of laboratories and laboratory equipment.

● LABORATORY SURVEYS. At the request of district directors, program reviews to be made of public health laboratories in their districts, including comprehensive survey of the administrative and technical organization of the laboratories and recommendations for improvement of services where indicated.

● LABORATORY SERVICE TO CDC AND EPIDEMIC AID. The Laboratory Division acts as a service division to the Communicable Disease Center, serving the laboratory needs of all the other divisions in their investigative and control operations; upon request provides laboratory assistance to the States and the Epidemiology Division in the investigation of epidemics.

The progress in the fiscal year 1946 toward the achievement of the above objectives and functions is given below in the accounts of the respective branches presently comprising the Laboratory Division. Plans have been completed for the organization and development of a Bacteriology Branch in fiscal year 1948, consisting of a Bacteriology and Immunology Section, Mycology Section, and a Tuberculosis Section. A Pathology Branch is planned for fiscal year 1949.

PARASITOLOGY BRANCH

The major function of the Parasitology Branch is instructional in nature. A series of courses are given in the laboratory diagnosis of parasitic diseases for all grades of public health laboratory personnel and for laboratory directors, and practice diagnostic materials are distributed to laboratories throughout the United States. As part of its reference diagnostic service the Branch receives specimens of all types from State and local health department laboratories and checks them for protozoan and helminthic parasites. An identification service is also offered for medically important arthropods. This Branch aids State and local health department laboratories having problems in diagnostic techniques for parasitic diseases by laboratory investigation and evaluation. In investigations of epidemiological problems confronting State and local health departments, the Parasitology Branch sends teams of trained parasitologists into the field to offer on-the-spot laboratory assistance, in collaboration with the Epidemiology Division.

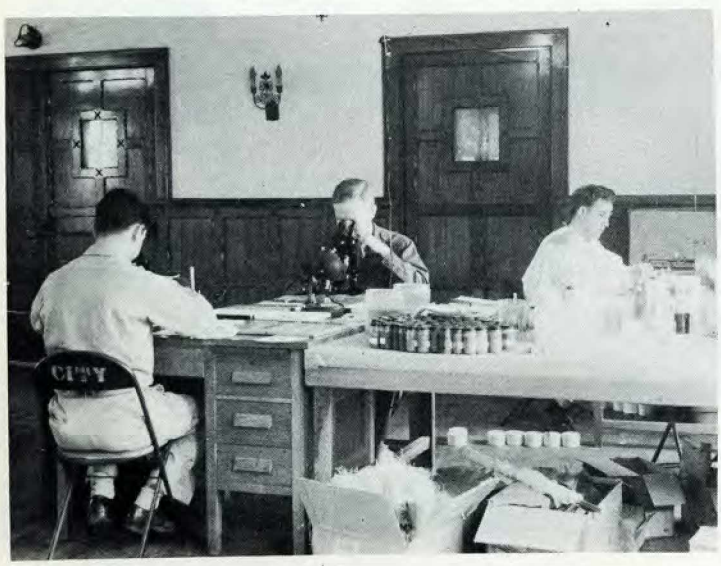
Health department workers received practical training in the laboratory diagnosis of parasitic diseases.

● TRAINING. During the fiscal year the Parasitology Branch continued the training in the laboratory diagnosis of parasitic diseases which had been developed during the previous year. Four six-weeks courses were conducted. About 80 laboratory personnel from all parts of this and other countries, including 42 States, the District of Columbia, Alaska, Puerto Rico, Greece, Bolivia, and Canada attended. In addition the staff of the Parasitology Branch gave a six-weeks course in medical parasitology to the medical students of Emory University.

Specimens for training were collected in Puerto Rico and Liberia, and in many parts of this country. Organisms were maintained in cultures and in laboratory animals. Fresh specimens were used extensively, although preserved specimens were also included in the training materials. These materials were also used in the preparations of specimens for the extension service; monthly shipments of two or three slides each were made available to 214 laboratories in the country, and seen by approximately 1,500 people. These materials, and additional test slides to gauge the diagnostic ability of laboratory technicians, were enthusiastically received.

An entomological museum was started which will provide students and visitors with study materials of the many species of arthropods of medical importance and also serve as a reference center for CDC entomologists throughout the United States and its possessions. Considerable work was also done in cooperation with the Entomology Division in the preparation of entomological keys and an atlas of the various arthropods of medical importance. Technical advice and consultation was also provided to the Production Division in the preparation of sound color motion pictures and film strips dealing with parasitological and entomological subjects.

● METHODOLOGY RESEARCH. Research on methodology was carried on in the protozoology, helminthology, and medical entomology laboratories of the Parasitology Branch. Problems were chosen because of their close relation to diagnostic procedures, with a view toward evaluating existing parasitological techniques and to devise new methods of handling and diagnosing parasitic diseases. Comparison was made of published methods of staining intestinal protozoa in fecal smears to determine their value and place in the diagnostic laboratory. As an outgrowth of the studies on staining two new methods were developed that, without solving all the staining problems of the diagnostic laboratory, did offer certain advantages over existing techniques. One method involved a single-solution, iron-hematoxylin mixture that stains rapidly (in three minutes) and does



Temporary laboratory facilities were set up in a city hall for the parasitology team surveying for carriers of amoebic dysentery.

not need to be differentiated. The other method, utilizing picric acid as a mordant for hemotoxylin in a two-solution technique, requires several hours to complete but differentiation is not necessary and overstaining practically never occurs.

Other studies included comparison of diagnostic results obtained by examining two direct smears instead of one direct and one zinc sulphate concentration preparation; comparison of the preservative action of four percent phenol and ten percent formalin for stool specimens; effects of deep freezing of fresh stools on the appearance and recovery of protozoan cysts; the use of polyvinyl alcohol resin containing fixative as a means of fixing and preserving intestinal protozoa, especially trophozoites, in fecal smears for shipment and subsequent staining in the laboratory; investigation of the mass staining technique of thick blood films for malaria in relation to transfer of malaria parasites from positive to negative slides in the same staining solution; observations on the use of the phase microscope as an aid in the diagnosis of intestinal parasites; development of a polyvinyl alcohol-giemsa technique for staining protozoa in blood films; investigations of mass procedures of staining malarial thick films; the effects of various bacteriostatic agents, such as penicillin, in reducing bacterial growths in cultures of feces for amoeba; the effects of freezing of cultures for maintenance of stock strains of protozoa; methods of staining cultured protozoa; and studies of various methods for preparing semi-permanent mounts of fecal specimens suitable for mailing for the extension service.

Comparison was also made of culture media for growing parasites. The purpose of these tests was two-fold: first, to determine which media would give the most satisfactory results in the CDC laboratory for the culturing of protozoa from fresh stools

(ABOVE) Comparisons were made of culture media for growing protozoan parasites.

(ABOVE) Malaria survey slides were diagnosed and identified in the laboratory. (BELOW) New methods were devised for handling specimens and diagnosing parasitic diseases.

LABORATORY DIVISION
REFERENCE DIAGNOSTIC SERVICES
FISCAL YEAR 1947

DIAGNOSTIC SERVICE		STATE AND LOCAL HEALTH DEPARTMENTS	CDC CLINIC	VETERANS ADM. HOSPITALS	PRESBYTERIAN HOSPITAL BABY CLINIC	TOTAL
Feces	Exam. for intest. parasites	87	52	39	780	958
	Culture for protozoa		5			5
	Culture for bacteria		8			8
Blood	Exam. for malaria[1]	3	10			13
	Routine counts, Hb & Diffr.	1	94			95
	Platelet count		1			1
	Hematocrit		11			11
	Sedimentation Rate		6			6
	Bleeding & clotting time		2			2
	Sugars		11			11
	Glucose tolerance		1			1
Urine	Routine urinalysis		95			95
Urethral & vaginal secretions	Exams. for gonorrhea		3			3
Sputum	Exam. for parasites	2				2
	Exam. for fungi	1				1
	Exam. for tuberculosis		2			2
	Exam. for cancer cells	1				1
Hairs	Exam. for fungi Culture for fungi	114				114
Milk	Culture for bact.		1			1
	Identification	71				71
Arthro-pods	Host preference-blood meal precipitin tests[2]	3,518				3,518
TOTAL						4,919

1 Exclusive of malaria survey slides
2 Host preference serology was transferred from the Virus and Rickettsial Branch in Montgomery, Alabama, during the last quarter 1946-1947.

LABORATORY DIVISION

DIAGNOSTIC SERVICES ON MALARIA SURVEY SLIDES
FISCAL YEAR 1947

MALARIA SURVEY SLIDES	DATES COLLECTED	NUMBER COLLECTED	NUMBER EXAMINED	NUMBER POSITIVE	PERCENT POSITIVE	REMAINING AT END OF YEAR
PUERTO RICO						
Santa Isabel	Fall 1945	1,219	560	58	10.3	0
	Spring 1947	1,086				1,086
Humacao Playa	Fall 1946	982	982	5	.5	
Loiza Aldea		842	842	8	.95	
Dorado						
Toa Baja						
Najuado	Fall 1946	662	662	21	3.2	
JAMAICA	Fall 1946	1,572				1,572
ARKANSAS		13,210	1,233	2	0.1	11,977
Counties bordering Mississippi River	Fall 1946	8,262	1,463	0	—	6,799
MISSISSIPPI						
Around reservoir in northern Miss.	Fall 1946	4,986	4,985	0	—	
NORTH CAROLINA	Fall 1946	10,025	9,890	0	—	
SOUTH CAROLINA						
Malaria Field Invest.	Fall 1946	1,225	1,225	0	—	
TOTALS		44,071	21,842			21,434

and the maintenance of cultures; and secondly, to establish some standard of growth that could be used for further problems by developing a statistically valid method of counting trophozoites from cultures. Eight recommended media were tested and a statistically valid counting method was developed. There were, however, too many variables to establish a growth curve on any of the strains used.

EPIDEMIC AID. The Parasitology Branch provided assistance in several epidemiological investigations during the fiscal year. A field investigation of an outbreak of diarrhea was made in Collins, Mississippi, between August 10 and 25, 1946 in cooperation with the Epidemiology Division. Two laboratory trucks were used; one equipped for parasitological and the other for bacteriological examinations. Laboratory Division personnel manned the trucks and performed the examinations of stools and rectal swabs obtained from 390 inhabitants of Collins. Results indicated that parasites were apparently not the cause of the iarrhea. An intestinal parasite survey was made in two towns in Texas from February 28 to March 22, 1947 in connection with the Dysentery Control Project operating in the vicinity of Pharr. Control of insects with DDT had

been in operation in one of the towns for about 18 months; the other village was untreated. A temporary laboratory was set up adjoining the bacteriological laboratory of the Dysentery Control Project, and 1,036 specimens were examined in this survey. No significant differences were found in the percentages of intestinal parasite infections in the two towns.

In cooperation with the Epidemiology Division, facilities and personnel were provided for an intestinal parasite survey, with particular regard to *E. histolytica*, of an institution for feebleminded in Orient, Ohio, from April 29 to May 24, 1947. A laboratory was set up in one of the institution buildings. Specimens collected in the various cottages were examined microscopically in the laboratory for intestinal parasites and streaked on culture media for bacteriological examination. The Ohio State Health Department laboratory completed the bacteriological examinations. Concurrent with this study, representatives of the National Institute of Health obtained blood specimens for testing indirect methods of diagnosing amoebiasis, and also made skin tests for the same purpose. In all, 520 individuals were examined once, and 301 of these a second time. Approximately 20 percent of the people examined were found to harbor *E. histolytica*.

VIRUS AND RICKETTSIAL BRANCH

The Virus and Rickettsial Branch was organized and began operation in 1946. The laboratories are located in Montgomery, Alabama, in the buildings formerly occupied by the rabies laboratory of the Rockefeller Foundation. This Branch engages in the laboratory diagnosis of neurotropic viruses. Identification or isolation of virus etiological agents are made by animal and egg inoculations, chicken red blood cell agglutinations, and neutralization tests. Rickettsial diseases are studied serologically. Diagnostic services are rendered for poliomyelitis, the various encephalitides, influenza, and rabies. Serological diagnosis includes the Weil-Felix reaction and complement-fixation tests for Rocky Mountain spotted fever, typhus, and Q fever. Also, surveys are being conducted by this Branch on the incidence of typhus in rats and humans. The precipitin test work to determine the host preference of mosquitoes was transferred to these laboratories in 1946.

Precipitin tests were conducted to determine the host preferences of mosquitoes.

● REFERENCE DIAGNOSTIC SERVICE AND EPIDEMIC AID. Specimens collected during the field study of an outbreak of poliomyelitis in Florence, Alabama, were examined for virus and immune bodies. Neutralization tests were carried out

on the human sera for the viruses of eastern and western equine encephalomyelitis, St. Louis encephalitis, lymphocytic choriomeningitis, and Lansing strain of poliomyelitis. After appropriate treatment, fecal material and pools of flies were inoculated into monkeys. The virus of poliomyelitis was obtained from six out of 24 fecal specimens, but none from the flies. Neutralization tests on human sera showed a high percentage of antibodies against the Lansing mouse-adapted poliomyelitis virus; six out of 14 were positive and three others were weakly positive. Neutralization tests against the other viruses were all negative.

Fecal specimens from Collins, Mississippi, were tested for virus by animal and egg inoculation. No virus was isolated from any of this material. Specimens were examined from an outbreak of diarrhea at Pinson, Jefferson County, Alabama. Studies failed to establish a virus as the etiological agent. Similar results were obtained from an outbreak of diarrhea at the State Hospital in Columbia, South Carolina. The rickettsiae of Rocky Mountain spotted fever were recovered from two of three specimens of blood obtained in Jefferson County, Alabama. The strain was proven by cross immunity tests in guinea pigs, using a known spotted fever virus. Two lots of ticks (*D. variabilis*) from the same area were negative for the Rocky Mountain spotted fever. Six lots of ticks from Huntsville and one other lot from Jefferson County, Alabama, were also tested. Results are not yet available.

Neutralization tests against eastern and western equine encephalomyelitis, St. Louis encephalitis, and Japanese B encephalitis were performed on human sera from Nashville, Tennessee, and Birmingham and Montgomery (Maxwell Field), Alabama. One serum from Birmingham was doubtful for St. Louis encephalitis. One serum from Maxwell showed weakly positive against St. Louis encephalitis and doubtful against Japanese B encephalitis. Three sera were taken at different time intervals from a patient at Maxwell Field, and the third was weakly positive for St. Louis virus and doubtful for the Japanese B strain. This patient had been in the Orient.

The fiscal year's complement-fixation tests for the rickettsial diseases included 24,722 examinations of human sera for murine typhus fever, of which 882 or 3.56 percent were positive; 625 tests of human sera for Rocky Mountain spotted fever, of which five or 0.8 percent were positive; and 263 tests for Q fever, of which one was positive. Examination of 18,037 rat sera for murine typhus was accomplished and 4,275 or 23.7 percent were found to be positive; 15 of 1,279 rat sera examined for Q fever were positive. Weil-Felix testing of human sera gave 384 of 3,496, or 11 percent, positive for OX19, and 89 of 3,496, or 2.54 percent positive for OX2.

● **INVESTIGATIONS.** Experimental and production work carried on by the Virus and Rickettsial Branch during the fiscal year included: an experiment to determine whether the concentration of antibiotics used in retarding bacterial growth in fecal specimens would be detrimental to the survival of a virus; comparison of different poliomyelitis strains by animal inoculation, serological techniques, and neutralization tests; the immunization of mice, hamsters, monkeys, and chickens to the Lansing poliomyelitis virus; experiments to determine the comparative susceptibility of two strains of white mice to the Lansing poliomyelitis virus diluted both in broth and saline; and the inoculation of mice with Y-SK and Lansing poliomyelitis virus as infected stock animals for preservation of these strains, and the passage in mice of Y-SK mouse-adapted virus and lymphocytic choriomeningitis virus to raise virulence.

An experiment was performed to determine the efficiency of the method used for

inoculation of flies into monkeys for recovery of the poliomyelitis virus. The virus used was not very potent, but as much as 1-500 dilution of virus could be detected by the methods used. Experiments were also performed to test the efficiency of autolyzed mouse brain tissue as a diluent for the Lansing poliomyelitis virus. Keeping the autolyzed mouse brains frozen did not alter the efficacy, although addition of this material did not greatly increase the potency of the virus as was reported in former experiments. Other work included rapid passage in mice and hamsters of a new strain (Gonce) of poliomyelitis in an attempt to adapt this strain to small animals; titration of stocks of Lansing poliomyelitis virus for potency after prolonged storage in a CO_2 ice box; injection of cotton rats with Lansing poliomyelitis virus to obtain virus for immunizing work; and experimental complement-fixation tests on animal and human sera performed against the Lansing virus mouse brain antigens. Also, standard viruses were prepared, titered, and sealed off in ampules; a variety of antigens were prepared; and the several strains of virus studied in the laboratory were maintained by animal passage. Studies were conducted on diagnostic procedures for mumps and standard sera were prepared for A and B strains of influenza. Stock strains were also propagated for Rocky Mountain spotted fever, and endemic and epidemic typhus fever. Large numbers of mosquito specimens from all of the malaria control programs in the southeastern States were submitted for host preference precipitin tests. In all, 86,615 mosquitoes were tested.

STATE SERVICES BRANCH

The State Services Branch is concerned with offering training materials and consultation services to State and local health department laboratories. Consultation service is available in planning, equipping, and staffing new laboratories, as well as for technical problems which arise in the operation of existing laboratories. Trained personnel survey and evaluate the technical procedures, administrative methods, and equipment employed by any public health laboratory.

Public health laboratory surveys and program reviews were begun during this fiscal year. The laboratories of the Minnesota Department of Health, the Louisiana State Department of Health, and the Virginia Department of Health were surveyed at the request of district directors. Many additional States will be included in these surveys in the next fiscal year.

Removing inoculated mouse brain and spinal cord for virus identification.

Inoculating monkey with fly material to recover poliomyelitis virus.

Technical Development Division

The objective of the Technical Development Division, located in Savannah, Georgia, is to expedite operational programs through technical guidance based on practical investigational work. Almost every activity of the Division is initiated because of a definite need for assistance on a specific operational deficiency or lack. Deviation from this practice occurs only where information of a more basic nature is necessary as a foundation for the practical solution of an operational problem.

Six technical branches, an Administrative Branch, and a Service Branch comprise the Division. The Insecticide Investigations Branch employs laboratory techniques in the preliminary evaluation of promising new materials, and in the more detailed investigations which cannot be efficiently handled by field techniques. The Control Methods and Evaluation Branch conducts field tests and evaluates promising new materials and methods under conditions actually met in control operations. The Chemical Investigations Branch conducts all of the chemical and physical evaluations, analyses, and experiments. The Equipment Development Branch is concerned principally with the design of new equipment needed in communicable disease control. The Bodent and Ectoparasite Control Branch handles those techniques, both laboratory and field, which are peculiar to the control of rodents and their ectoparasites. The Vector-Transmission Investigations Branch studies the transmission of certain communicable diseases among non-human hosts. A great deal of close cooperation is carried on among the various branches to permit the efficient investigation of a problem which may involve two or more techniques before a solution is reached.

INSECTICIDE INVESTIGATIONS BRANCH

● SUSCEPTIBILITY OF FLIES AND MOSQUITOES. During the year, tests were run on the relative susceptibilities of the house fly, *Musca domestica*, and the mosquito, *Anopheles quadrimaculatus*, to the residual "killing" effectiveness of DDT and certain other promising insecticides. The results are summed up graphically in Figures 1 and 2. Generally, house flies were considerably more sensitive to DDT than mosquitoes, but the insecticides exposed to house flies tended to show a sharp break in effectiveness and a rapid drop in efficiency. For the mosquito, the insecticides showed a gradual decrease of efficiency from the initial time of testing, but no marked break or drop in effectiveness. For equal exposure periods, the insecticides had the same general order of effectiveness against both test insects, although the various insecticides were quite different in their initial toxicity to the two insects.

FIGURE 1. Twenty-four hour mortality (percent) of adult female *A. quadrimaculatus* after 30-minute exposures at indicated times to deposits of 200 mg. of various insecticides per square foot from five-percent xylene emulsions applied to plywood surfaces.

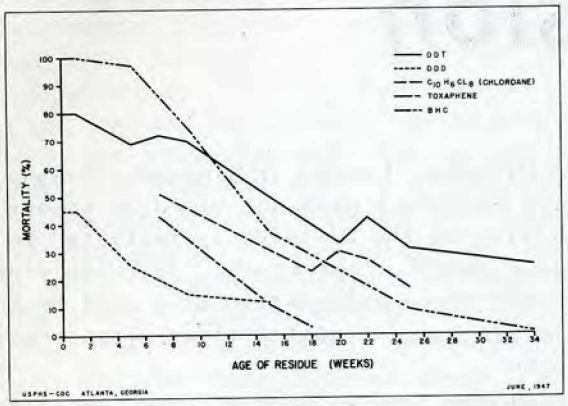
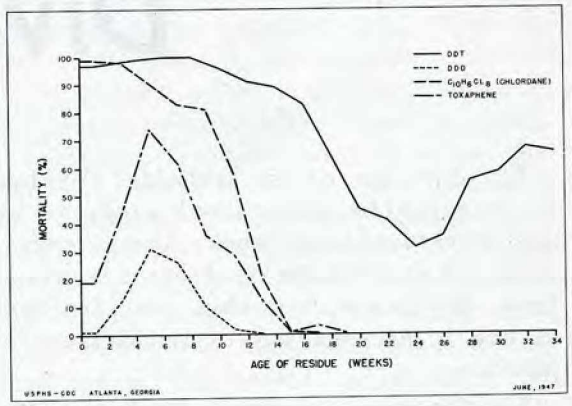


FIGURE 2. Twenty-four hour mortality (percent) of adult female *M. domestica* after 30-minute exposure periods at indicated times to deposits of 200 mg. of various insecticides per square foot from five-percent xylene emulsions applied to plywood surfaces.



● NEW INSECTICIDES. None of the newer candidate insecticides so far tested have been able to seriously compete with DDT as a residual insecticide for the control of flies and mosquitoes. Some of the materials tested give initial results essentially equal to DDT, but none have stood up as well over a period of four to six months. Since chlordane is claimed to produce a more rapid knock-down of flies and mosquitoes than DDT, it seemed that the combination of both chlordane and DDT in the same spray might be of some value. Table I shows the results obtained in preliminary experiments combining the two materials. Chlordane sprays appear to be more effective when kerosene is used as a solvent. Indications are that such combinations might be worthy of field testing.

● SURFACE AND RESIDUAL EFFECTIVENESS. Because residual sprays are applied to a variety of kinds of surfaces, the effects of these surfaces on the DDT residuals were investigated. Three general types of surfaces were tested: exterior, interior, and fabric. The results indicated that the surfaces may be re-divided into three groups on the basis of their retention of the residual effectiveness of the DDT. Group 1 (dry bamboo, rusty sheet metal, rusty metal screen, and bark) had residual toxicities equal to or better than the standard plywood, having relatively rough surfaces which might aid in obtaining a good spray coverage and adherance. Group 2 (new sheet metal, glass, glazed tile, and palmetto thatch) was three- to four-fifths as efficient as the standard, with very smooth, continuous surfaces which made it difficult to obtain good coverage because the emulsion spray separated into discrete droplets. The third group (new metal screen, plexiglass, cement, shellacked wood, waxed wood, nylon, rayon, and celanese) was three-fifths or less as efficient as the standard, having surfaces either smooth and discontinuous such as the plastic fabrics and the new metal screen, or else having surfaces such as shellac, wax, or plexiglass which might temporarily be softened and penetrated by the xylene in the emulsion thus trapping a portion of the DDT below the surface on drying. The low residual effectiveness of the spray on cement might well be due to the high porosity of this surface.

● EFFECTS OF CLEANING. The effect of common household cleaning operations on residual toxicity was also investigated. Dry cleaning with mineral spirit naphtha caused the residual toxicity to drop markedly, probably because of the solvent action of the cleaner on the DDT crystals. Brushing of mohair surfaces resulted in somewhat rapid loss in residual toxicity, but vacuuming had relatively little effect. Laundering appeared to have little effect in removing the residues, but ironing may be an important factor. A hot iron caused marked deterioration. Wiping with a dry dust cloth caused a gradual removal of DDT from shellacked wood and wallpaper. Paste wallpaper cleaner rapidly removed the DDT deposit from wallpaper. Waxing previously sprayed surfaces of shellacked wood and linoleum greatly reduced the residual effectiveness.

CONTROL METHODS AND EVALUATION BRANCH

● RESPRAYING SURFACES. One of the important insect control problems is the frequency with which surfaces should be resprayed. Some of the first buildings sprayed with DDT in 1944 were available for testing, and still showed marked toxicity to flies and mosquitoes in June 1947. Although these rooms have not been occupied, they do indicate that the DDT itself is not the limiting factor in the number of spray applications necessary. Tests in rooms fitted with furniture to simulate occupancy have indicated that the thoroughness of coverage — spraying the backs and undersides of furniture as well as the walls and ceilings — is probably the most important factor in extending the length of residual effectiveness. Tests in the simulated occupancy rooms indicated DDT to be more satisfactory than any of the competing new synthetic toxicants for residual control of house flies and mosquitoes. Water-wettable powders vary in effect, depending upon the particular formulations used. Some were unsatisfactory from the standpoint of suspendability and the clogging of nozzles. Preliminary testing of the application of DDT with whitewash in dairies indicated that such a procedure might prove to be satisfactory in some instances.

Table I

TWENTY-FOUR-HOUR MORTALITIES OF ADULT FEMALES OF *M. DOMESTICA* AND *A. QUADRIMACULATUS* AFTER 30-MINUTE AND 60-MINUTE EXPOSURE PERIODS TO 200 MG. PER SQ. FT. DEPOSITS OF DDT OR DDT-CHLORDANE* COMBINATION.

TEST FORMULA PERCENT-CHEMICAL	TEST INSECT	EXP. TIME (MIN.)	AGE OF RESIDUE (WEEKS)				
			1/2	2	4	6	8
100-DDT (xylene)	*M. dom.*	30	—	100	100	100	100
	A. quad.	30	100	—	—	38	
		60	100	—	—	71	
80-DDT 20-chlordane (xylene)	*M. dom.*	30	—	100	100	97	100
	A. quad.	30	95	—	—	54	
		60	100	—	—	98	
80-DDT 20-chlordane (kerosene)	*M. dom.*	30	—	100	99	100	99
	A. quad.	30	100	—	—	96	
		60	100	—	—	100	
60-DDT 40-chlordane (xylene)	*M. dom.*	30	—	100	100	100	100
	A. quad.	30	100	—	—	98	
		60	100	—	—	100	

*Chlordane — $C_{10}H_6C_{18}$

● MOSQUITO LARVICIDING. The most noteworthy indication from the field larviciding program during the year was that DDD (dichloro-diphenyl-dichloroethane) may be as satisfactory or even superior to DDT when used in the one-gallon mist larvicide formula. Under varying conditions of infestation and weather, DDD appeared to give slightly more efficient results than DDT, thus indicating that this material is worthy of large-scale tests on control programs. Also, observations on wildlife indicated that DDD may be slightly safer to use as a larvicide than DDT; limited tests with DDD at 0.05 and 0.025 pound per acre showed no reductions of fish population. Chlordane produced similar results, but is much more expensive than DDD Toxaphene is an effective fish poison at 0.1 pound per acre.

● AIRPLANE LARVICIDING. The relative effectiveness of airplane applications of 0.1 pound DDT per acre by exhaust-generated thermal aerosol and by spray produced from five regular spray nozzles was tested on four plots of the Savannah Wildlife Refuge, furnished through the cooperation of the U. S. Fish and Wildlife Service. Though the recovery of deposits obtained from thermal aerosol applications was considerably more uniform over the whole area, the minimum recovery at individual stations was generally greater for the application from the spray nozzles; 10 - 15 percent recovery for thermal aerosol as against approximately 65 percent for the spray. It seemed evident from gross observations that little or no harm was done to fish populations as a result of the first season's operations. No changes in distribution and number of birds attributable to the DDT were observed. Trapping of rodents, chiefly cotton rats, indicated that the DDT had no effect on the rodent populations. Insects were not exterminated in the treated areas, although Coleoptera such as Dytiscids, Gyrinids, and Hydrophilids, and aquatic Hemiptera, especially Corixids, were killed in considerable numbers. Many adults of aquatic Diptera were found dead on the water surface, and large numbers of adult dragon flies and damselflies were also killed. There was no indication of serious harm to five colonies of honey-bees in the treated area. No discernable drastic kill of plankton occurred from the DDT treatment during the course of the experiments.

CHEMICAL INVESTIGATIONS BRANCH

● DDT RESIDUAL DETERIORATION. A condition of primary importance in the control of insects by residual sprays is the masking or deterioration of DDT deposits. Several possible factors in masking and deterioration were studied, as well as the effects of several different surfaces. Common unfinished poplar was used as the surface for standard comparison. Panels covered with wallpaper were used as typical of absorptive surfaces, and glass was used for hard, non-absorptive surfaces. One set of these three surfaces was sprayed with standard xylene emulsion containing five percent DDT, and the other set with kerosene solution containing five percent DDT. Table II describes the tests and the results obtained. High temperatures (140 degrees F.) definitely hastened the decomposition of DDT, but ordinary household temperatures were a minor factor in deterioration. Irradiation with ultra-violet light at controlled temperatures ruled out this factor as of importance. Preliminary studies were begun to determine the effect of the solvent and the concentration of DDT in the spray upon the

Table II

RECOVERY OF DDT (PERCENT) FROM CONTROL PANELS OVER A THREE MONTH PERIOD AT TIME OF SUMMER ROOM TEMPERATURES

DESCRIPTION OF TESTS	RECOVERY FROM 5%-DDT KEROSENE ON			RECOVERY FROM 5%-DDT EMULSION ON		
	GLASS	PAPER	WOOD	GLASS	PAPER	WOOD
1. DDT was removed after 3 days to establish the recovery rate for different type panels.	100%	91%	92%	101%	97%	95%
2. Control panels kept in dark at room temperatures for one month.	63%	85%	86%	97%	97%	95%
3. Control panels kept in dark at room temperatures for three months.	74%	70%	73%	95%	90%	98%
NOTE: Percentages are based on the amount of DDT theoretically applied.						

crystal formation of surface deposits as a possible factor. Activity of a large number of flies exposed to a relatively small area of surface masked the DDT residual toxicity "biologically," though the DDT could be recovered chemically.

PENETRATION OF SURFACE. In the case of wood surfaces, there is little doubt that penetration into the surface is of considerable importance to residual effectiveness. A series of tests was designed to determine the importance of various factors governing penetration of DDT spray into wood surfaces. In general, the more volatile solvents caused less penetration. Green wood had more effect in retarding penetration from xylene emulsions than from kerosene solutions. In dry wood penetration was also less from emulsions than from solutions. The more concentrated the DDT in the mixture, the less the penetration. Wetting the wood surface with water before spraying appeared to be quite effective in reducing the penetration, although any free water on the surface at the time of spraying caused the spray to run off. Spraying damp surfaces might provide improved residual deposits.

EQUIPMENT DEVELOPMENT BRANCH

NEW AND MODIFIED EQUIPMENT. A new model, four-gallon spray can, for use with an outside source of air, was fabricated from aluminum for lightness and resistance to corrosion. An oval filler opening is provided in the bottom of the can, which permits the cover to close from the inside and to be sealed by both the internal pressure of the liquid and compressed air and an exterior spring clamp. The air inlet consists of a conventional tire tube valve with fitting screwed into the top of the sprayer (Figure 3).

At the request of the Engineering Division, a power duster was converted for use as a space sprayer for the dispersal of DDT in areas endangered by poliomyelitis.

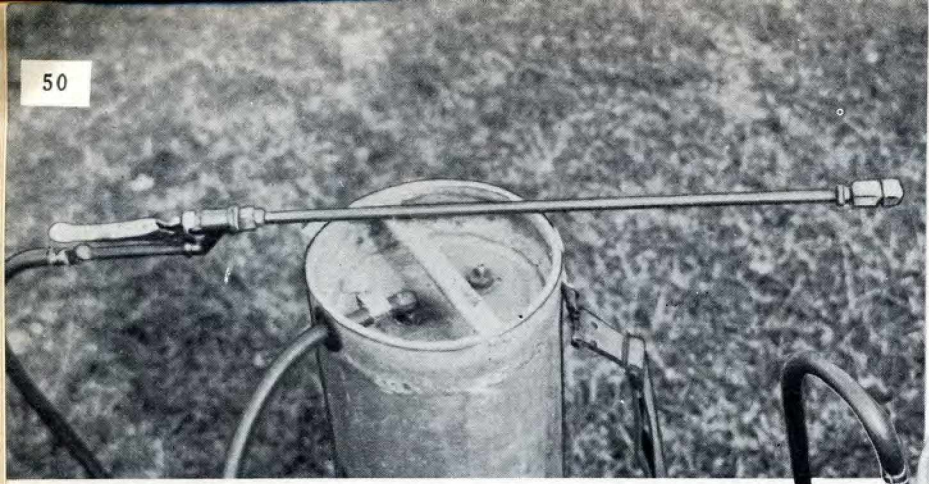
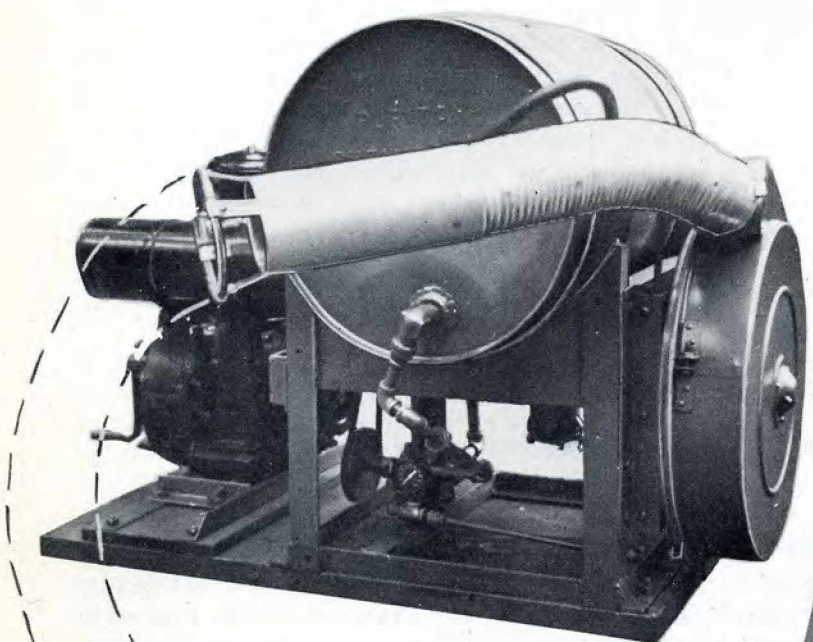


FIGURE 3. At right a four-gallon aluminum sprayer stands bottom-side up to show oval filler opening and cover with exterior spring clamp. Above photo shows sprayer top, with air valve inlet, carrying handle, spray outlet, hose, shut-off valve, wand, and nozzle.



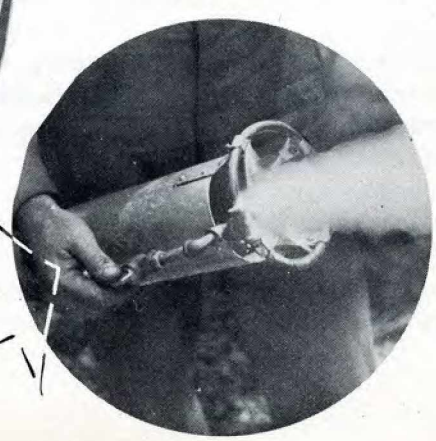


FIGURE 4. Centrifugal fan-type sprayer, showing air discharge tube from fan and spray nozzle ring attached to the end of the tube. A 30-gallon drum replaces the dust hopper. Close-up shows nozzle ring and excellent break-up of liquid by air blast from fan.

The dust hopper was replaced with a 30-gallon metal drum, and a five-inch diameter nozzle ring, with several equally spaced holes for injection of sprays into the air stream, was placed in front of the discharge tube from the fan outlet (Figure 4). The sprayer was mounted on the bed of a truck.

To satisfy a need expressed by State and district CDC representatives, a tool was constructed to replace the rubber tip in the pin on Hudson Perfection shut-off valves. The principle used was that of forcing the rubber tip through a short, restricted opening. The two-handle assembly tool works on the plier principle and is relatively simple and efficient. All adjustments have been eliminated and there are no loose parts. A squeeze on the handles inserts the rubber tip in the pin.

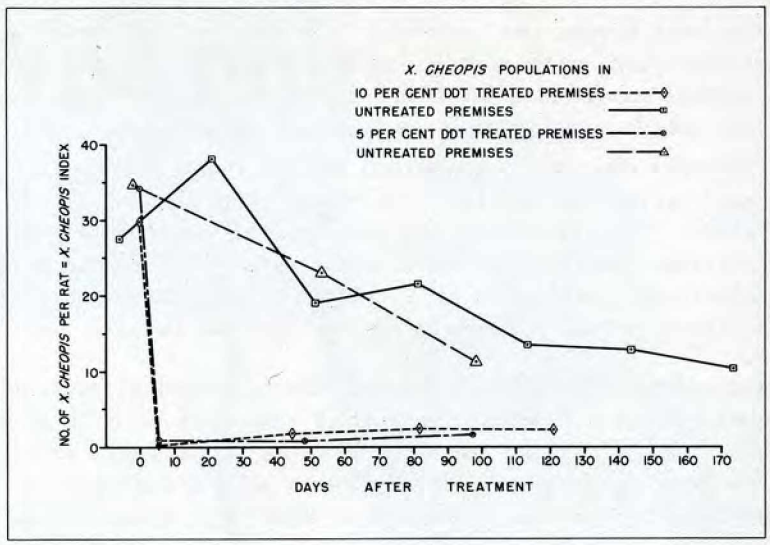
● EQUIPMENT EVALUATION. Through the combined efforts of several of the branches, new equipment developed by commercial companies as well as items developed by this Branch have been evaluated from the physical, chemical, and biological standpoints. One of the most interesting developments was a combination sprayer-duster known as the Buffalo Turbine Sprayer-Duster. This unit incorporates an axial-flow turbine, spray pump, spray tank, and a dust hopper mounted on a frame and powered by an 18 H.P. gasoline motor. Field tests at the Savannah city dump indicated control of flies for about one day in those portions of the dump up to 30 feet upwind from the path of the nozzle. Results from this type of equipment would vary with direction and velocity of the wind at the time of application and this will limit to some extent the value of the blower.

Another machine of general interest is the thermal-aerosol fog generator known as the Todd Insecticide Fog Applicator. It is recommended primarily for applying a space treatment of insecticide in recreation areas, garbage dumps, on live stock, field crops, etc. The machine was evaluated with respect to residual treatment of house interiors by directing the fog into the rooms tested. The results showed that the rooms into which the fog was directed received only a fraction of the quantity of DDT which would result from a residual spray treatment with conventional hand sprayers, and most of the deposit was on the floor and walls directly opposite the discharge nozzle. Biological laboratory tests substantiated the chemical findings. This machine was judged unsatisfactory for applying a residual house treatment.

RODENT AND ECTOPARASITE CONTROL BRANCH

● DUSTING INVESTIGATIONS. With the successful use of ten percent DDT dust in the control of rat ectoparasites, especially fleas, the question arose as to whether the concentration of DDT could be appreciably reduced. A dust containing five percent DDT in pyrophyllite was therefore evaluated under field conditions in Columbia, S. C. The methods of treatment were those commonly employed in the USPHS typhus control program in southern states; i.e. dusting of rat burrows, harborage areas, and runways. Seventeen business establishments were chosen for treatment and eighteen others were used as checks. *X. cheopis* populations were almost completely eliminated one week after application of the five percent dust, and reinfestation had not occurred to a significant degree at the end of three months. There appeared to be no significant difference between the results obtained with either five or ten percent DDT dust over a three-month period.

A comparison of the results obtained with five percent dust in Columbia and ten



Comparison of five and ten percent DDT dusts applied for control of the rat flea, *Xenopsylla cheopis*.

percent dust applied during the previous season in Savannah, Georgia, is given in Figure 5. These results should not be construed as a recommendation of the reduced dosage because results of more wide-spread usage are necessary to fully establish any such recommendation. The duration of control obtained against other ectoparasites than *X. cheopis* was not adequately determined because of the scarcity of these species in both check and treated establishments.

● COLORING OF DDT DUST. Because the DDT dust used in typhus control so closely resembles flour, it was suggested that the dust be colored as a precautionary measure. Two types of pigments were given field and laboratory tests. The green-lake pigment did not have any detectable effect on the toxicity of the formulation to rat fleas, was insoluble in water, and did not stain wooden surfaces or adhere to them. The red dye did not influence toxicity, but was somewhat soluble in water and stained woodwork; it is not recommended because of the latter effect. Neither dye had any effect on the behavior of rats or ectoparasites toward the dust.

● RODENTICIDES. Preliminary laboratory and field tests were conducted with certain rodenticides, including the sodium salt of p- dimethyl amino benzenediazo sulfuric acid (known as "Rattengift"), and the fumigant "Tritetre," which is believed to consist of 20 percent trichloroethylene and 80 percent tetrachloroethylene. Neither of these materials showed promise for use in the typhus control program.

Some further tests were conducted with sodium fluoroacetate ("1080"). An attempt was made to color the "1080 water" to reduce the danger of children drinking this deadly poison. Bright colors were discarded as resembling too closely soda pop. India ink and blue-black writing ink were tried. Neither of these appeared to repel rats. An attempt was made to develop a bait from "1080," using agar as a base. Further work is necessary before any recommendations can be made.

● RATPROOFING INVESTIGATIONS. Tests were undertaken during the year to determine the resistance to rat gnawing of fabricated composition materials of possible use in ship construction. The results indicated that almost any building material can be penetrated by rats if given sufficient time and incentive. No systematic studies of the factors involved were studied.

Training Division

The Training Division is concerned with providing facilities for field training of public health workers associated with the control of communicable diseases. During the fiscal year 12 programs relating to development of the best methods for carrying on field training in communicable disease control were placed in operation. Emphasis was placed on the practical nature of these programs, which were designed to supplement the academic courses of educational institutions with properly correlated field training, with a minimum of classroom work. Under the close supervision of the training staff, the trainees worked in the field as actual members of local health departments. The programs were kept flexible enough to meet the needs of each trainee, both as to educational background and the practical experience required.

The Division maintained evaluation procedures and sufficient records to develop a pattern for field training programs for many types of public health personnel, including sanitary engineers, sanitarians, health educators, and record analysts. In this way assistance could be offered to States, which were conducting field training programs, through consultation and temporary assignment of training personnel skilled in carrying on field training operations. Special provision was made for foreign trainees who were studying in this country under the auspices of government and private agencies.

● FILM LIBRARY. A film library was established in the Division, through which several hundred film strips and motion pictures, and projection equipment, were made available to the field training stations. A film source was compiled listing outlines, synopses, and abstracts of visual and audio-visual aids pertaining to public health activities. An alphabetical listing of all audio-visual dealers in foreign countries handling and repairing American equipment was also compiled for foreign visitors who contemplated buying American equipment.

INSECT AND RODENT CONTROL BRANCH

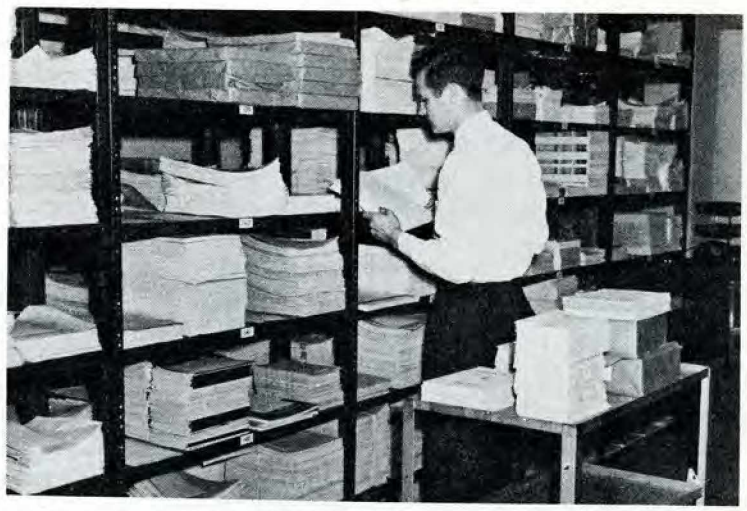
The Insect and Rodent Control Branch, located at CDC headquarters in Atlanta, conducted training programs in environmental control procedures for foreign trainees, evaluation of DDT dusting, and rodent-borne disease control during the year. The training programs were carried on in cooperation with the Georgia Department of Public Health, the Atlanta Department of Health, the Albany-Dougherty County Health Department, Emory University Field Station, and other divisions of CDC. Personnel of the Branch were made available to States for lectures and demonstrations in the control of rodents and insects of public health importance. This Branch prepared many insect specimens for training purposes and also began work on a manual, "Rodent-Borne Disease Prevention and Control."

● ALBANY-DOUGHERTY COUNTY FIELD TRAINING AREA. During the fiscal year an agreement was worked out with the Albany-Dougherty County Health Department and the Georgia Department of Public Health to use the facilities of the Albany-Dougherty County Health Department in conducting field training in insect vector control and environmental sanitation control procedures. Although the training was carried out under the supervision of personnel of the Insect and Rodent Control Branch, a sanitarian was assigned to the Dougherty County Health Department to assist in the field training. This Area was utilized extensively to furnish field experience to foreign trainees.

● FIELD TRAINING FOR FOREIGN VISITORS. Approximately 100 foreign visitors from 28 countries were given field training in insect vector and environmental sanitation control during the fiscal year. These key administrators, medical officers, and sanitary engineers from foreign countries had just completed their fellowships in universities in the United States and had been assigned by their sponsors to field training work with CDC. Many of them came under the auspices of the Rockefeller Foundation, the Institute of Inter-American Affairs, and the Office of International Health Relations of the U. S. Public Health Service. Several foreign governments sent their representatives directly to CDC to participate in the field training activities. Those trainees who were not able to arrange their travel time to fit into regular course schedules were given field training individually or with one or two other trainees when possible.

The four-week program, Field Training in Environmental Control Procedure for Foreign Trainees, was designed to fill the needs of public health personnel from foreign countries in the fields of malaria control, typhus control, and basic sanitation. The first part of the program, presented by lectures and laboratory studies, included the epidemiology of malaria and typhus fever and the biology and identification of malaria and typhus vectors. Control and evaluation measures were discussed in detail. After a brief period of observation in the field, the trainees participated in intensive control practices in the Albany-Dougherty County Field Training Area. One period of field training was devoted to basic sanitation, in which the trainees received practice in the construction and installation of sanitary pit privies and septic tanks, and the drilling of wells. Milk and food establishments were inspected, satisfactory methods of wastes disposal were observed, and southern housing conditions were studied by the trainees. The malaria bionomics studies being carried on at the Emory University Field Station were also observed, and some of the trainees received additional entomological field training at the Emory Station. Since many of the foreign visitors were from tropical and semi-tropical countries, problems similar to those met in their home countries were emphasized.

Trainee installing a metal plate as a rat-proofing measure.



Publications stock room in CDC headquarters, Atlanta. Reproduced material and audio-visual aids are used to supplement practical field training.

● RODENT-BORNE DISEASE CONTROL. This six-week, comprehensive training program included extensive supervised field practice in the principal rat control procedures applicable in the control of rodent-borne diseases. The program included consideration of: rodent-borne diseases and their relation to public health; epidemiology of the various rodent-borne diseases; rodent-borne disease surveys; habits, characteristics, and identification of the various rodents and their ectoparasites; techniques of ratproofing existing buildings, including estimating, contracts, and bookkeeping; procedures and techniques in the control and eradication of rats; ratproof construction of new buildings; control of rodent ectoparasites; evaluation of DDT residual dusting projects; and organization of local rodent-borne disease control programs. Field training and practice was obtained on the typhus control program of the Atlanta Department of Health.

● DDT DUSTING EVALUATION. A one-week practical program, Evaluation of DDT Dusting in Murine Typhus Control, was designed to assist operational typhus control personnel in the evaluation of DDT residual dusting activities. Trainees were acquainted with the latest methods of applying DDT dust to rat runs and in the techniques of securing representative samples of rats and rat ectoparasites by means of trapping. Instruction and practice in bleeding rats to obtain serum for typhus complement-fixation tests was given. The program also included instruction in making typhus surveys and in the compilation and interpretation of evaluation data. Emphasis was placed on actual field work and discussion of field practices.

● INSECT AND RODENT CONTROL. A one-month training program consisting of typhus fever and rodent control, malaria control, and fly and tick control was given for 15 CDC representatives from State and district offices. The time was divided into ten days for typhus and rodent control, two days for fly control, one day for tick control, and seven days for malaria control, which included a discussion on impounded water surveys. The course was interrupted during the three-day conference of State and district office personnel. The classroom and laboratory work was supplemented by field demonstrations and observations carried on in cooperation with the Atlanta Department of Health.

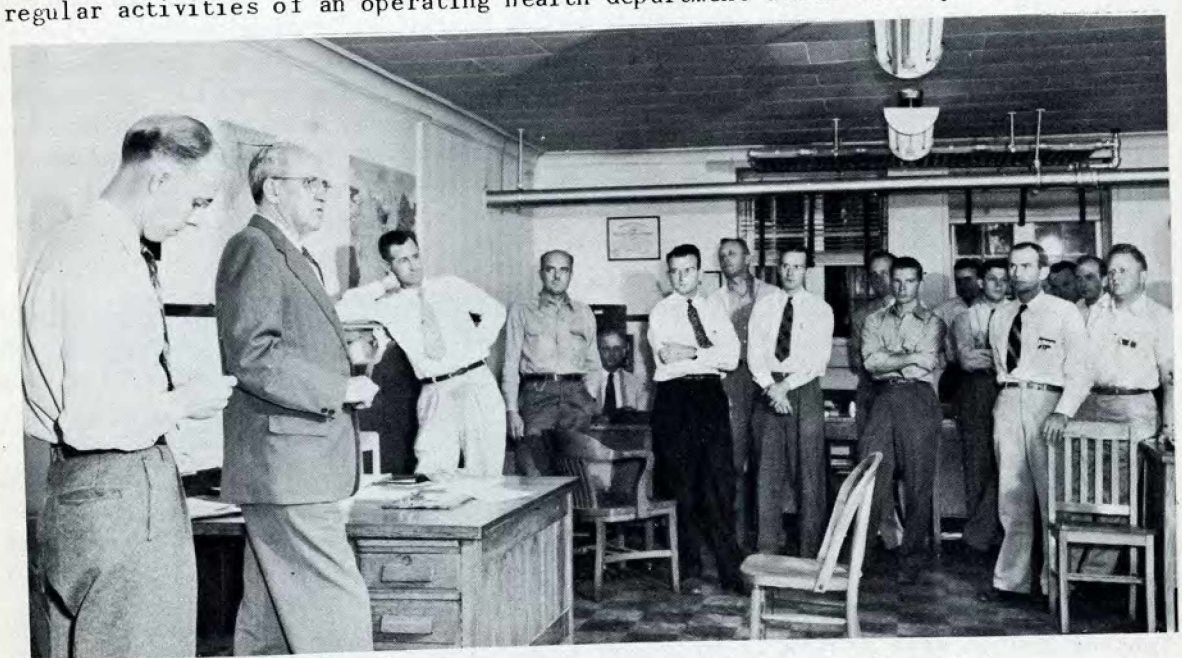
● SHORT COURSE IN INSECT AND RODENT CONTROL. Personnel of the Insect and Rodent Control Branch were available to render assistance to States in giving lectures and demonstrations in the control of rodents and insects of public health importance. This program was intended to help public health workers become better ac-

quainted with new control techniques. During this fiscal year CDC training personnel were invited to assist in an insect and rodent control school for health officers and sanitarians, which was sponsored by USPHS District No. 2 in cooperation with the Maryland State Department of Health and the University of Maryland. A three-day program was held, consisting of lectures, films, and field demonstrations, and included such subjects as medical entomology; habits and characteristics of rats; ratproofing; rat eradication; endemic typhus fever; fly control; control of ticks, mites, roaches, lice, and bedbugs; habits, characteristics, and life cycles of mosquitoes; use of DDT in insect control; enlisting public support for insect and rodent control; and pest control. Open discussions were held at the end of the presentation of material on each group of subjects.

COLUMBUS PUBLIC HEALTH TRAINING STATION

The Public Health Training Station, established at Columbus, Georgia, in the summer of 1946, was utilized during the fiscal year for the field training of both sanitarians and sanitary engineers. Activities of the Station were developed in cooperation with the Columbus-Muscogee County Health Department and the Georgia Department of Public Health. The city made a building available as a training center, and CDC equipped it with chemical and bacteriological laboratories and furnished the training staff personnel.

● ADVANCED SANITATION TRAINING. Two 12-week courses of the program, Advanced Sanitation Field Training, were given for sanitarians. The trainees engaged in the regular activities of an operating health department under the supervision of the



Trainees being "briefed" for their participation in the regular activities of an operating health department. Columbus, Ga.

Sanitary engineer trainees conducting a water analysis test. Columbus, Ga.

training staff. Experience was received in the following environmental sanitation activities: urban and rural water supplies and sewage disposal, garbage collection and disposal, school and recreational sanitation, private premise sanitation, housing and plumbing, food and milk sanitation, insect and rodent control, health education techniques, and record keeping and report writing. Trainees performed laboratory tests related to these activities and were instructed in the interpretation of these tests. Thirteen trainees attended the programs.

● SANITARY ENGINEER TRAINING. Twelve graduate sanitary engineers, including four from foreign countries, participated in the 12-week program, Sanitary Engineering Field Training. Daily practical assignments were made in such a way that the trainees worked in teams of two, and actually engaged in the regular activities of the operating health department as well as in public health engineering activities of other public works departments in the area. Arrangements were made to participate in the operation of the Columbus rapid sand filtration plant where a laboratory had been installed specifically for the trainees to conduct tests of the water during purification. They were also able to participate in the drilling of wells and in planning and assisting in the construction of septic tank systems. Assignments were made for one week in connection with the operation and testing of sewage treatment plants at Fort Benning, and inspection and reports were completed for several types of garbage disposal systems, including sanitary land fills. Practical experience was given on insect and rodent control programs; food sanitation; milk production and pasteurization; housing, premise, and plumbing surveys; and in field techniques of health education. Extensive use was made of film strips, motion pictures, and demonstration training aids to supplement the field work.

SAVANNAH FIELD TRAINING STATION

The Savannah Field Training Station operates in cooperation with the City-County Health Department and the Georgia Department of Public Health. The training staff is furnished by the Training Division, Communicable Disease Center. Three types of field training programs were carried out during the fiscal year: Primary Sanitation Field Training, of 12 weeks duration, for the practical training of sanitarians from State and local health agencies; Public Health Education Field Training, 12 weeks, for graduate public health educators; and Practical Health Department Records Training, eight weeks, for record analysts. A total of 69 trainees successfully completed the programs.

● PRIMARY SANITATION TRAINING. The program for sanitarians was so organized that the trainees actually engaged in the regular activities of an operating health department. The trainees engaged in various environmental sanitation activities, including municipal and rural water supply and waste disposal, school and recreational sanitation, home plumbing, insect and rodent control, milk and food sanitation, health education techniques, record keeping, and report writing. Laboratory tests in the fields of water supply and milk sanitation were performed by the trainees.

● PUBLIC HEALTH EDUCATION TRAINING. This program covered 12 weeks during the summer months and was attended by three trainees who had recently received advanced degrees in health education from major universities in the United States. Trainees participated in the preparation of news releases through conferences with professional news writers, and through group discussions. A part of the field training period was spent in making community survey forms with the community groups and organizing these groups for permanent action in solving the major public health problems of the area. Practical instruction was given to the trainees in the use of audio-visual training aids and equipment, as well as practice in public speaking and the preparation and evaluation of pamphlets and other bulletins.

● RECORDS TRAINING. This program was limited to a few, specially selected applicants in order to establish a pattern for such training programs which can be offered to employees from State and local health departments. The purpose was to provide trainees with practical training in all aspects of record keeping and reports in the various divisions of a health department, and to solve pertinent problems through actual participation in the use of records.

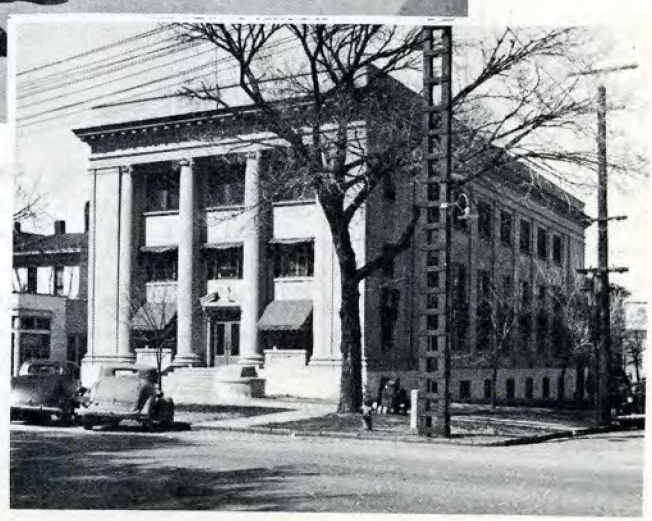
● PUBLIC HEALTH NURSE ORIENTATION. A project was developed at the Savannah Field Training Center for the orientation of graduate nurses in public health programs. The nurses performed various nursing duties involved in public health programs under the direction of practicing supervisors. They were taught the accepted techniques of home nursing visits, and were given a series of cases for clinic or home supervision. Clinic organization, administration, and procedure were studied, and the nurses participated in clinic activities and in child health centers. The trainees also worked closely with regular health department nurses and with teachers in promoting and developing a sound health program in the schools. Two separate orientation programs were given: the one-month course consisted of instruction and observation, without actual participation; the three-month course included also active participation in public health nursing activities. Seventeen graduate nurses from Georgia and Arkansas received this orientation.

TOPEKA FIELD TRAINING CENTER

The Topeka Field Training Center is a cooperative endeavor of the Topeka City-Shawnee County Health Department, the Kansas State Board of Health, USPHS District No. 7, and the Communicable Disease Center. The 12-week program, Midwest Sanitation Field Training, emphasized sanitation methods of the midwestern region. Ten trainees were secured for the first course, which started January 6, 1947. The specialized training in environmental sanitation was designed to equip the trainees with a working knowledge of an over-all program of municipal and county sanitation work.

Experience was obtained with a successfully administered city-county health department and by actual field work. The first four weeks of background information were devoted to public health administration, records, bacteriology, public health nursing, and public health education. The fundamentals of this orientation were carried throughout the field training activities of the program, including rural sanitation, rodent and insect control, plumbing, meat inspection, housing, milk sanitation, and sanitation of eating and drinking establishments. It is anticipated that the training area at Topeka will be utilized to give field training to health officers and public health nurses, as well as sanitarians.

The training center was also used by the Kansas State Board of Health and the medical school of the University of Kansas for a three-week orientation course for eleven medical students who were preparing themselves for health officer activities. The Topeka training staff assisted other state health departments in District No. 7, notable the Missouri State Department of Health and the University of Missouri, in carrying on the Fifteenth Annual Milk and Food Control Shortcourse.



(ABOVE) Lecture in environmental sanitation at the Topeka Field Training Center.
(RIGHT) The Field Training Station at Topeka, Kansas.

Production Division

The Production Division is a service unit, designed to produce technical and professional audio-visual aids for the training and operational units of the Communicable Disease Center, as well as for other professional agencies engaged in public health training. Sound motion pictures and film strips, slide films, still photographs, and illustrations for CDC publications comprise the audio-visual media produced. Display material and consultation service for public health exhibits are also provided by the Division.

The functions of the Division are carried out by three branches. The Story Development Branch plans all productions, and assigns project supervisors to direct the preparation, development, and over-all production of motion pictures and film strips, working in conjunction with technical advisors and writers. The Production Branch handles all physical production, such as photography, cutting and editing, art work and miniature set construction, recording, and laboratory processing. The Utilization Branch promotes a program for the effective use of all audio-visuals by maintaining liaison with technical personnel in public health training. A film library is maintained by this Branch, with adequate prints for service to all CDC activities, U. S. Public Health Service Districts, State and Territorial Boards of Health, and institutions of higher learning concerned with public health training.

● SCOPE OF ACTIVITIES. The Production Division develops training aids for use in schools of public health, preventive medicine, and sanitary engineering, and for CDC training activities, all U. S. Public Health Service Districts, and State and Territorial Boards of Health. It also provides technical assistance in production of research films. Training and documentary films comprise the training aids produced. Services are provided by the Division for evaluating films produced by other organizations in the various fields of interest to CDC. The Division seeks to stimulate interest in better teaching methods through workshops, field utilization programs, and evaluation surveys. An attempt is made to place visual aid materials in the hands of those in a position to use them in curricula, and to initiate and promote effective utilization programs. The Division also seeks to advance the use of visual aid materials through governmental and national collaborative movements.

A long range production program is projected by conducting audio-visual workshops with the association of professors of preventive medicine. At these workshops, through the guidance of these men, subject matter categories representing production needs are worked out and assigned production priority according to the urgency of the need. Proper utilization of the films and other aids developed is encouraged through classroom demonstrations, lectures, and production of evaluative catalogues, training film guides, and other types of publications.

The Production Division produces motion pictures and film strips at the request of other divisions of the U. S. Public Health Service, State and local health departments, medical and public health schools, and, in some cases, foreign governments (through the State Department) if justification is sufficient to warrant the cost of production. The Division is also able to produce motion pictures, film strips, still photographs, and slides, involving specialized interests in the field of public health, on request, where arrangements can be made for a transfer of funds to cover the costs involved. Production is limited to the technical field only. The Division does not undertake work in the field of lay education.

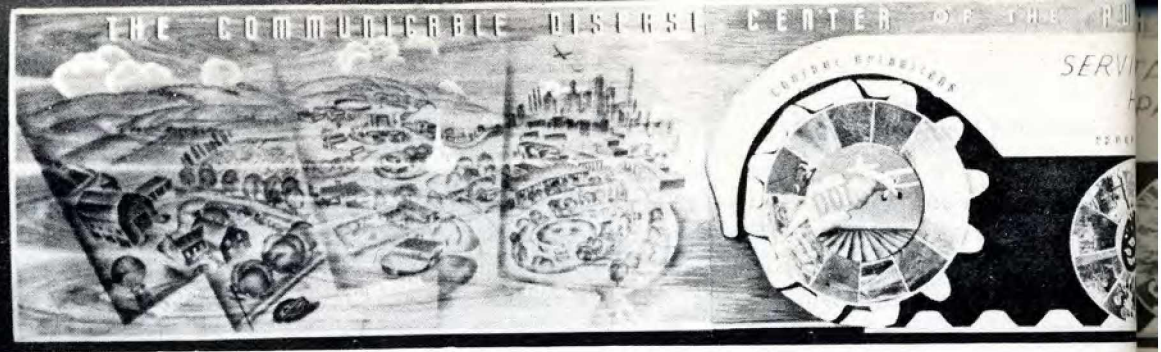
● **ACCOMPLISHMENTS.** Prior to this fiscal year the processing of films and release prints was done by contract with private agencies. With the purchase of professional motion picture equipment and processing machinery, the Division has been able to do practically all of its own work here. During the fiscal year nine motion pictures and 20 film strips were produced and released for distribution, and 12 motion pictures and 17 film strips were in the process of production. These included:

● RELEASED MOTION PICTURES:

Aircraft Quarantine
Sanitary Land Fill
DDT as a Mosquito Larvicide
DDT as a Mosquito Larvicide (English Version)
DDT as a Mosquito Larvicide (Persian Version)
Preparation and Staining of Blood Films
Hydraulic Dredging
Education in Malaria Control
Representative CDC Motion Pictures

● RELEASED FILM STRIPS:

Field Activities, Training Division
Minimum Essential Facts
Arkansas' Unwelcome Guest
Hand Spraying of DDT, Edition III
In Self Defense
Chills and Fever, Why
Your Key to the Malaria Problem
The Genera of Mosquito Larvae — How to Identify Them
Malaria — How to Stop It
Rat Eradication Measures on Ratproofing Projects
Scope and Structure of the CDC of the USPHS
Representative CDC Film Strips
CDC Slides
DDT as a Mosquito Larvicide (Italian Narrative)
DDT as a Mosquito Larvicide (Greek Narrative)
DDT as a Mosquito Larvicide (Persian Narrative)
DDT as a Mosquito Larvicide
Rat Proofing of Existing Buildings



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PRODUCTION

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1 CDC exhibit prepared for a public health meeting.

2 Shooting a motion picture in the field.

3 Project supervisors prepare scripts which serve as guides in the production of films and film strips.

4 CDC motion picture crew planning a "set" according to the script.

5 Taking photomicrographs for a film strip.

6 Preparing art work for film strips and motion pictures.

7 Discussing story board sequences for a film strip.

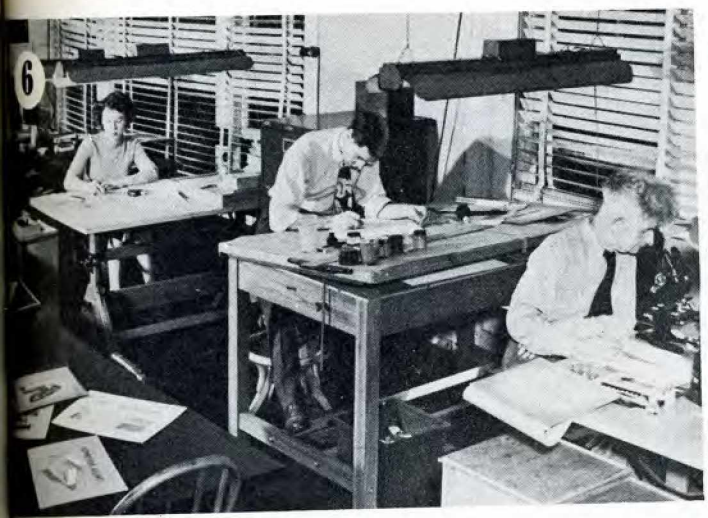
8 Processing photographs for exhibits and for reproduction in handbooks and manuals.

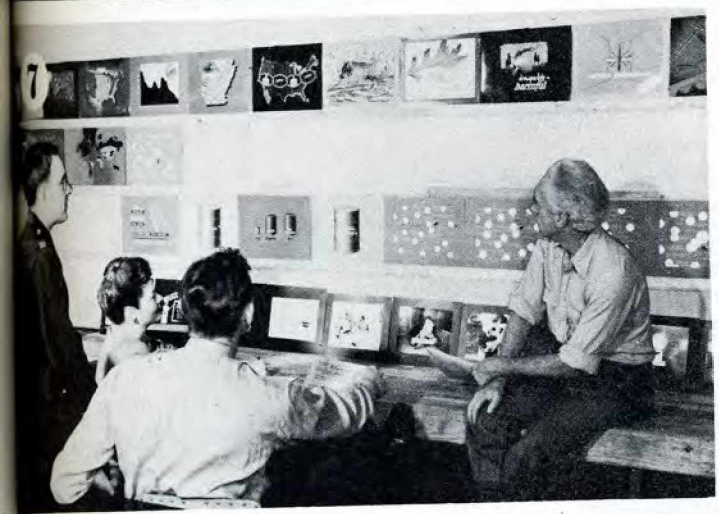
9 Editing motion picture film.

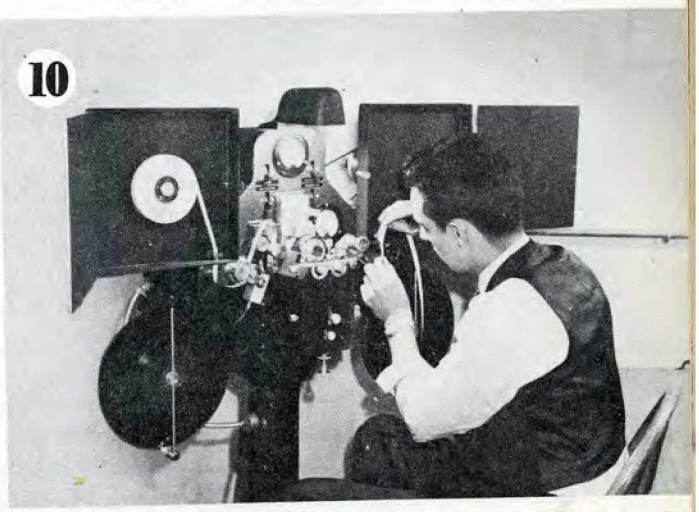
10 Loading a 16 mm. continuous printer to make duplicate prints of a film.

11 "Still" photographs are carefully filed for reference.

DIVISION







● **RELEASED FILM STRIPS:** (cont'd)

Filariasis
Sanitary Design in Drinking Fountains

● **MOTION PICTURES IN PRODUCTION:**

Manson's Blood Fluke
Schistosoma Mansoni Study Films (6)
Diagnosis of Tuberculosis with an Improved Culture Medium
Clinical Endemic Typhus Fever
Typhus Complement Fixation
Epidemiology of Murine Typhus Fever
Hand Ditching in South Carolina
McGehee Bayou
Reservoir Maintenance — Chapter V
TVA — Malaria Control in Kentucky Reservoir
Life Cycle of the Fish Tapeworm
Spleen Puncture for the Diagnosis of Kala Azar

● **FILM STRIPS IN PRODUCTION:**

Hookworm Disease and Hookworm Infection
Clinical *Vivax* Malaria
Clinical *Falciparum* Malaria
The Life Cycle of a Malaria Parasite
Spread and Prevention of Trichinosis
Worms in Your Muscles
Breeding Areas
The Genera of Mosquito Larvae — How to Identify Them
Ecology of United States *Anopheles* Mosquitoes
Identification of Malaria Parasites in the Thick Blood Film
The Life Cycle of the Malaria Vector
Identification of U. S. Genera of Adult Female Mosquitoes
The Identification of Some Common Rat Lice
The Identification of Some Common Rat Mites
Rabies Eradication
The Hospital of Tomorrow
Construction Methods in Ratproofing of Existing Buildings

Within the Division, efforts have been concentrated on improving the photographic and audio qualities of the finished products so that they will compare favorably with the best being produced by others in the field. More efficient scheduling of productions and use of technical personnel has resulted in an increased volume of production. The physical plant has also been redesigned to correct the majority of difficulties experienced in past years. General in-service training of personnel was continued. Sound recording techniques have advanced to the point where the Division is now independent of outside contractural services for a great majority of such work. When additional units to the sound system have been installed and calibrated, the Production Division will be able to produce first-quality sound records for both motion pictures and film strips quickly and economically.

Library and Reports Division

It is the function of the Library and Reports Division to maintain records of past accomplishments and experiences through the medium of a reference Library Branch, and to record current achievements and experiences for future reference through the medium of an Editorial (Reports) Branch. The diversified activities of the Editorial Branch fall into three general categories: reporting of CDC accomplishments; editorial services to CDC; and the preparation of training aids used in the training and orientation programs of the Communicable Disease Center and other Federal agencies. The Library contains basic reference or source books in the various sciences related to communicable disease control and a comprehensive collection of pertinent current periodicals. In addition, the Division is responsible for the review and official U. S. Public Health Service clearance through the Division of Public Health Methods of all manuscripts written by CDC personnel for either presentation at meetings or publication in scientific or technical journals. A complete, cross-indexed file of these manuscripts is maintained for reference purposes.

EDITORIAL BRANCH

The Editorial Branch prepares for publication each fiscal year's annual report, which consists of a detailed, illustrated account of the operations of the headquarters and field offices in regard to activities of epidemiological, entomological, engineering, diagnostic, training, and investigative nature. The annual report also includes an account of CDC programs in each State having such a program. As a corollary to these annual reports, an all-inclusive "History of Malaria Control in War Areas" is being prepared to cover the years 1942-1946. To keep headquarters and field personnel informed of current activities of CDC, the Editorial Branch prepares the *CDC Bulletin* which contains technical and informative feature articles, personnel items, statistics of operations, program notes, and other current information. Other types of reports are prepared at the request of other CDC and USPHS divisions.

Editorial services to the divisions of CDC vary all the way from minor editing to actual writing of articles, reports, guides, and the like. The Editorial Branch is frequently consulted by other divisions in the preparation of manuscripts, manuals, training course outlines, catalogues, etc. Personnel of the Division write scripts or act as technical advisors for films and film strips produced as part of

CDC professional and technical services, and in some cases a member of the Division serves as project supervisor, with the responsibility of supervising the over-all production of audio-visual aids. The Division also cooperates with other Federal agencies, State and local health departments, and private institutions and professional persons interested in public health in furnishing information concerning communicable diseases and their control. All materials released by CDC are edited, marked for typography, illustrated, vari-typed, and "laid-out" for duplication. The production of training aids includes the preparation of manuals and handbooks for use by professional and technical field personnel on operational programs, manuals to accompany motion pictures and film strips, and training manuals and schedules for use in CDC and other USPHS training and orientation programs. The cooperation of all CDC divisions, and other USPHS units, are enlisted in the preparation of these manuals and handbooks.

● ACCOMPLISHMENTS. During the year the last annual report of Malaria Control in War Areas, covering the 1946 fiscal year, was prepared and distributed. This report gave an account of the MCWA program immediately preceding the end of the war, and the changes which occurred as a consequence of the conclusion of hostilities, including the termination of the MCWA organization on June 30, 1946. Four *CDC Bulletins* were issued, one for each quarter of the fiscal year. In order to improve the *Bulletin* along the lines desired by headquarters and field personnel, a questionnaire was sent to all CDC activities requesting comments and suggestions on previous and future *Bulletins*. About 90 percent of the readers expressed a desire for more prompt issuance of the *Bulletin*. This was accomplished by rescheduling publication so that the *Bulletin* was distributed in the month ending the quarter instead of the month following the quarter. The order of preference for items already carried ranked feature articles first, followed by Field Notes, Division and Headquarters Notes, and lastly Tables of Expenditures, Operations, and Personnel. Ninety percent desired the feature articles and Field Notes to be enlarged upon. Ninety-eight percent approved of the general size and format, although 72 percent wanted more illustrations and more technical information. All changes suggested by the survey were incorporated into the *Bulletin*, including also reviews of books relating to public health and films produced by CDC, accounts of experimental projects in progress, and lists of publications of interest to CDC activities. A large majority of the readers were willing to contribute items to the *Bulletin* upon request, and advantage was taken of these offers for future *Bulletins*. More than anything else, this survey showed that the *CDC Bulletin* is an important medium of exchange of information among CDC activities and that it is widely and carefully read by all personnel.

At the request of the Executive Office, a brochure, *Communicable Disease Center*, describing the organization, functions, and services of CDC, was prepared for a meeting of District Directors in Washington, D. C., in April 1947. This brochure was also extensively used by the Training Division in the orientation of trainees and visitors to CDC. A handbook was prepared to accompany the CDC film strip, "Filariasis." This handbook was given to all persons who required more intensive study on that subject. A compilation of all MCWA-CDC scientific publications from 1942 on was prepared for reference purposes. This list is being kept up-to-data in a cross-indexed file. Three revisions of handbooks previously issued were accomplished: *Identification of Female Anophelines of the United States; Larviciding;*

1 Writers gather and coordinate material from many sources in the production of a manuscript.

2 Artists in the Editorial Branch designing cover for CDC bulletin.

3 Vari-typographer, artist, and writer in the Editorial Branch collaborate in laying out the "dummy" of an annual report.

4 Preparing varityped copy from a manuscript for reproduction by photo-offset processes.

5 Vari-typographer placing varityped copy, artwork, and photographs in exact position to be reproduced by photo-offset processes.

and *DDT Residual Spray Operations.* Another handbook, *DDT For Control of Household Pests,* first issued in 1945, was so much in demand that it became necessary to have copies printed by the Government Printing Office. The handbook was revised in cooperation with the Department of Agriculture and put on sale to the general public by the Superintendent of Documents.

For use by the Training Division, a *Schedule of Field Training Programs* for the 1947 calendar year was prepared and distributed. This *Schedule* was sent to all agencies interested in sending employees for training in the control of communicable diseases. In cooperation with the Training Division, a preliminary *Film Catalogue* was issued, describing the motion pictures and film strips produced by CDC. Also at the request of the Training Division, an orientation and training manual, *For the Nation's Health,* was undertaken. This manual, describing the organization and functions of the entire Public Health Service, was originally intended for use only in the CDC Training Division programs. However, the demand for it throughout the Service was so great that it will be issued for use of all the bureaus and divisions of the Public Health Service. Copies of the second draft were mineographed and distributed for temporary use until the final, illustrated manual is completed. The cooperation of all Public Health Service bureaus and divisions was enlisted in securing information for the manual. The Editorial Branch also assisted the Training Division with editorial aid in the preparation of the manual, *Rodent-Borne Disease Prevention and Control.*

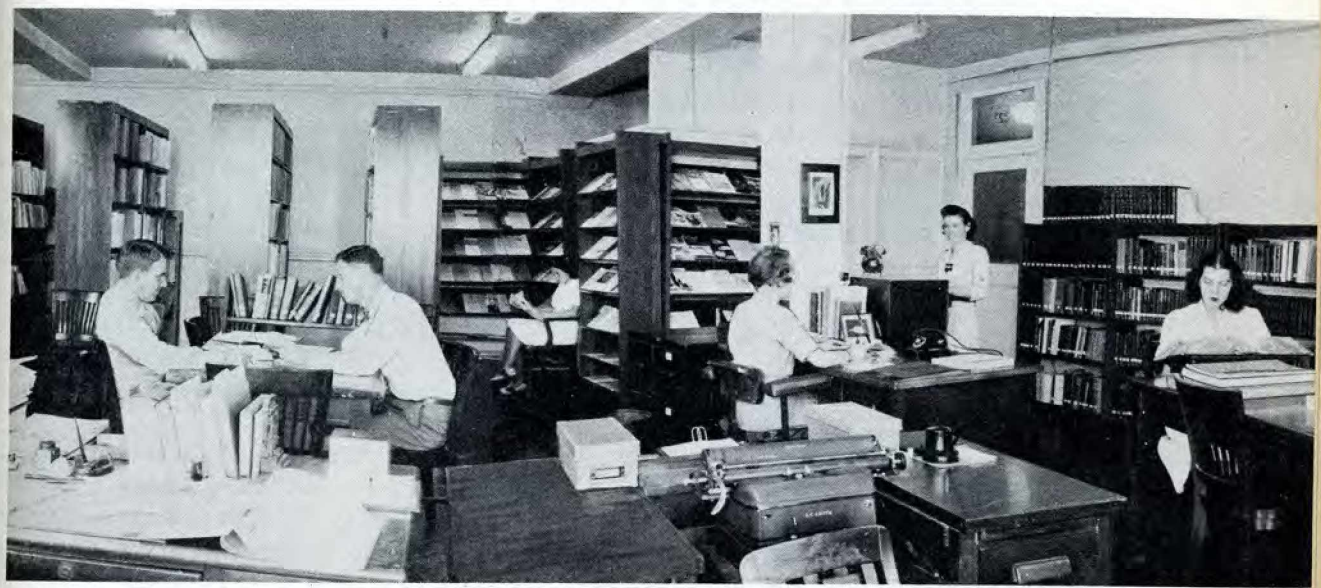
Three manuals were prepared for Public Health Service agencies outside of CDC. The *Commissioned Officers Guide,* containing 30 pages of information of value to newly commissioned officers, was prepared at the request of the Division of Commissioned Officers. Two cancer control monographs were published for Cancer Control Section of the States Relations Division. One, of 80 pages, was entitled *Procedural Analysis of the Compilation of Cancer Data for Statistical Uses in the Massachusetts Department of Public Health Cancer Control Program.* The other, 20 pages, was *General Nursing Policies of the Public Health Service in Cancer Control.*

LIBRARY BRANCH

The Library, which contains basic reference books and current periodicals in the various sciences related to communicable disease control, is used by both headquarters personnel and trainees attending the various CDC training courses. The resources of the Library are also made available to CDC field operations and training activities, and other agencies and individuals interested in public health, on a short or long term loan basis.

The CDC Library completed its first year of existence concurrently with the end of the fiscal year. The first few months were spent in planning the set-up, selecting the best classification system, and collecting for cataloging all of the books and periodicals already acquired by other CDC divisions. Publishers' catalogues, bibliographies, reading lists, etc., were checked for pertinent material. Personnel in the different divisions gave suggestions for necessary items. All phases of communicable disease control were considered in purchasing books and periodicals, but since the Georgia School of Technology held much material on engineering subjects and

Emory University had an excellent medical library, an attempt was made only to fill the needs of medical zoology, which was not covered adequately anywhere in the vicinity. An exchange service was worked out with the colleges, universities, medical schools, and the Georgia State Department of Public Health in Atlanta and vicinity to supply requested reference material not possessed by the CDC Library. Basic books, such as encylopedias, a variety of dictionaries (general, biographical, scientific, and foreign language), indices, and handbooks were ordered.



Panoramic view of the CDC library showing book shelves (right), magazine racks (center), and periodical stacks (left). Not shown here are additional book shelves and the cataloging department. The library is equipped to provide reference materials in the field of medical zoology and, through exchange services with other libraries, references in sanitary engineering and preventive medicine.

The National Institute of Health supplied 2,700 index cards covering communicable disease control, and offered their facilities in an exchange service. The index cards, which were circulated to interested CDC personnel, will later be replaced by the *Quarterly Cumulative Index Medicus*. The Library of Congress sent pull sheets for all entries in medicine and technology, comprising some 3,000 titles. These were valuable in keeping up with new publications, verifying proper entries, and getting card numbers for catalogue cards. Selected items were circulated to interested CDC personnel. The Library also received gifts of books and periodicals from CDC and other individuals.

At the end of the fiscal year, the Library contained 2,200 volumes, of which 900 were out on loan, and about 6,000 cards in the catalogue and shelf-list. There were more than 200 titles in periodicals, comprising approximately 2,000 volumes. Current periodicals were circulated to headquarters and all field station activities. The Library ordered and catalogued all books for field training stations; the Technical Development Division at Savannah, Georgia; the Virus Laboratory at Montgomery, Alabama; the Dysentery Control project at Pharr, Texas; and all district office CDC activities.

Administrative Division

The Administrative Division is an important link in the chain of supporting services to the professional and operational activities of the Communicable Disease Center. It renders assistance by carrying on administrative procedures and paper work with a minimum of burden being placed on the operational and professional personnel. The major responsibilities of the Division embrace appointment, classification, and separation of all headquarters and field personnel; preparation of budget estimates and consolidation of budgets; control of expenditures of allotted funds; payrolls; maintenance of retirement and tax deductions and leave records; issuance of travel authorizations; procurement and distribution of supplies and equipment; security of all Federal property; engineering and statistical drafting; reproduction and distribution of training and similar materials; machine records statistics; maintenance and repair of automotive equipment; files and records; and office services.

Four branches perform the functions of the Division. Two — the Service and Supply Branches — are primarily service units. The other two — the Fiscal Branch and the Personnel Branch — may be considered as management units. In addition there are 22 State and project administrative offices which function in a manner similar to the headquarters branches, and are technically responsible to this Division.

FISCAL BRANCH

The Fiscal Branch is responsible for the preparation of consolidated budgets; control of allotted funds; certification of expenditures; preparation of disbursement, collection, and adjustment documents; coding by accounting classification all accounting documents; maintaining allocations, allotments, and general ledger; designing operating procedure for production of necessary budgetary and accounting data; and preparation of reports for the Central Office and allocation units.

The beginning of this fiscal year saw the inauguration in this Branch of new systems and procedures to insure complete budgetary control throughout CDC activities. An entirely new accounting system was installed, using IBM equipment for detailed recording. These changes and innovations made possible advance estimates for budgets and periodic allocations of funds to a high degree of accuracy, as well as to provide

Preparing the CDC activities payroll.

detailed data of expenditures for reports to all CDC activities, Congress, and the Bureau of the Budget. The functions now performed are in accordance with the regulations of the Comptroller General and conform with those conducted in other Federal agencies. Reconciliation of retirement and tax accounts as maintained in the general ledger and reflected on the individual earning cards was effected, and quarterly reconciliations are now being made. All leave records were inventoried and are now up to date. An audit of travel and miscellaneous vouchers was begun, and the use of authorized signature cards was initiated to protect fund expenditures for travel, services, and supplies. Delegation of authority from the Central Office to issue travel authorizations at this level resulted in prompter payment of travel vouchers. Perhaps the most important contribution to a smooth and continuous flow of work in this Branch was that of the establishment of definite time schedules for the submission of all documents and reports to and from higher and lower echelons.

Gathering data for preparation of CDC budget estimates.

PERSONNEL BRANCH

The Personnel Branch administers personnel policies and procedures established to meet the needs of CDC programs in accordance with Civil Service regulations, and Federal Security Agency and U. S. Public Health Service policies. Programs for the promotion of employee morale and welfare are initiated and encouraged. A great deal of time and effort was directed during the year toward developing standards and securing approval on a wide variety of positions in order to establish uniform qualification standards. Authority was delegated by the Central Office for the classification of positions up to and including P-4 and CAF-11 on which standards have been approved. Authority was also granted for the journalization of two-grade promotions involving salary increases up to 1,000 dollars. Approval of efficiency ratings became a delegated function of this headquarters this year, and a committee of three was established for this purpose. A Board of U. S. Civil Service Examiners was created to prepare and announce examinations, rate examination papers, and register results.

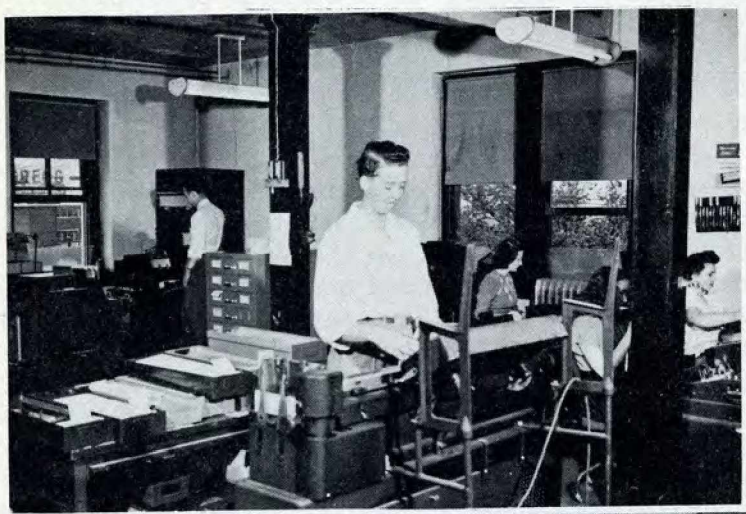
Early in the fiscal year the Employee Relations Section was established for employee counseling, assistance in securing housing accomodations, financial assistance through

Interviewing an applicant for a position with CDC.

the Federal Credit Union, orientation for new employees, and other related activities. Outstanding among the accomplishments was the inauguration of "The Centerpiece," a newssheet for CDC personnel, issued monthly. Other activities included securing chest X-rays, smallpox vaccinations, and blood typing for all employees.

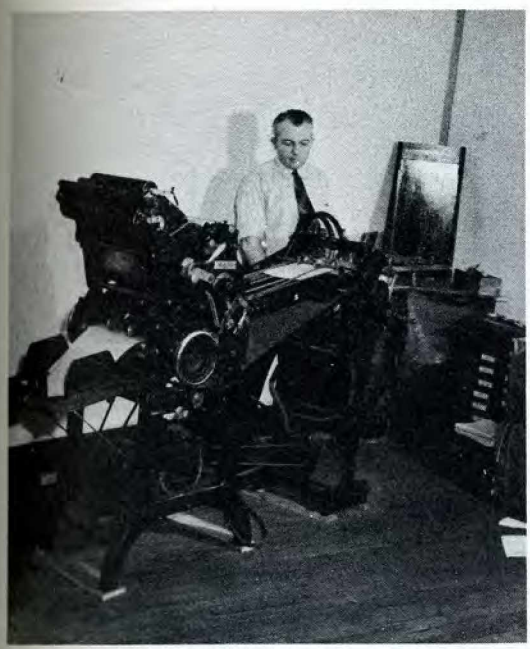
SERVICE BRANCH

At the beginning of this fiscal year the Service Branch absorbed the functions of drafting, mapping, reproduction, and distribution services, and mechanical statistical operations. Drafting services and technical assistance were made available to CDC headquarters and field offices in the preparation of all types of mapping, architectural and mechanical drawings, and statistical charts. Reproduction services included vari-typing; cutting stencils; black line and blue line printing; planograph, mimeograph and ditto reproduction processes; preparation of forms; and the collating, stapling, and distribution of reproduced forms and operational material. The facilities of one of the field offices of the Government Printing Office were utilized for quantity reproductions of large bulletins and manuals.



(LEFT) Statistical records of operational and survey data are tabulated by mechanical equipment.

(RIGHT) The drafting unit produces graphs, maps, charts, and other such materials for use in operational and training programs.



Duplicating equipment in CDC headquarters includes a multilith machine (left), an "ozalid" reproducer (right), a mimeograph machine, and "ditto" processing. This equipment is used to reproduce standard forms, maps, charts, graphs, drawings, and textual matter for operational and training programs.

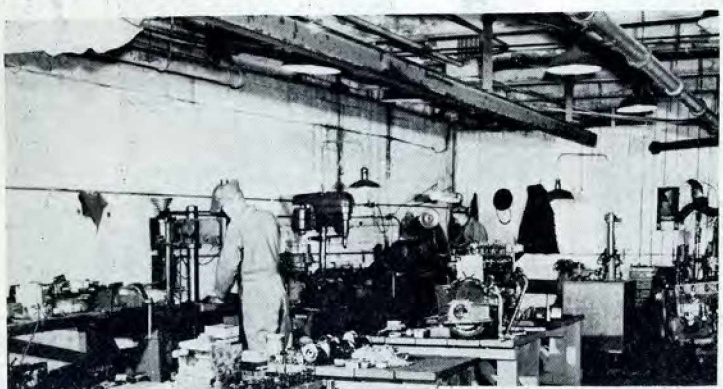
Machine records equipment provided facilities for card punching, sorting, tabulating, and recording of administrative, epidemiological, engineering, and other statistical data. This unit was organized only a short time before the beginning of this fiscal year, but it has grown as fast as necessary equipment could be obtained. Statistical tabulations and records were provided during the year for personnel data and fiscal accounting, mosquito host preference studies, poliomyelitis morbidity, diarrhea and dysentery surveys, rodent examinations, malaria studies, rodent host vector studies, typhus morbidity, and malaria morbidity and mortality. During the latter part of the year a Statistical Committee was established to appraise the statistical requirements of the various operational projects, to develop and establish procedures and schedules to meet these requirements, to determine personnel needs, and other related activities.

SUPPLY BRANCH

The Supply Branch contracts for stores, and distributes supplies, equipment, materials, services, utilities, and space; assembles and maintains property records; handles sales, transfers, or other disposition of non-expendable property; maintains, dispatches, and repairs vehicles; and builds and repairs special field equipment. The activities of the Branch were materially affected during the year by two important procedural changes: (1) delegation of authority to solicit and accept bids for

supplies and materials not exceeding 2000 dollars; and (2) delegation of authority to approve supplements to utility contracts where less than 25 dollars is involved. These changes expedited considerably the procurement of supplies and equipment.

Activities of this Branch were greater during this fiscal year than any preceding year because the establishment of various CDC training and investigational programs required the procurement and distribution of a great deal of equipment and supplies.



(LEFT) Portion of the CDC headquarters garage, where complete engine overhauling and machine shop facilities are available.

(RIGHT) Interior of one of the CDC headquarters warehouses, where "everything has a place." Additional space is required because here there isn't a "place for everything."

An established and proven stock control system and a complete inventory and rewarehousing program was initiated. A catalog of stock items was issued, including instructions and information for ordering and recording. Much effort was expended in the simplification of property accountability and reporting procedures as required by the Central Office. The Federal Tort Claim Act, passed by Congress in August 1946, made the Federal government liable for personal injuries sustained in accidents involving government vehicles, as well as for property damage. Certain changes in the procedure of handling accident reports and claims, the revision of certain forms, and a stricter enforcement of the rules and regulations governing the use of Federal automotive equipment was necessitated by this act.

Since the inauguration of the Communicable Disease Center, effort has been made to secure as much decentralization of authority as possible in order to permit expeditious administrative operation. Almost complete autonomy now has been granted to CDC for procurement, personnel, and fiscal transactions, resulting in more rapid and efficient administrative services in support of professional and operation activities.

Work . . . in the field

In the 14 Southeastern States where communicable diseases such as malaria and typhus were of sufficient endemicity to make necessary extensive control operations, CDC activities were conducted under the jurisdiction of the respective State Health Departments, in cooperation with USPHS District Offices and CDC Headquarters. In the more northerly States, where these diseases were not endemic but a potential hazard existed, CDC activities were carried on from USPHS District Offices, in cooperation with the respective State Health Departments. A CDC representative was placed in each of the 14 State Health Departments and in each District Office (except Districts 5 and 9) to coordinate CDC activities.

District No. 1

Headquarters: New York, New York

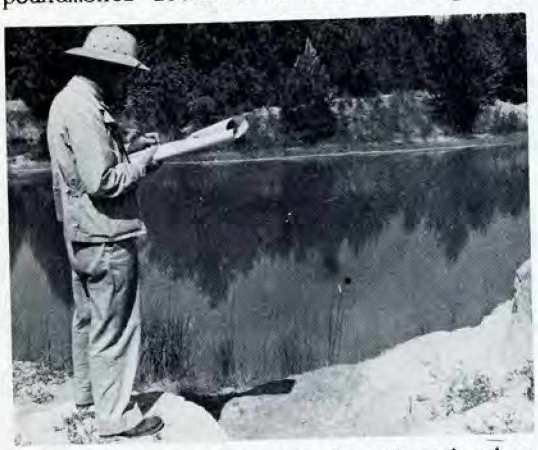
The inauguration of CDC activities in District No. 1 on July 1, 1946 was marked by a post-war modification in concept and policy for the operation of control programs in the ten northeastern States comprising the district. Specific concern with malaria control, although still the keynote, was supplemented with general insect and rodent control for the amelioration of existing health hazards. The great curtailment in the number of military installations obviated much of the problem of malaria control, and active mosquito control operations were restored to civilian authorities and local health agencies. The function of the District CDC Office emerged as that of consultant and technical advisor, and "trouble-shooter" in matters pertaining to insect- and rodent-borne diseases. This transition to the broader community-protection aspect was accomplished during the fiscal year 1947.

MALARIA CONTROL. In the summer of 1946, the malaria potential which had been introduced into this District during the war years was still considered of sufficient possible danger to warrant the continuation of malaria control operations. Two mobile units functioned in District No. 1. Mobile Unit 1, based at Cushing Veterans Hospital (formerly Cushing General Hospital), Framingham, Mass., operated in Massachusetts and Connecticut; Mobile Unit 2 was based at Camp Kilmer, New Jersey, and operated in New York, New Jersey, and Pennsylvania. The District CDC Office exercised general supervision over the field activities. Entomological surveys were carried out at the request of Federal, State, and local governmental agencies, and reports and recommendations were made. Routine identifications of adult and larval mosquitoes were conducted for all field groups and for 11 installations in the First Army area.

Mobile Unit 1 carried on larviciding and minor drainage projects around the Murphy General Hospital and the Cushing Veterans Hospital in Middlesex County, Massachusetts, and the Old Farms Convalescent Center in Hartford County, Connecticut. Occasional inspections were conducted around the West Roxbury and Northhampton Veterans Hospitals in Norfolk and Hampshire Counties, Massachusetts. Mobile Unit 1 was discontinued on September 30, 1946, after the transfer of equipment and supplies to the District No. 1 Office and CDC headquarters in Atlanta, Ga.

As in the previous year, Mobile Unit 2 continued to act as a surveillance unit, affording protection in New Jersey to Fort Dix in Burlington County and Camp Kilmer in Middlesex County. In New York, Camp Shanks in Rockland County and Halloran General Hospital in Richmond County were kept under observation, as was Valley Forge General Hospital in Chester County, Pennsylvania. This unit also gave demonstrations in the use of DDT residual spraying for insect control to interested communities and military installations. Mobile Unit 2 was disbanded in October 1946, and its equipment and supplies were stored in space furnished by Camp Kilmer.

District CDC Office personnel conducted ten surveys at proposed and existing impoundments located in the U.S. Engineer District, Pittsburgh, Pennsylvania, to determine the malaria hazard. The impoundments in Pennsylvania included reservoirs at Crooked Creek, Loyalhanna Creek, Mahoning Creek, Shenango River (also in Ohio), Tionesta Creek, Turtle Creek, Youghiogheny River (also in Maryland), Conemaugh River, and the Allegheny River; and the Tygart River Reservoir in West Virginia. In each survey detailed technical information was assembled and reports and recommendations were submitted through the CDC headquarters office in Atlanta.



Ten surveys at proposed and existing impoundments were conducted by District CDC Personnel in the U. S. Engineer District, Pittsburgh, Penn., to determine the malaria hazard.

MOSQUITO AND OTHER INSECT CONTROL. With the conclusion of the 1946 mosquito breeding season active CDC malaria control operations in District No. 1 ceased. The new aspect, that of consultant in malariology and insect control, became functional in the spring of 1947 when the New York City Health Department, the Veterans Administration, the First Army area, the Federal Public Housing Authority, and local health groups asked for technical advice for their respective malaria and mosquito control programs. Malaria surveys were conducted at Veterans Administration hospitals and centers in New York and Massachusetts. Each center received a light trap and instructions for its operation. Collections were submitted for identification during the mosquito breeding season, and specific advice on control measures was given wherever necessary.

Mosquito light traps were also lent to Public Housing Authority projects and local health departments. The Framingham Board of Health, operating in the area of Cushing Veterans Hospital, and the East Middlesex mosquito control project in the area of the Murphy General Hospital, were lent equipment and were given technical advice on

malaria control procedures. These regions had formerly been protected by Mobile Unit 1. The First Army continued to submit material for identification from all operating installations in the area. Aid was also extended to the personnel of the First Army by participation in training courses in insect and rodent control. General insect control demonstrations and lectures were conducted at Coast Guard Stations, U.S. Marine Hospitals, and various local health and welfare agencies and technical associations.

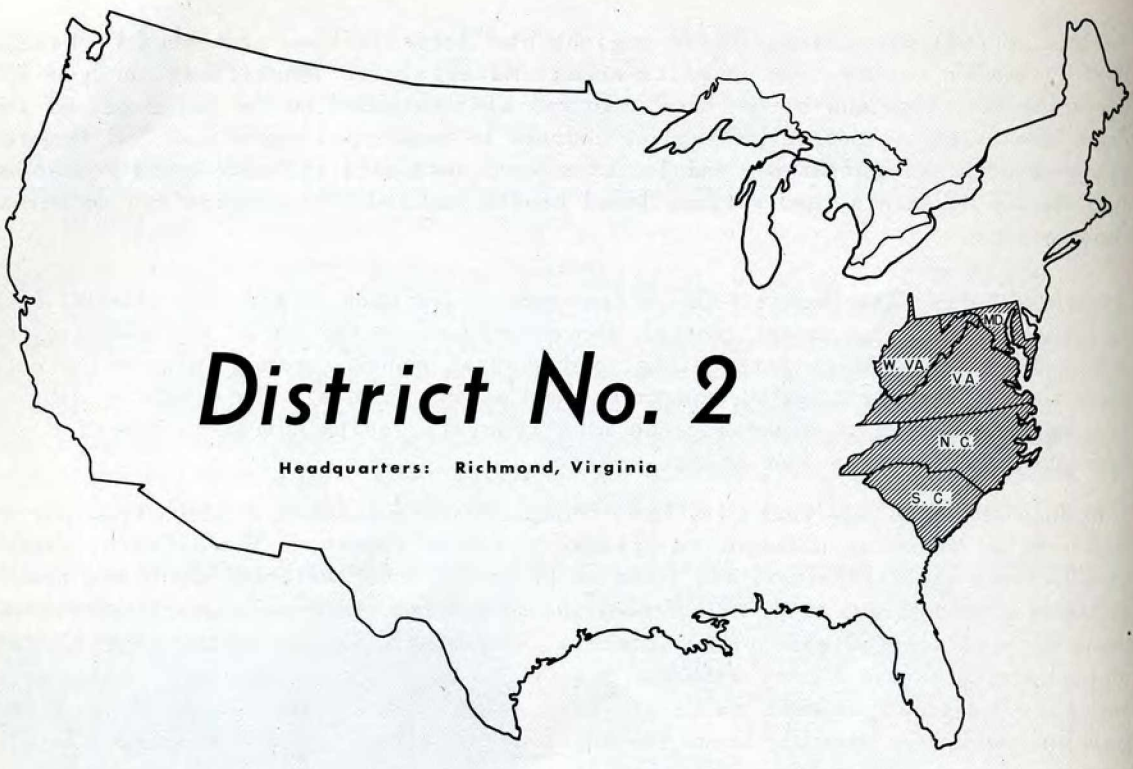
RODENT CONTROL. The District CDC Office was called upon to aid many groups, both public and private, in rodent control. Demonstrations in the use of the rodenticides 1080 and ANTU, advice on ratproofing, and general rodent control information were given to sanitation and health departments and marine hospitals. An extensive library was compiled to aid in answering the many requests for technical information and literature on rodents and rodent control.

In July 1946 the New York City Health Department requested a sanitation survey in the city, where an undiagnosed disease had been reported. The disease, subsequently named rickettsialpox, was found to be caused by *Rickettsial akari* and transmitted by a mouse-borne mite, *Allodermanyssus sanguineus*. This newly described rodent-borne disease aroused widespread interest. Therefore, in the spring of 1947, CDC planned a cooperative survey with the New York City Health Department to secure as much information as possible about the rodent reservoirs and the transmission of rickettsialpox. This agreement for cooperative function was organized to last through the next fiscal year.

District CDC personnel aided many groups, both public and private, in rodent control. Here a rat burrow at the bottom of an elevator shaft is discovered.

MISCELLANEOUS ACTIVITIES. Promotional and recruiting work was carried on for the CDC Laboratory and Training Divisions in connection with training courses for sanitarians, and for technicians and laboratory directors in the laboratory diagnosis of parasitic diseases given for State and local health department personnel. The efforts of the District Office in gathering comprehensive literature and films on all phases of CDC activities has been richly rewarded. Many public and private agencies borrowed technical films and received literature on insect- and rodent-borne diseases and their control.

Representatives from the District CDC Office attended a six-week course in the control of plants detrimental to public health and the use of 2,4-D, the new herbicide, conducted at New York University. Conferences and meetings on noxious plants in the northeast were also attended. Literature, technical information, and laboratory material for pollen identification were made available to State health departments and interested local agencies. Cooperation was extended to the New York City Health Department in their ragweed control program, and power equipment was lent to them.



District No. 2

Headquarters: Richmond, Virginia

CDC activities in District No. 2 this fiscal year consisted of State-operated programs in North Carolina, South Carolina, and Virginia. In Maryland the principal problem encountered, water chestnut in the Potomac River, had been virtually eliminated during the previous fiscal year and the U. S. Engineers maintained patrol activities this year to insure that this aquatic plant did not again obtain a foothold. Antimalaria and anti-mosquito work in the District of Columbia were conducted during this year as a part of the District of Columbia Health Department activities, without Federal assistance.

North Carolina

CARL V. REYNOLDS, M. D.

State Health Officer

During the year extensive programs were conducted in extended malaria control, typhus control, and the supervision of impounded waters. A few small demonstration fly control projects were also operated in scattered areas in the western half of the State, where no residual spraying operations had been conducted, in order to stimulate

the use of DDT in that section. Very little difficulty was encountered in obtaining local contributions to the residual spraying program for the second half of the fiscal year, so that local funds were available to pay all of the spray crews. Extended program larviciding was conducted, with one minor exception, entirely at local expense. Typhus control activities were also carried on almost entirely with local funds. War malaria control operations were confined to two counties. In Buncombe County operations were conducted around Moore General Hospital, consisting of a small amount of No. 2 fuel oil larviciding and ditch maintenance. In Craven County a drainage project previously started on the outskirts of New Bern was completed.

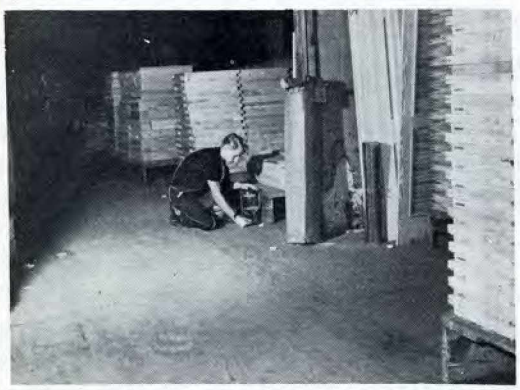
EXTENDED PROGRAM LARVICIDING. Very little larvicide work was actually done on the extended program; the town of Roanoke Rapids applied 1,275 gallons of No. 2 fuel oil with labor furnished entirely by the locality. A part of the oil and equipment was supplied by CDC. Considerable larviciding was conducted by other towns in the State, but these operations were not considered a part of CDC activities since the entire expense was borne locally. The various power companies in the State carried on extensive larviciding programs on their reservoirs, in compliance with regulations of the North Carolina State Board of Health, which provided technical advice.

RESIDUAL HOUSE SPRAYING. During the first half of the fiscal year, with a few exceptions, the total cost of residual spraying was defrayed with CDC funds. Spray crews were made up of one foreman and one laborer, both of whom were required to spray. Each two-man crew was supplied with a truck, three spray cans, and the necessary incidental equipment. The policy regarding CDC participation was changed for the second half of the fiscal year, so that all of the crews doing the spraying were furnished locally, CDC funds being used for materials, equipment, transportation, and supervision only. Local participation in the program was readily obtained. Over the year 53,930 homes in 37 counties received a residual application, at an average of 0.84 man-hour of labor per treatment. At Roanoke Rapids, where over a hundred positive slides for malaria had been reported by the local hospital in 1945, a complete spraying of the entire town, containing approximately 1,700 residences, was undertaken with labor furnished by the municipality and cotton mills. Three, two-man crews gave two spray applications to each home within the city or adjoining urban area. Very gratifying results were obtained; mosquitoes practically disappeared from the town and a sharp reduction in malaria transmission took place. It was the opinion of local physicians that all malaria which occurred in 1946 was due to relapses.

Mortality and morbidity statistics, as well as blood slide surveys conducted by the Malaria Control Unit, indicated a distinct downward trend in malaria. Five deaths from the disease were reported to the Division of Vital Statistics, while the Division of Epidemiology received only 190 reported cases. On a survey taken among school children 13,309 blood slides were examined without finding one positive. On the other hand the existence of a substantial amount of malaria within the State was definitely established by blood slide

Each two-man spray crew was supplied with a truck and the necessary spraying equipment.

Applying DDT dust to a basement window sill in Charlotte. Rats made free use of this entryway into the basement.



Placing cups of 1080 water in a warehouse. 1080 was used only in business areas. Red squill bait was used in residential sections.

Building a ratproof garbage stand back of a large food market. Note dilapidated wooden garbage stand previously used.

examinations of the diagnostic department of the State Laboratory of Hygiene. During the year 1,258 slides were submitted for diagnosis by practicing physicians; of these, 75, or six percent, were positive. Only a small percent of the physicians in the State took advantage of the diagnostic service; some utilized facilities of other laboratories, others had their own technicians, and many relied on clinical diagnosis alone.

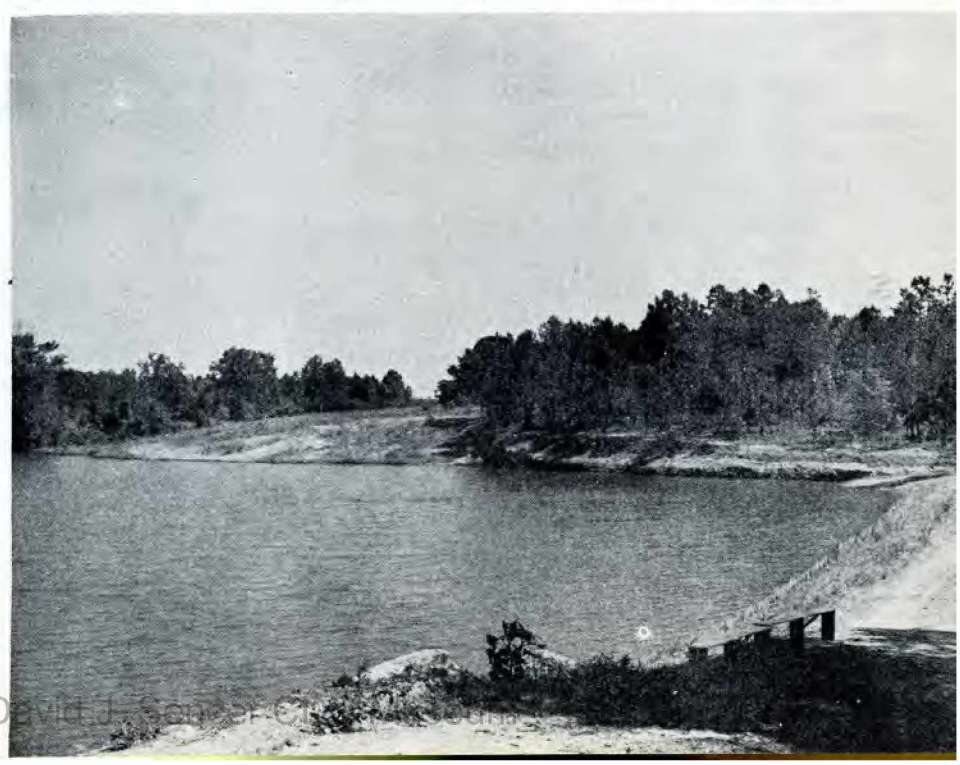
TYPHUS CONTROL. In setting up a DDT dusting program, the city officials were contacted and a program was outlined. The officials were asked to furnish laborers for distributing the dust, storage space for supplies and equipment, and office space. The North Carolina State Board of Health furnished a truck, equipment for distributing the dust, and a foreman to supervise the laborers. Dobbins hand dusters, cyanogas foot pumps, Root rotary dusters, and hand shakers were used in all residential and business areas of the cities and towns. Dust was distributed in rat runs, burrows, and harborages. During the year 57,669 establishments in 13 cities and rural towns in the counties of Craven, Granville, Harnett, New Hanover, Sampson, Wayne, and Wilson received treatment, at an average of 0.25 man-hour per establishment.

No ratproofing was carried on in conjunction with dusting operations, but rat eradication was done concurrently, using red squill and 1080 water. The 1080 water was used only in the business areas under the supervision of the trained foreman in charge of the program. Red squill was distributed in the residential areas by the method of mixing the squill with fish, hog rations, dog bran, a small amount of cottonseed oil, and molasses in a proportion of one to nine. Results have been very effective. Trapping, combing, and bleeding were also carried on in connection with dusting. Rats were trapped, combed, and bled before dusting, and similarly three weeks after dusting.

Ratproofing programs were arranged in a manner similar to dusting activities. City officials were asked to furnish supervisors, a secretary, a revolving fund, a crew of carpenters and a brickmason, and office and storage space. After the program was set up, the business buildings were surveyed and estimated for cost of materials and labor for ratproofing by trained supervisors furnished by the North Carolina State Board of Health. Property owners were required to sign agreements or contracts for the work and were billed for the cost, the funds being reimbursed to the city. During the year 1,514 business establishments in the cities of Durham (Durham County), Winston-Salem (Forsyth County), Dunn (Harnett County), Charlotte (Mecklenburg County), and Goldsboro (Wayne County) were ratproofed, at an average of 30 man-hours per establishment. Concurrent poisoning and trapping activities were conducted in the business establishments and warehouses which had been ratproofed, using red squill, 1080 water, arsenic, and a small amount of DDT dust. The results obtained were very satisfactory; in every instance ratproofed buildings were freed of rats.

The towns conducting rat poisoning campaigns appropriated funds for purchasing bait materials, including red squill, hog rations, dog chow, etc. The preparation and distribution of the bait was carried on by laborers furnished by the town. The Typhus Control Unit of the North Carolina State Board of Health provided part of the supervision for this work, together with the local sanitarian, and sanitarians in adjoining counties. The laborers distributed the mixed bait in all business and residential areas throughout the entire town. Results obtained indicated a 50 to 65 percent destruction of the rat population. A total of 10,910 establishments in ten towns in the counties of Beaufort, Caldwell, Edgecombe, Iredell, Mitchell, Nash, and Rockingham were treated, requiring an average of 0.2 man-hour per establishment to place a total of 785 pounds of red squill bait.

POND IMPOUNDMENTS. It was estimated that approximately 400 small ponds were built in the State for fishing, boating, and other forms of recreation. The State Board of Health required a permit before construction of a pond was allowed, embodying an agreement to maintain the pond in such a manner that it would not breed malaria mosquitoes. The U. S. Soil Conservation Service cooperated with the health department by helping owners to fill out applications, obtain permits, and plan and construct ponds. In this way, little difficulty was encountered in having the owners comply with regulations.



Impoundments in Wake County properly constructed and maintained. Note clean shoreline.

South Carolina

BEN F. WYMAN, M. D.

State Health Officer

During this fiscal year CDC activities in South Carolina were continued under the same organization and administrative practices as control work in the preceding year, with the Division of Preventable Diseases exercising administrative supervision for the State Board of Health. All personnel in the field were assigned and operated as parts of the respective county health departments. Control programs were furnished with an increased State and local participation in lieu of reduced Federal appropriations. The residual house spraying program was expanded to a larger number of counties as a result of this State and local participation, and the typhus and *Aedes aegypti* control programs were carried on to about the same extent as during the previous year. War area malaria control was reduced to a minimum because only permanent war camps remained occupied, and they only with much reduced personnel.

All the programs conducted this year cooperatively by the State Board of Health and CDC have met with very favorable response on the part of the citizens. The DDT residual house spraying program was one of the most popular and effective activities, as evidenced by the fact that a number of people wrote the State Board of Health commending this program, and that the legislature was willing to appropriate substantial sums for this and the next fiscal year's operations. The ratproofing campaigns also were very effective and won approval in the towns in which activities were conducted. In no town in which a program had been begun was it abandoned nor was any great difficulty experienced in completing operations, indicating the extent to which the city officials and owners of business establishments approved of typhus control. The city of Charleston financed completely its own ratproofing campaign. The *Aedes aegypti* control operations won similar approval in Charleston, as indicated by the county appropriating sufficient funds to continue control the next fiscal year.

The contact man prepared the householder for the arrival of the spray crew.

RESIDUAL HOUSE SPRAYING. The extended program of residual house spraying was carried on in 24 coastal counties during the fiscal year, including: Allendale, Bamberg, Barnwell, Beaufort, Berkeley, Calhoun, Charleston, Clarendon, Colleton, Darling-

Two-man spray crews were employed, using hand-type sprayers. A few counties were provided with power equipment.

ton, Dillon, Dorchester, Georgetown, Hampton, Jasper, Lee, Marion, Marlboro, Williamsburg, Aiken, Florence, Horry, Orangeburg, and Sumter. All rural homes in these counties were sprayed, with the exception of parts of the last five above-mentioned counties. The houses sprayed in April and May of the preceding year were given a second treatment in August and September of this fiscal year. Houses sprayed during June to August were given only one treatment. A total of 126,994 sprayings was applied, using an average of 1.86 pints of 35 percent DDT concentrate per house. Spray crews spent an average of 1.03 man-hours applying each residual treatment, with an additional 0.3 man-hour per house being expended on supervision, mapping, and miscellaneous time lost. An additional 6,916 houses were sprayed through cooperation of the State and local counties, with no Federal appropriation being involved. These houses were located in incorporated towns and cities not included in the regular extended program in Colleton and Barnwell counties, and rural homes in Greenwood, Laurens, Saluda, Edgefield, Richland, Kershaw, and Chesterfield counties. The latter three counties were included in the extended program in the spring of 1947.

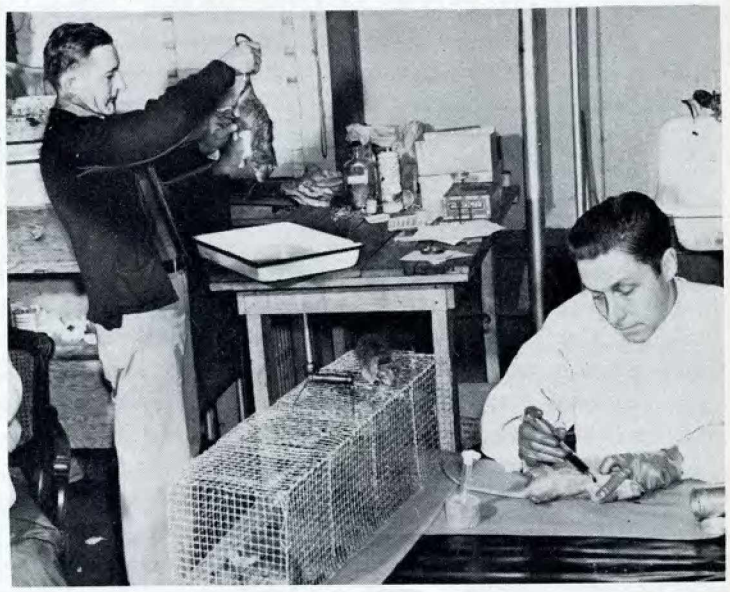
Two-man spray crews were employed on the extended program, using Hudson type pressure sprayers. A few counties were provided with power equipment. During the first half of the fiscal year CDC furnished all equipment and personnel. During the second half of the year CDC furnished equipment, supplies, county supervisors, an administrative assistant, clerical personnel, and two district engineers. The State Board of Health provided labor, a part of the field supervision, the director, a State supervising engineer, a district engineer, and two entomologists who supervised the inspectional activities. The South Carolina State Legislature appropriated substantial amounts to pay the labor costs and also to purchase some DDT.

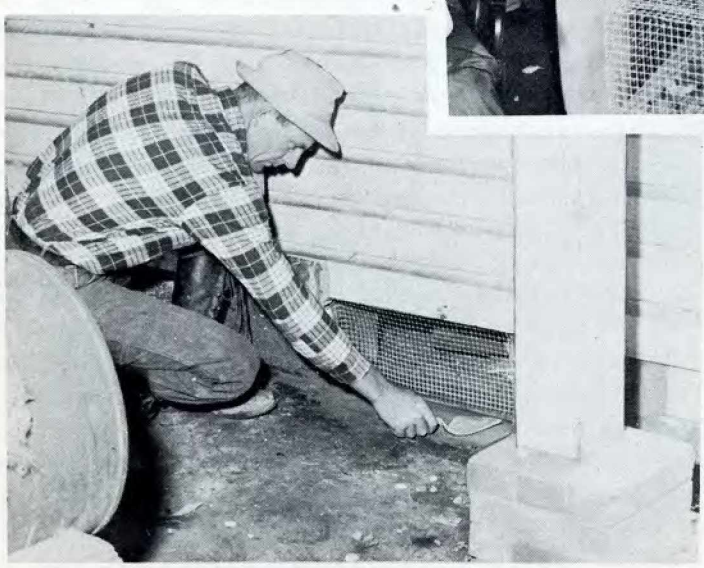
The plan in South Carolina generally was to conduct schools by districts for training the county supervisors in the proper technique of house spraying. These supervisors then conducted two-day schools for the spray crews on their programs. There was considerable turnover in spray crew personnel. During the second half of the year a county supervisor was assigned to each of the 24 counties, with responsibility for the operation of the program and for the entomological surveillance. The result of this arrangement was disappointing, especially in regard to surveillance. Available entomological data showed that of 12,073 sprayed houses inspected, 305 or 2.5 percent were positive for mosquitoes; of 1,729 unsprayed houses inspected, 720 or 41.6 percent were positive. These data indicated satisfactory control in the sprayed houses for a period of eight to 12 weeks. Inspections were based on houses sprayed with 2½ percent DDT. During 1947, five percent DDT was used for the most part. An experimental project was carried on with DDT spray percentages from one through five, and results indicated that the five percent spray was the most lasting of those tried.

WAR MALARIA. Permanent military camps at which malaria control operations were conducted this year included the Navy Yard at Charleston, Shaw Air Field at Sumter, and Fort Jackson in Richland County. Drainage operations were confined to cleaning ditches and ponded areas, and larviciding activities were carried on at a minimum in the zones around the much reduced housing areas. Fuel oil was used exclusively, applied by hand sprayers. The control was satisfactory and no complaints of mosquitoes were received from Army personnel. Control operations were also carried on at these bases by the respective military organizations. The city of Spartenburg conducted its own program of ditch cleaning of the lined ditches previously constructed as a protection to Camp Croft. During the year 459 gallons of fuel oil were used to larvicide 453,480 square feet of watered surface, and 12,009,300 square feet of ponded areas and 146,702 linear feet of ditches were cleaned.

TYPHUS CONTROL. DDT dusting for typhus control was carried on by four mobile units, which applied ten percent dust in all business establishments of 79 towns and cities in nine counties. The Charleston unit, consisting of a supervisor, a foreman, and two CDC laborers, serviced Charleston and Dorchester counties. Late in the fiscal year an experimental program of five percent DDT dusting was begun in Charleston.

Ectoparasite and serological examinations of trapped rats were used to evaluate the effectiveness of the DDT dusting program. →





Installing a hardware screen in a building as part of the rat stoppage and proofing program in Charleston. ←

The other three units were each supplied with CDC equipment, dust, and a Typhus Control Aide. The Aide regularly visited and dusted business establishments in his area with the help of one or two local laborers furnished by the respective towns. Mobile unit 1 included Allendale, Bamberg, and Colleton counties, operating from Walterboro. Mobile unit 2 included Beaufort, Hampton, and Jasper counties and operated from Beaufort. The Orangeburg unit included only Orangeburg County, but almost as many cities and towns as in the other areas. A total of 6,645 business establishments was dusted during the year, in approximately the same area as covered in the preceding year.

Ratproofing programs were conducted in business establishments in the cities of Charleston (Charleston County), Florence (Florence County), Laurens (Laurens County), and Anderson (Anderson County), and in rural schools in Fairfield County. In the urban areas the local supervision was furnished by CDC and the labor was supplied by the respective cities. The general plan was the same as used previously, with the city adopting a rat control ordinance and underwriting the program and the owner of each ratproofed premise paying to the city the actual cost of operations. The State Board of Health furnished the director of the program and one sanitarian who did promotional work and some supervision; an assistant to the State sanitarian was provided by CDC. The ratproofing program was conducted on a block or unit basis and included vent stoppage, the use of chain walls where necessary, and such other construction as required to render the building ratproof. Rat eradication was carried on following proofing, and all ratproofed buildings were also dusted. A total of 492 business establishments and 11 rural schools was ratproofed during the year. Poisoning campaigns were carried out in the cities of Florence and Sumter, using red squill mixed with horse feed at the rate of one part squill to 12 parts feed. The ratproofing and poisoning programs were very successful, and typhus fever was reduced considerably in all towns treated.

AEDES AEGYPTI CONTROL. *Aedes aegypti* control was carried on in the city of Charleston as an integral part of the general sanitation program. Operations were conducted to about the same extent as in the preceding year; the Charleston County Health Department replaced the four CDC inspectors withdrawn from the program. Inspection of individual premises was done during the breeding season and filling of potential breeding places and closing of cisterns during the winter months. This year a total of 34,604 premises was inspected, of which 1,368 were found to be breeding yellow fever mosquitoes and were treated; an index of 3.95. The *Aedes aegypti* program in Charleston proved effective enough for the county to appropriate funds for its continuance next year to the same extent as in previous years.

EXPERIMENTAL WORK. The program of epidemiological and entomological studies was continued at the Manning station, but a reduction in staff necessitated a reduction in the area under study. Monthly blood films, however, continued to be collected from more than 90 percent of the 2,000 inhabitants of the area. The entomological studies on the density and species of mosquitoes were carried along with the dissection of both *A. quadrimaculatus* and *A. crucians* mosquitoes. Some studies were also begun on avian malaria. The Manning station also cooperated with the Malaria Research Laboratory, National Institute of Health, Columbia, S. C., in their studies on the infectivity of local cases of malaria in this area to mosquitoes.

Virginia

L. J. ROPER, M.D.

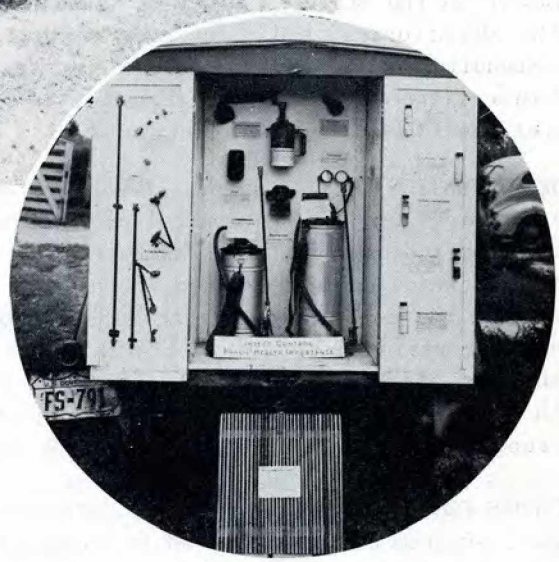
State Health Commissioner

During this fiscal year local participation in mosquito control replaced the extensive war malaria program carried on during the war years. The CDC funds for malaria control were greatly reduced, making it necessary to curtail the program both in scope and amount of work. Operations were conducted only around the most important permanent military establishments and VA hospitals, and surveillance was maintained in the less important areas. Local mosquito control districts were promoted to make up for the reduction of the Federal program, and seven such districts were established. Men trained on the war malaria program were used to operate the local mosquito districts. Substantial sums were appropriated by these districts for mosquito control, abetted by State funds. Other State activities included a program for residual spraying of public institutions, the creation of a demonstration insect and rodent control unit, and a typhus control program. The State CDC office also cooperated with the CDC Impounded Water Section in securing and assembling data on the proposed Buggs Island Reservoir.

MOSQUITO CONTROL. Many war areas which had formerly contained military establishments were eliminated this year, and the remaining areas were greatly reduced in size. During the year a total of 13 military establishments and seven VA hospitals throughout the State received malaria protection by larviciding, clearing, cleaning, and surveillance. A summary of control operations included 378 acres dusted with 555 pounds of paris green, 690,900 feet of ditches under ten feet wide larvicided with 1,775 gallons of oil, and 131 acres of breeding area treated with 1,172 gallons of oil. Also, 900 linear feet of ditches were cleaned and 49,600 square feet of potential breeding area cleared of vegetation. A total of 10,395 man-hours was expended, of which 3,602 were for control operations and the remainder were spent on maintenance, building, surveys, demonstrations, and miscellaneous activities. The equipment in Virginia is old, and a repair shop was kept busy maintaining vehicles. The war program was directly credited for establishing mosquito control on a permanent basis in Virginia.

Mosquito control was also carried on in six Federal Public Housing Authority projects on a reimbursable basis during the 1946 breeding season, and again in the 1947 season. Operations included 2,865,300 feet of ditches larvicided with 9,400 gallons of oil, 344,100 square feet of clearing, 90,089 feet of ditch cleaning, 2,981 linear feet and 207 cubic yards of ditching, and 76,000 square feet of ditch bank spread. A total of 8,350 man-hours was expended on operations, inspection, supervision, etc.

In January 1947, the Virginia Mosquito Control Association was formed to further mosquito control activities in the State. All interested persons were eligible, and over 100 members, including many influential citizens, joined the association. A



MOBILE DEMONSTRATION UNIT. Side panel lifts to show rodent control demonstration. The opposite side panel (upper inset) shows mosquito control, and the back of the truck (lower inset) is devoted to control of other insects of public health importance.

(LEFT) Sanitary Landfill. Land reclaimed by this garbage disposal method is to be used for a housing project in Norfolk, Virginia. (BELOW) Sanitary garbage collection truck used in Fredericksburg, Va.

monthly paper, "The Skeeter," kept the membership fully informed of the mosquito control activities in Virginia, as well as in other parts of the United States and the world.

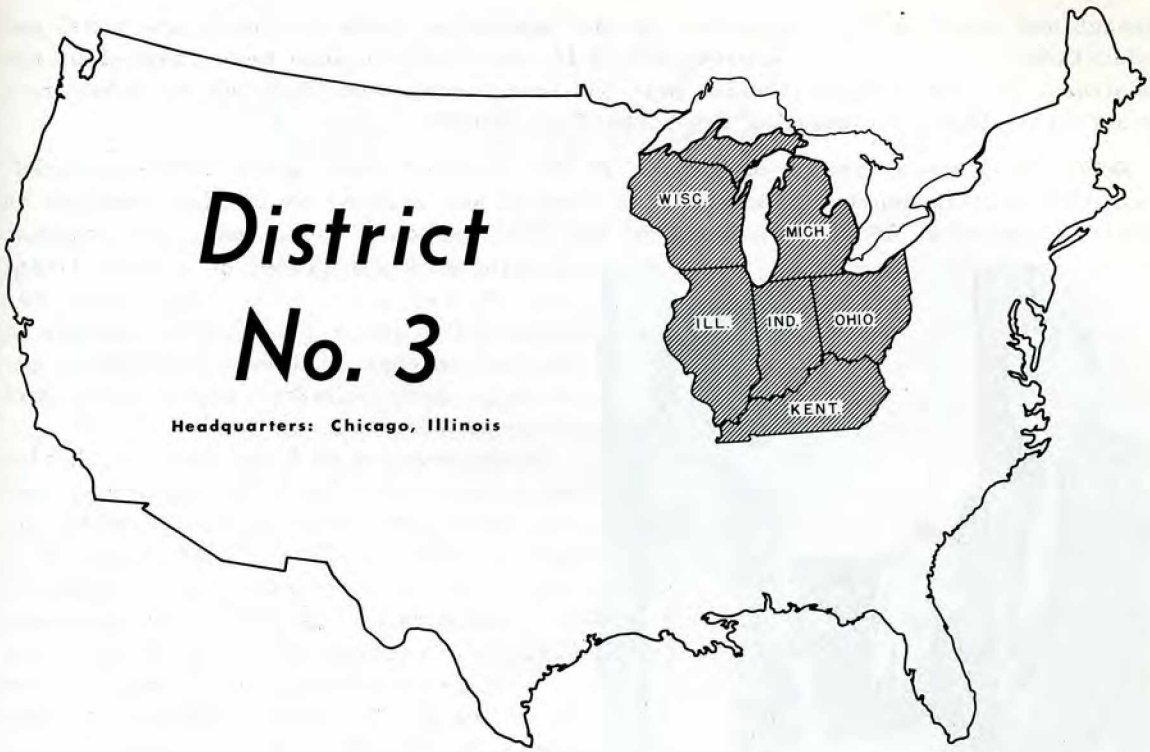
INSTITUTIONAL RESIDUAL SPRAYING. During the summer of 1946 a program for spraying public institutions was inaugurated. The purpose was to demonstrate the proper use of DDT residual spray against certain household pests and insects of public health importance, and to correct a great deal of confusing and conflicting information which had been given out about DDT. This program also served to keep intact a crew especially trained in residual spraying for emergency use in the event of a malaria outbreak anywhere in the State. A total of 83 institutions, including kitchens, rooms, dining halls, dormitories, beds, porches, toilets, and dairies and stables, was sprayed at an expenditure of 54 gallons of DDT concentrate and 549 man-hours of labor, inspection, and miscellaneous time. Also, 45 employees of these institutions were trained in the proper use of DDT. Public reaction to this program was very good.

DEMONSTRATION UNIT. A special truck was equipped as a demonstration unit to exhibit the equipment used in the control of mosquitoes, other insects of public health importance, and rodents. The body was built on a pick-up truck, with panels on the back and two sides which could be opened for exhibit and closed in a few minutes for traveling. The truck was also equipped with an air compressor so that it could be used as a work truck for residual spraying. The unit was shown at seven locations to 181 nurses, sanitation officers, and health officials. This demonstration unit was a joint project with the District 2 office. As a result of this and the other State activities an increasing interest in insect and rodent control has been manifested in the State.

TYPHUS CONTROL. Beginning in the latter part of the previous fiscal year, a typhus control program had been started in Norfolk City. The work was discontinued at the end of November 1946 and resumed again in May 1947. The program consisted of dusting rat runs with ten percent DDT powder. Rats were trapped, bled, and combed before and after dusting to test the effectiveness of the control measures. Before dusting 138 rats were trapped, with an average flea count of 3.7 per rat. After dusting only two fleas were found on one rat of the 103 trapped. Positive typhus complement-fixations reactions were obtained in 17.7 percent of the rats taken. During the first part of the program, the city contributed 34.4 percent of the total cost of operations. This was increased in the 1947 season and will probably amount to 75 percent.

After the dusting program terminated for the winter, beginning in December 1946 rats were trapped in several communities to determine the amount of typhus fever in the rat population. In Norfolk City it was found that the percent positive reactions had dropped from 17.7, as previously obtained, to 6.1 in 410 rats taken in this survey. Portsmouth City had a 3.3 percent positive reaction among 151 rats trapped. Data in Norfolk County and Newport News is still incomplete. Of the 3,370 man-hours spent on this survey, 2,566 were local man-hours and the remainder contributed by CDC.

Although typhus fever apparently is not involved in all Virginia communities, several cities expressed an interest in rat control programs. Surveys of rat populations were made in Roanoke, Lynchburg, Newport News, Portsmouth, and Charlottesville. Ratproofing ordinances designed according to U. S. Public Health Service standards were adopted in Norfolk, Richmond, and Roanoke. In all cases, rat control work was performed by private pest control operators according to local health department specifications.



Expanded community insect and rodent control services and the virtual termination of the war malaria control program marked the introduction of CDC activities in District No. 3 this fiscal year. The activities of the District personnel included the supervision of the DDT residual spray program in western Kentucky, where approximately 18,000 homes were sprayed for malaria control. In addition a large number of requests were received from the six States comprising the District for assistance on insect and rodent control problems. To better handle these requests, an insect and rodent control mobile demonstration unit was developed for direct assignment to the States. This unit consisted of a one-ton enclosed truck carrying equipment for the application of insecticides and rodenticides, and samples of the various formulations of DDT and other insecticides and rodenticides.

ILLINOIS The war malaria program in Illinois consisted of entomological surveillance of the areas around Scott Field and Chanute Field, carried on by District CDC personnel. Another CDC activity in the State was the conducting of an insect and rodent control seminar at Peoria, under the joint sponsorship of the Illinois Department of Public Health, the Peoria Health Department, and the District CDC Office. District personnel also appeared on various other State programs to discuss insect and rodent control. The insect and rodent control mobile demonstration unit was used to a considerable extent by the Illinois Department of Public Health throughout the southern part of the State in connection with DDT demonstrations at county fairs and the like.

INDIANA. Assistance was given the city of Terre Haute, through the Indiana State Board of Health, in conducting its malaria mosquito control project. At the request of the State Board of Health the District CDC Office also assisted in conducting three

insect and rodent control seminars for the benefit of State hospitals and penal and educational institutions. Approximately 16 such institutions were covered by the seminars. The mobile demonstration unit was used during these meetings to demonstrate practical methods recommended for control of insects.

KENTUCKY. Kentucky is the only State in the District which had a "State-operated" extended malaria control program. This program was carried on in nine counties in western Kentucky. At the beginning of the 1947 season's operations, the residual spraying work was placed on a local financial basis; i.e., each home owner was requested to pay a fee of three dollars to defray the cost of labor. Equipment, materials, and technical supervision were financed from Federal funds.

Photo courtesy Courier—Journal and Louisville Times

Insect and rodent control seminars stimulated several communities to begin control programs.

In cooperation with the Kentucky Health Department and other local agencies, several insect and rodent control schools were held in various parts of the State. As a result of these schools several communities inaugurated insect control programs. Also, it was expected that several rat control programs would be started at the beginning of the next fiscal year. About nine cases of endemic typhus fever were reported from Bowling Green. A complete survey of typhus conditions, including epidemiological studies, was being conducted in this area. Present indications would seem to justify the inauguration of a typhus control program in this area.

MICHIGAN. At the request of the Michigan Department of Health a program for ratproofing and rat eradication was outlined for Detroit. Considerable time was spent in assisting this city in the preliminary planning for a rat control program. Similar assistance was also given to several other localities in Michigan.

OHIO. A two-day insect and rodent control school was conducted in Columbus for State sanitary engineers and sanitary inspectors. The purpose of the course was to thoroughly acquaint these health workers with the use of recently developed insecticides and rodenticides on insect and rodent control programs. The mobile demonstration unit was used quite extensively. Much time was spent in Ohio in discussing the various phases of insect and rodent control activities before meetings of local health departments, city officials, and various civic groups. Also, consultative services were given to several communities for the organization of rodent control programs.

WISCONSIN. At the request of the Wisconsin State Board of Health a two-day insect and rodent control seminar was held at the Mendota State Hospital for approximately 60 State employees. Assistance was given to several cities in Wisconsin which desired to organize rat control programs.

Kentucky

PHILIP E. BLACKERBY, M. D.

State Health Commissioner

Increasing local participation was developed under this fiscal year's State CDC activities policy, and it is believed that this policy can be maintained until eventually the main contribution of CDC will be in technical and advisory capacities. The programs carried on by CDC, or given technical aid and direction, included entomological inspection of war areas and veterans' hospitals, extended program larviciding and spraying, typhus surveys, fly control projects, and public institutional spraying. For administrative purposes the State was divided into two districts: District I, with headquarters in Paducah, comprising the "Purchase Area" of western Kentucky and a few adjoining counties, included that part of the State in which extended program spraying and larviciding were carried on; District II, supervised from the State office in Louisville, included the remainder of the State in which activities were mainly inspection and control of malaria mosquito populations for the few remaining military establishments and for veterans' hospitals.

EXTENDED PROGRAM LARVICIDING. In the larviciding program carried on during the first half of the fiscal year, activities were conducted largely by employees of the local health units, with materials, equipment, and technical supervision furnished by CDC. The larvicide used was a solution of 0.05 pound DDT per gallon of Diesel oil with a good spreading agent added. Applied at the rate of one gallon to an acre of water surface, satisfactory control of all *A. quadrimaculatus* and most culicine

Extended program inspection and DDT-diesel oil larviciding in Guthrie Pit at Paducah.

larvae was maintained, and no reports of ill effects on fish or wild life were received. The population centers in and around the cities of Paducah, Mayfield, Murray, and Fulton received larviciding protection. A total of 873,000 linear feet of ditches and 56 acres of water surfaces were larvicided with 100 gallons of the DDT-oil solution. Man-hours expended for both larviciding and inspection totaled 1,456. Very few of the A, B, or C stations inspected had more than ten *Anopheles quadrimaculatus* adults per inspection for more than one week throughout the season.

RESIDUAL SPRAYING ACTIVITIES. During the first half of the fiscal year, the CDC residual spray program operated in the most malarious portions of 10 counties in western Kentucky: Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Livingston, Lyon, Marshall, and Trigg. A total of 6,967 applications were made, using an average of 0.68 pound of DDT and 1.1 man-hours per house. In the 1947 season operations were carried on in nine counties; Trigg and Lyon counties were dropped because of the slow progress made in public contribution campaigns. During this period 11,207 houses were treated with five percent DDT emulsion, using an average of 0.9 pound of DDT and 2.36 man-hours per house. The increase in DDT per house was due to the larger houses being sprayed in cities and towns which were larvicided in the previous season. The increased man-hours per house application resulted from sick leave, annual leave, travel, time lost because of inclement weather, time spent in public contribution campaigns and workshops, etc., being included in man-hours per house on progress reports. Another factor involved in the increase was the turnover in State personnel. In the 1946 season a total of 227 entomological inspections was made of both sprayed and unsprayed premises in the ten counties operated. Of 139 sprayed houses, 4 or 2.9 percent were positive for *A. quadrimaculatus;* while of 88 unsprayed houses, 19 or 21.6 percent were positive. Thus, in the same general regions, malaria mosquitoes were found over seven times as often in unsprayed as in sprayed homes.

The residual spray crews were composed of one sprayer foreman and two or three sprayer laborers, assisted by a contact man and an area supervisor who also helped with the contact work. The crews having three laborers were used to advantage in the larger towns and cities. During the 1947 season CDC personnel were used only for supervision. Local employees were certified under the State Merit System, and were given one day's training at district headquarters in Paducah before being sent out into the field with experienced crews to observe and actually take part in spraying operations. Each foreman was assigned a half-ton truck equipped with necessary pressure spray cans of the four gallon Brown type, and other equipment. The central mixing plant at the Paducah district office mixed and distributed DDT concentrate, installed compressor units, and repaired and painted equipment and vehicles, in addition to building display units and

Treating kitchen walls with DDT spray.

taking part in promotional activities.

Much of the accomplishment in the way of local participation in the residual spray program was attributable to the cooperation of public-spirited organizations and individuals. Individual home demonstration agents, county farm agents, school teachers and principals, and county school superintendents lent active aid in promoting the program. Local newspapers gave willingly of space for information and advertisement, and local radio stations gave time for instruction and promotion. In each of the counties having residual spray operations, one or more clubs and organizations acted as sponsors of the program, and as promotion and collecting agents. An information specialist added to the western district staff furnished data and educational films, assisted in writing newspaper articles and radio scripts, and participated in a total of 42 public programs and 159 conferences with local health officials, sponsors, and school officials. Each county supervisor was responsible for collecting three dollars from each household to be sprayed, to defray labor and other expenses.

Mixing DDT concentrate at Paducah central mixing plant.

INSTITUTIONAL SPRAYING AND WORKSHOPS. In order to better acquaint the people of the State, especially those in public office, with the effectiveness and technique of the application of DDT, a program of spraying public institutions was carried on for the second time throughout the State. In this program, which was conducted during the late fall and winter, tax-supported and charitable institutions were sprayed for cockroaches, bedbugs, and other household insects. During the year 16 large State and Federal establishments, and schools, infirmaries, county farms, jails, courthouses, kitchens, dining rooms, and sleeping quarters in 71 counties were sprayed, using a total of 1,355 gallons of DDT Isomer concentrate at an expenditure of 1,297 CDC and 1,409 local man-hours of labor. Also, workshop programs were continued this year in both DDT and rodent control. Seven workshops featured films, talks and demonstrations. At the request of the District No. 3 office in Chicago, an insect-rodent control demonstration unit was built on a truck by the Paducah district maintenance shop. This display truck was used six different times within the State.

WAR MALARIA. Regular entomological inspections were made around three permanent war areas— Camp Campbell in Christian County, Fort Knox in Meade and Hardin counties, and the Army Medical Depot in Jefferson County. Entomological surveillance was maintained for the three veterans' hospitals within the State. At no time during the year did the *Anopheles quadrimaculatus* populations around these war areas warrant larviciding. On the basis of the 1945 and 1946 seasons' findings, inspections during the 1947 season were made at bi-weekly intervals, or less frequently, unless otherwise indicated by unexpected rises in mosquito populations.

TYPHUS CONTROL. Very few cases of typhus had been reported annually for the State of Kentucky during the past years. However, during the fall and winter of 1946, an increase in reported cases of typhus occurred in the city of Bowling Green, Warren County, near the southern line of the State. At the request of the local health officer of that county, CDC inaugurated a typhus survey in Bowling Green during the spring of 1947. This survey included a study of the rate of typhus among rats, the number and kinds of rat ectoparasites, and reported human cases as well as a search for unreported cases. As a first step in the inauguration of a long-term control program, the city was encouraged to establish an approved system of garbage pick-up and disposal. The typhus and rat problem of the city was kept before the public by means of newspaper articles, talks to clubs, and by personal contact with business men and city officials.

Sera from 30 rats trapped were given the complement-fixation test and 13 or 43 percent were found positive. These positives were rats from two different establishments which had been indicated as probable foci of infection by a study of the human case histories. Flea populations on 42 rats trapped were quite low, as could be expected for the time of year the survey was made (March). It was planned to make another study of the rats of the town later in the season to obtain the midsummer-flea index and to determine more accurately the extent of typhus among the rats of the city.

FLY CONTROL. Two cities of the State have inaugurated DDT fly control programs, and a third city was making plans for such a program. CDC personnel gave aid and advice in these programs and provided entomological evaluation of the work.

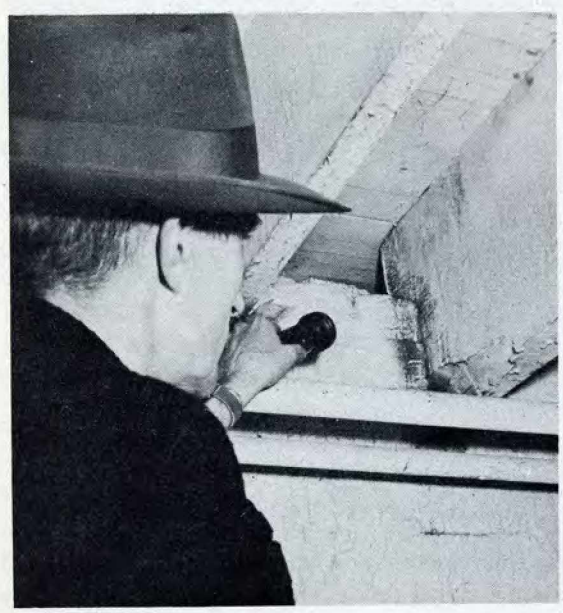
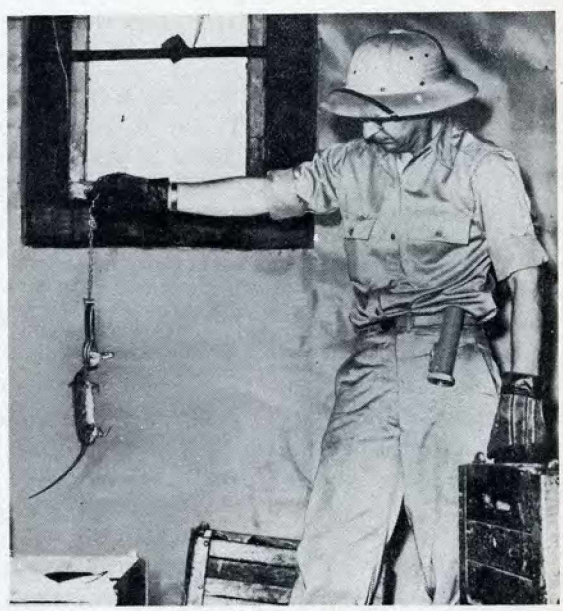


Photo courtesy Courier — Journal and Louisville Times

Practical training in rat control was stressed in seminars for county inspectors. Here trainee discovers a rat run.



Rats were trapped for serological and ectoparasite examinations. These data, when correlated with the incidence of human cases of typhus fever, were used to delineate foci of infections. Control operations were then applied to these foci.

With the initiation of CDC activities in District No. 4 this fiscal year, the scope of public health protection for the population of the seven States comprising the District was broadened to include many services not heretofore offered on as large a scale. Although malaria control continued as the principal program, the shift in emphasis from war malaria larvicidal operations to protection of the entire civilian population in endemic areas by residual spraying methods was completed this year. Other new or enlarged programs included typhus control, water hyacinth eradication studies or surveys, and fly control. The chief contribution of CDC activities, however, was to be found in stimulating an increased amount of local participation in insect- and rodent-borne disease control, aiming at the eventual objective of total local financing and operation of control programs, with Federal assistance confined to consultation and technical advice.

MALARIA CONTROL During this fiscal year malaria control operations in District No. 4 consisted almost entirely of the DDT residual spraying of all houses in the most malarious sections of the District. In the seven States included in the District there were 866,047 spray applications made during the year by State and local health departments, assisted by CDC personnel and equipment. It was estimated that approximately 33 percent of the houses were sprayed twice. Thus the 866,047 sprayings were made in 571,591 houses, representing a total of 2,286,000 persons protected, based on the census report of an average of four persons per house. Records obtained from entomological inspections made at regular intervals showed that 98 percent of the sprayed houses were free of the malaria-carrying mosquito, *Anopheles quadrimaculatus,* at the time of inspection.

TYPHUS CONTROL. In order to receive Federal funds for typhus control from CDC, a county had to be on the approved list. This approved list included all counties where an average of ten or more cases of typhus fever had been reported annually during the period from 1940 through 1946. Of the 188 counties on the approved list for the entire United States, 102 of these were located in the seven States comprising District No. 4. There were typhus control operations in effect in most of the approved counties in the District; the few exceptions were due mainly to lack of local ordinances pertaining to ratproofing. Most of the cities and towns which did not have proper ordinances planned to pass such laws as were necessary.

WATER HYACINTH ERADICATION STUDIES OR SURVEYS. A resolution of the Committee of Rivers and Harbors of the House of Representatives, adopted February 6, 1945, requested that the Board of Engineers for Rivers and Harbors review the existing Federal project for removal of water hyacinth and directed that the Fish and Wildlife Service of the Department of the Interior, the Department of Agriculture, and the U. S. Public Health Service cooperate with the Board of Engineers in a joint investigation of the problem. A member of the staff of the District No. 4 Office, provided by CDC, was assigned to attend the public hearings and meetings of the joint committee working on this project. Water hyacinth control in District No. 4, as with 2,4-D in Florida, is at present in the experimental stage.

FLY CONTROL A fly control project was begun in north Alabama during the summer of 1946. The purpose of this project was to perfect methods and equipment and to train personnel in fly control work so that other projects could be established to determine the relationship of flies to poliomyelitis. A member of the District staff, provided by CDC, was assigned to this project to act as operation officer and as chief entomologist. Results of the fly control work were very encouraging; about 95 percent control of flies was obtained in the areas worked.

Alabama

D. G. GILL, M. D.

State Health Officer

Four types of control programs were carried on in Alabama during the 1947 fiscal year: war malaria, extended program, typhus, and *Aedes aegypti*. The war malaria program, which had been sharply reduced during the previous fiscal year, was still further curtailed this year. The scope of residual house spraying activities was greatly enlarged through city and county participation in the program. The typhus control program was expanded to cover an additional two counties. *Aedes aegypti* control operations remained essentially the same as in the past year.

EXTENDED PROGRAM LARVICIDING. A very small amount of larviciding work was done on the extended program during the 1946 mosquito season. A total of 225 gallons of oil was used to larvicide areas in Prattville (Autauga County) and Fort Deposit (Lowndes County). No larviciding was conducted during the 1947 season.

RESIDUAL HOUSE SPRAYING. During the 1946 season residual house spraying was carried on in all or parts of 21 counties. There was no local participation in rural house spraying in that season. All houses were treated twice, but only the second treatment was done in fiscal year 1947. For purposes of supervision and administration, operations were set up under area headquarters as follows: Montgomery Area (Montgomery) including Montgomery, Autauga, Bullock, Crenshaw, Elmore, and Macon counties; Dallas Area (Selma) including Dallas, Lowndes, and Perry counties; Greene Area (Eutaw) including Greene, Hale, Lamar, Marengo, and Sumter counties; Mobile County (Monroeville) including Baldwin, Clarke, Monroe, Washington, and Wilcox counties; Geneva Area (Geneva) including Geneva County; and Colbert Area (Tuscumbia) including Colbert County. The average amount of DDT applied per house (200 mg. per sq. ft.) during the second treatment was 0.84 pound at an average expenditure of 1.73 man-hours per house. A total of 105,401 houses was sprayed on the CDC extended program during the fiscal year.

Chilton County conducted a county-wide residual spraying program without State or Federal subsidy and with no charge to the householder.

The areas treated during the summer of 1947 were expanded considerably by means of county participation in the program. Ten counties employed sufficient crews to treat all rural areas not treated in the CDC extended program: Autauga, Dallas, Geneva, Greene, Lamar, Lowndes, Marengo, Perry, Washington, and Wilcox. Personnel and spraying equipment were provided by the counties and concentrate was also furnished by the counties for use by their crews, except in cases where there was a reduction in the CDC program from the previous season, so as to make concentrate available in quantity sufficient to treat those portions of counties dropped from the CDC program. CDC vehicles were loaned to the counties, although the cost of operation was borne by the counties. No charge for spraying was made to the individual householders in these ten counties. In Crenshaw County an attempt was made to treat the portion not worked by CDC crews by collecting individual householder fees for the service. Records are not complete, but it was not felt that this was a satisfactory approach to the problem of financing the work. Colbert County employed crews to treat that portion of the county which was done the previous season by CDC crews; no CDC personnel were employed in Colbert County during the 1947 season. Chilton County conducted a county-wide residual spraying program, including all municipalities, entirely at county expense. It is believed that this was the first county in the United States to carry on such a program with no subsidy from State or Federal sources, and with no charge to the individual householder. A total of 26,014 houses was sprayed by county-employed crews, using the same technique employed on the CDC extended program.

During the fiscal year 25 municipalities carried on residual house spraying at

local expense. Statistics are not complete at this time, but so far a total of 11,732 homes was reported sprayed in municipalities at local expense. The cities participating included Sulligent, Vernon, Millport, Fayette, Moundville, Greensboro, Demopolis, Centerville, Brent, Linden, Marion, Uniontown, Camden, Thomasville, Jackson, Fort Deposit, Chapman, Prattville, Monroeville, Frisco City, Luverne, Brantley, Tuskegee, Opp, and Selma. The city officials and the people generally were highly pleased with the results.

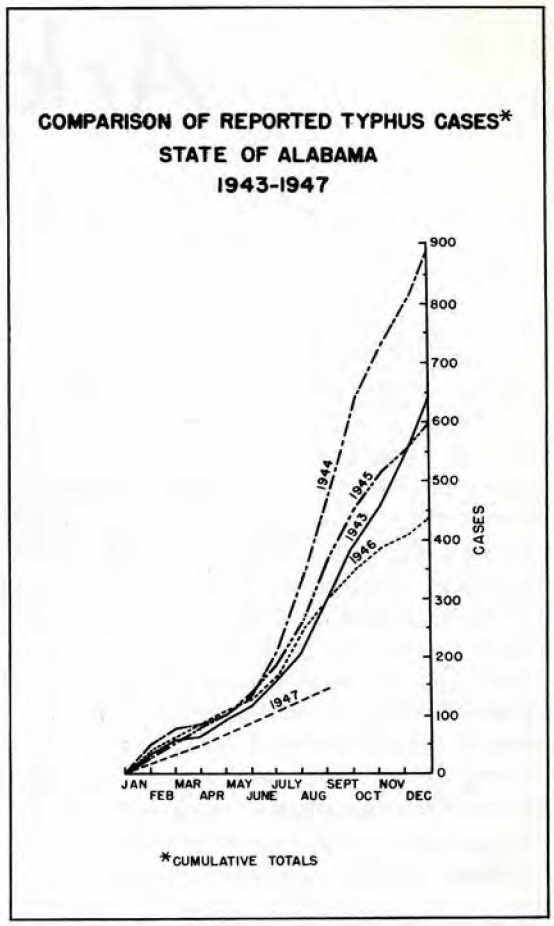
Alabama was one of the States which participated in the single house spraying per season experiment now under investigation by CDC. Houses in three counties — Greene, Geneva, and Macon — were given a single treatment in April at dosages of 200 mg. per square foot, 250 mg., 300 mg., 360 mg., and 400 mg., respectively. Inspection reports to date from the 2,016 houses involved have indicated good kill in all. Observations during the latter part of the 1947 season should be of value in determining the practicability of single treatments and the most desirable dosage.

All but two CDC crews used vehicles equipped with Westinghouse T-1 compressors during the 1947 season, which proved highly satisfactory. The sprayers, however, were not satisfactory. The modified Lofstrand sprayer developed cracks in the head of the can which were difficult to solder, and even when a good repair job was done other cracks soon developed. The cost of these sprayers was much too high considering the amount of trouble experienced. Light-weight galvanized sprayers, such as the Hudson Industrial, were too light and flimsy in construction to give long service. It was felt that there is a definite need for a better type of sprayer for use with compressed air. The 25 percent DDT concentrate purchased from the War Assets Administration varied in color and odor, and much of it left stains, particularly on light-colored surfaces. Approximately $600 was spent in reparation of damages done with this material, and it is believed that slight damage was done to many other homes. The use of this material was probably damaging to the program in that it decreased popular approval, led to loss of crew time, and brought about a decreased enthusiasm and efficiency on the part of the crews.

WAR MALARIA. Entomological surveillance was maintained around four military establishments: Maxwell Field, Gunter Field, Craig Field, and Brookley Field, A small amount of larvicidal work was carried out near Maxwell and Gunter fields, using a total of 600 gallons of oil. Ditch cleaning was conducted adjacent to Maxwell, Gunter, and Craig fields to the extent of 35,000 linear feet. This work required 1,742 man-hours, not including inspection or area-level supervision.

TYPHUS CONTROL. The 18 counties which received approval for typhus control operations on the basis of the greatest reported incidence of the disease included: Autauga, Barbour, Calhoun, Coffee, Covington, Crenshaw, Dale, Dallas, Escambia, Geneva, Hale, Henry, Houston, Jefferson, Mobile, Montgomery, Pike, and Talladega. In general, the typhus program covered the inspection and treatment of business establishments and private premises, using a ten percent DDT powder for ectoparasite control, red squill bait and arsenic water for poisoning rats, and hydrocyanic acid gas for rat extermination in burrows and harborages. County-wide projects, covering all premises in the county, were conducted in Coffee, Dale, Houston, and Pike counties. In the remaining counties, projects included selected beats or areas of typhus foci.

Rat stoppage projects were carried on in the cities of Mobile, Anniston, and Eufaula. During the year 1,431 buildings were inspected and 499 buildings were ratproofed. Considerable data of entomological value were obtained from all counties having typhus control activities through trapping of rats for ectoparasite and blood examinations. A comparison of the reported typhus cases for this fiscal year as compared to the previous year showed 371 cases in 1947 to 584 cases in 1946.



In the 18 counties in which the typhus control program operated, all worked areas received two or more complete coverages during the year. A summary of activities showed 78,649 premises inspected, 58,199 premises treated, 205,786 pounds of ten percent DDT dust applied, 44,396 pounds of poison bait, 2,595 gallons of arsenic water, and 7,177 pounds of hydrocyanic acid gas used. A total of 46,908 man-hours of supervision and labor was furnished through the U. S. Public Health Service and 46,477 man-hours were supplied by the participating counties.

Near the end of the fiscal year Alabama initiated a special program in cooperation with investigations being carried on by CDC, utilizing five percent DDT powder in areas of Covington County not previously dusted with ten percent DDT powder. Trapping of rats will be carried on to check the flea index and rat bloods to determine the degree of control obtained with five percent as compared to ten percent DDT dust.

Field observations and reports indicated a considerable drop in the degree of rat infestation in premises treated on the typhus control program. The program was well-received in the counties and the degree of success obtained was attested to by the ready response of the county governing bodies in appropriating funds to participate in the continuation of the program. At least five additional counties are proposed for inclusion in the next fiscal year's operations thus far, and operations in several counties now operating will be expanded to a county-wide basis.

AEDES AEGYPTI CONTROL. The *Aedes aegypti* program in Mobile operated throughout the year on the same basis as the previous year, as part of the general sanitation activities. A total of 98,556 premises was inspected, of which 1,169 were breeding mosquitoes; an index of 1.19. This program was discontinued as part of CDC control operations at the end of the fiscal year; the work will be carried on entirely at local expense in the future.

Arkansas

T. T. ROSS, M. D.

State Health Officer

The program in Arkansas this year changed from war and extended area malaria control to one of wider scope, both in policy and actual operations. Protection was shifted from military and related projects to the whole population in general in those areas where malaria was reported to be most prevalent. In such preapproved counties or parts of counties as could be cared for with available funds, spraying was offered to all householders in the rural sections and in those towns which were to be sprayed. The acceptance was above 95 percent. Extended program larviciding was reserved for the larger cities and towns where this method of control was more practical than residual spraying. The changed procedure caused a change in the outlook and in the qualifications of malaria control personnel. The program came out of the ditches and swamps and into the constant attention of and contact with the public. The professional and technical personnel had to assume door-to-door contact roles in addition to their technical skills. Deactivation of military establishments decreased the war program to a minimum. Typhus control was found to be necessary and other diseases transmitted by insects were considered. Intensive educational work and the results obtained on the control program elicited a generous amount of local financial participation in operational costs to replace reduced Federal appropriations.

EXTENDED MALARIA CONTROL. Extended malaria control work was expanded this fiscal year to include all or parts of the 38 most malarious counties in the State. In order to provide better and closer supervision of the operational areas the State was divided into four districts, each of which had a supervisor who was assisted by an entomologist and a health educator. The districts were further subdivided into areas, with the same general organization as in the districts. CDC activities, which were carried out under the Bureau of Sanitary Engineering of the State Department of Health, included larviciding around 28 towns and residual spraying of house interiors in rural areas and in towns where the problem of control was so costly or difficult that it was not practical to larvicide.

A total of 179,332 house spraying applications was made during the fiscal year, requiring an average of 0.8 pound DDT and 1.56 man-hours per application. DDT was available in sufficient quantity to permit houses to be resprayed in 1946 until the anticipated approach of cold weather warranted the cessation of operations in September; 77,000 houses received a second spray treatment. Larviciding was done with Diesel oil, Diesel oil and DDT mist, DDT mist alone, and some paris green. Thermal aerosol was applied by plane to rice field acreages. Altogether, a total of 15,664 gallons of oil, 27,625 gallons of DDT mist, 765 pounds of paris green, and 556 gallons of thermal aerosol was used to treat 9,610 acres of breeding surface and 16,018,220 feet of ditches in extended larviciding operations. Cleaning of 441,987 feet of

ditches, and 7,152 cubic yards of drainage and maintenance activities were also carried out.

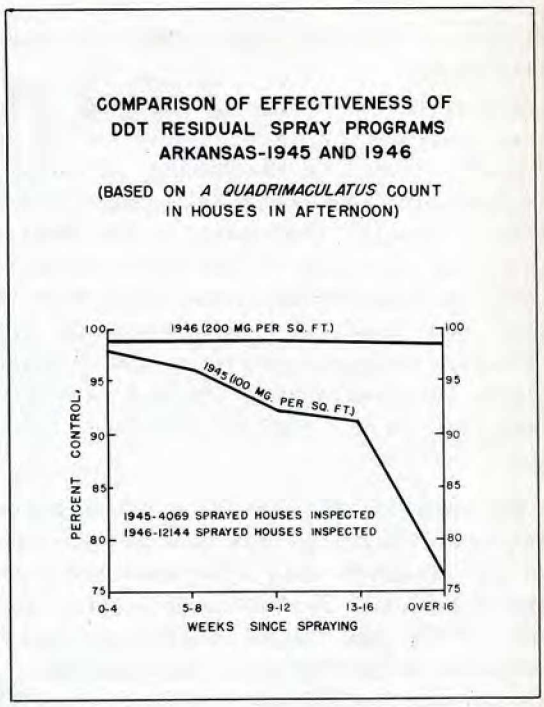
During the previous fiscal year three-man spray crews had been used. Starting this year the crews were cut to two men, a leadman and a sprayer, without materially reducing the number of houses sprayed per crew per day. The reduction in man-hours per house was appreciable. Each crew was assigned to a certain territory, usually that part of the area where the members lived. The territory was so set up that a crew had three months of steady work and yet would have as little travel as practicable. Spray cans were used exclusively; some crews used hand-pumped cans, some used air compressors and tanks to obtain operating pressures. Tactical vehicles, weapons carriers, and command cars were used most exclusively and were highly satisfactory in the mud, but parts and repairs were a problem. Concentrate was mixed at the central warehouse and delivered to the operating areas by warehouse personnel.

WAR MALARIA. Deactivation of military establishments and prisoner of war camps, and the closing of war plants decreased the number of larvicidal zones from 31 to 11, of which only five were active for any length of time. In 1946 operations were conducted around Camp Chaffee and Fort Smith in Sebastian County; Shumaker Naval Depot and the city of Camden in Ouachita County; and the Army-Navy Hospital and city of Hot Springs, and Lake Hamilton and Lake Catherine Rehabilitation Camps in Garland County. Surveillance was accorded Adams Field, the Arkansas Ordnance Depot, Camp Robinson, and Maumelle Ordance Depot, all in Pulaski County. In Sebastian, Ouachita, and Garland counties, a total of 11,512 gallons of No. 2 Diesel oil was used to treat 1,091 miles of ditches and 5,062 gallons were applied to 357 acres of ponded area. All larviciding was done by hand with knapsack sprayers, requiring 10,221 man-hours. Supplementary control measures included removal of aquatic and semi-aquatic vegetation from 22 miles of breeding surfaces, clearing land vegetation from 116 miles, 8,588 linear feet of ditch cleaning, and hand dug, open-type drainage construction amounting to 308,621 square feet, 28,622 linear feet, and 1,785 cubic yards. All supplementary control measures required 5,752 man-hours of labor.

The malaria control program came out of the ditches and swamps.

All of the residual spraying was done with spray cans. Some were of the hand-pumped type; others were charged from air compressed tanks mounted on tactical vehicles.

ENTOMOLOGICAL INSPECTIONS. Residual inspections were made in all of the counties where houses were sprayed. Also, a natural resting place within one-fourth mile of each house inspected was examined. Only a very small percentage of the houses examined had live mosquitoes in them in the afternoon, the factor used in determining the effectiveness of control measures. The accompanying graph summarizes the information obtained. Inspections were carried on in the regular CDC larvicidal zones and data obtained indicated satisfactory control. Entomological inspections were also made in several towns operating their own control programs, and on the power company's project on Lakes Catherine and Hamilton.



SPECIAL SURVEYS. In September and October of 1946 a blood slide survey was made in 25 counties located in the Mississippi Delta section to determine whether there had been an increase or decrease in the amount of malaria among school children since the last survey made in 1943. Results of this survey are not yet complete. Also during 1946 a host-preference study of *Anopheles* mosquitoes was undertaken. Of 6,523 specimens collected on the larvicidal and residual spray programs, 55 *A. quadrimaculatus*, or 0.8 percent, had fed on humans. Entomological surveys were made around U. S. Engineers' proposed impoundments in Lone Rock, Greer's Ferry, Water Valley, Bell Foley, Blakely Mountain, and Narrows. In addition several inspections were conducted around USED lakes under construction at Nimrod, Norfolk Dams, and Blue Mountain to assist in the malaria control programs being carried on at these places by the U. S. Engineers. Inspectors were also assigned to impoundage surveys outside of the malaria control program areas to advise owners of impoundments about mosquito control on their ponds.

TYPHUS CONTROL. During the winter of the previous fiscal year a typhus survey had been conducted to obtain information on the distribution of parasites throughout a large part of Arkansas. An average of eight percent of the rats collected from 32 towns were found to have positive complement-fixation bloods. From the 3,585 rats combed, 8,477 *X. cheopis* were obtained, or an average of 2.4 per rat. During the first half of the 1947 fiscal year ectoparasites were collected from 145 rats in the Little Rock and North Little Rock typhus control program. An average of 2.4 *X. cheopis* per rat was also found in these areas. In Little Rock 24.4 percent of the 97 rats bled had positive typhus complement-fixation reactions, and in North Little Rock 16.7 percent of the 45 rats bled were positive.

No residual dusting operations were carried on in Arkansas this year. Ratproofing was conducted in 605 establishments in Little Rock and North Little Rock, at an average expenditure of 28 man-hours per establishment. Poisoning was carried on in

connection with proofing and as a separate campaign. A total of 511 premises was treated with red squill bait and 1,376 premises with 1080 water. Of the 32,418 total man-hours worked, 82 percent was contributed locally.

HEALTH EDUCATION ACTIVITIES. The educational program in Arkansas this year was conducted in two overlapping phases: operational activities and lay education activities. Under operational activities, pre-season promotion was carried on in the fall to obtain local participation in the malaria control program. In the early part of 1946 contributions were obtained from 45 cities and towns in the program area. In the fall of 1946 a charge of three dollars was collected from each householder for the 1947 season. Before a single house was sprayed in the 1947 season enough local participation had been obtained to insure the maintenance of at least the past level of malaria control activities.

In-service training was conducted for over 80 spray and larviciding crews by area malaria control assistants, and several one-week in-service training programs were held for supervisory personnel. Many "brush-up" sessions were also held on rainy days during the actual season of operations. All refusals of spray services were investigated by malaria control assistants, and in most instances the complainants were educated to the need and acceptance of the service. Other operational activities included the preparation of the monthly "Arkansas Malaria Bulletin" by the State office education staff; and the release of radio scripts and 7,000 column inches of newspaper publicity printed in 1946, of which more than 90 percent was printed as front page news.

Lay education activities included formal instruction in schools and active participation by the students in community malaria surveys. These community surveys consisted of locating cases of malaria, both those reported to the county health units and unreported cases, making personal contact with these cases for educational purposes, and following the cases for a period of 30 days. An effort was made to have some form of malaria exhibit at every fair and livestock show occurring in the program area. To aid in this activity, four automotive trailers were converted into traveling malaria exhibits. Also, malaria control assistants spoke to a total audience of 68,000 people at various meetings, and 75,000 individuals were contacted personally. At the meetings, motion pictures and film strips were shown and literature of various sorts distributed. During the summer of 1946, ten malaria workshops were held at eight State colleges and universities in Arkansas.

The Arkansas State Board of Health malaria control exhibit at the N. E. Arkansas District Fair, Blytheville, 1947.

Florida

WILSON T. SOWDER, M. D.
State Health Officer

The transition from a war-accelerated program to peacetime Communicable Disease Center activities this fiscal year required local participation of far greater significance than had heretofore been emphasized. Local communities were held responsible for contributions in the form of, or equivalent to, labor, all supervision except technical, office space, and incidentals for residual spray or larvicidal measures, and in addition had to secure the cooperation of individual householders and the community as a whole for adequate anti-malaria, typhus, and *Aedes aegypti* campaigns. Also, 16 new counties became eligible this year for residual spraying in addition to operations in counties which had been eligible in previous years. The necessity for planning and carrying out a marked geographical expansion of CDC activities was made possible only through county and city contributions for the control of rodent- and insect-borne diseases. CDC solicitation received enthusiastic cooperation in Florida from local householders and that enthusiasm proved to be of great assistance in obtaining local financial participation.

DDT RESIDUAL SPRAY PROGRAM. During the 1946 season, the State was divided into three districts: District 1 included the counties of Bay, Calhoun, Gulf, Holmes, Jackson, Walton, and Washington; District 2 included Dixie, Gadsden, Gilchrist, Jefferson, Lafayette, Leon, Madison, Taylor, and Wakulla; and District 3 included Alachua, Citrus, Hamilton, Hernando, Levy, Marion, Sumter, and Suwannee. For the 1947 season the setup was essentially the same, except for some rearrangement of the counties within each of the districts, the termination of operations in Alachua, Gadsden, Jackson, Levy, and Marion counties, and the activation of Franklin and Liberty counties. Personnel organization within the county had to be modified to incorporate county participation, and the "spray unit" was devised as the smallest operating unit practicable for field use. The spray unit, of which each county had at least one, consisted of one contact man (State), two spray leaders (county), four spray assistants (county), two spray trucks, one contact truck, and one reserve truck. Spray cans were either of the compressed air or hand pump type. Men experienced in the application of DDT residual spray were available for key positions in those counties which had extended program activities in previous years and this eliminated much of the spray crew training that might have been necessary. A central mixing plant for furnishing 35 percent DDT concentrate was operated as an activity of the Jacksonville State Headquarters warehouse. This use of xylol rather than tolyol was favored as a solvent because xylol appears to be more stable under conditions in Florida.

Over the year 58,774 houses were sprayed at an expenditure of 2.35 pints of five percent DDT and 1.27 man-hours per house. During the 1946 spray season, 14,690 of the eligible homes were sprayed twice at the rate of 200 mg. of DDT per square foot. After careful study of the residual toxicity of the spray in the Florida climate, it was decided that one application was sufficient to provide the protection desired. Through

FLORIDA

Spraying "chickee" (house) in Seminole Indian Reservation, Glades County, Florida. Indian family stands in foreground.

November 1946, evaluation of the effectiveness of the application of residual DDT spray revealed that a high degree of protection was being obtained. Of 3,641 house inspections made during the 1946 season, *Anopheles quadrimaculatus* was present in only 25. In May and June 1947, inspections were made in 114 houses in which residual spray had been applied more than six months previously, and where outbuilding density of *A. quadrimaculatus* was determined to be over 10. Adult *quadrimaculatus* mosquitoes were found in only five of these houses.

WAR MALARIA. War malaria control activities, drastically curtailed since the previous year, were carried on only in Lake City, Tallahassee, and Gainesville. A total of 991 acres of breeding surfaces was larvicided with 5,407 gallons of Diesel oil and 970 pounds of paris green dust, and 5,541 linear feet of ditches were dug and 33 miles of ditches cleaned.

WATER HYACINTH CONTROL. At Lake City, herbiciding operations were carried on in Hamburg and Alligator Lakes. A total of 204 acres of hyacinths was destroyed by using sodium arsenite, or "Weedone," applied at the rate of five pounds to 55 gallons of water with a power sprayer mounted in a boat. A cutting machine rented from the U. S. Engineers was used to masticate approximately 150 acres of water hyacinth in Alligator Lake and 60 acres in Hamburg Lake. This method was very effective in deep water, but could not be used near the shore.

TYPHUS CONTROL. At the beginning of typhus control activities under USPHS auspicies in Florida in the latter part of 1945, measures had been taken to make all projects cooperative undertakings among local, State, and Federal agencies, both in financial backing and operations procedures. In line with this policy, sizeable contributions in man-power, trucks, storage space, clerical help, office space, and laboratory facilities were obtained from the cities and counties prior to the beginning of operations. The State Board of Health determined the over-all policies, with each of the projects operating as an integral activity of the local health unit of the county or district in which the project was located. This course was believed to be the best approach to establishing a permanent type of typhus

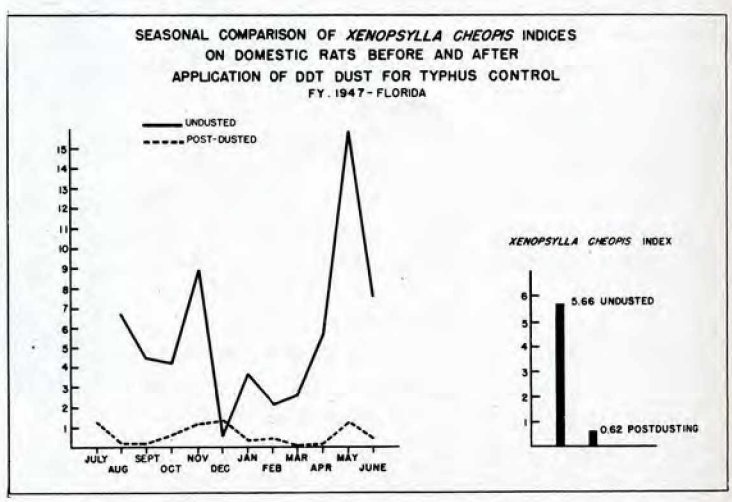
Distributing ten percent DDT dust in rat runs with hand shaker.

control program within local health organizations, which, in all probability, will assume the additional cost and responsibility as Federal aid is diminished. During this fiscal year, local sources provided more than twice the man-hours furnished by CDC.

Typhus control projects were operated in six counties: Dade, Duval, Escambia, Hillsborough, Pinellas, and Polk. DDT dusting was carried on in all counties. In Polk County, only establishments which had been ratproofed in previous years were dusted. In Pinellas County activities were confined to the distribution of ten percent DDT dust in all business establishments and residences within the corporate limits of the cities of Dunedin, Largo, Pass-a-Grille, and Tarpon Springs. Evaluation rat trapping was also conducted to aid the dusting program. A dusting project was begun in St. Petersburg, but difficulty was encountered in finding suitable personnel and the project was terminated at the beginning of January when local funds were exhausted. Dade County activities consisted of DDT dusting and the distribution of poisoned rat baits. In addition, drives were made for the accumulations of trash and rubbish, and for the replacement of unsatisfactory garbage cans. A number of fly-infested chicken yards, which also provided feeding places for rats, were eliminated under provisions of city ordinances. Near the end of the fiscal year ratproofing was added to the county's objectives. In this county a plan was tried wherein the property owner did the ratproofing personally or employed a contractor. Moderate progress was made in this direction but the majority of the establishments treated did not require extensive corrective work. Not until more difficult jobs are undertaken can the effectiveness and practicability of this procedure be determined.

In Duval County the program consisted of ratproofing, rat poisoning, and dusting of certain sections of Jacksonville. A large amount of outside baiting in alleyways and along the water front was done periodically to hold down the rat population. In Escambia County DDT dusting, ratproofing, and eradication work through trapping, distribution of poisoned bait, and Cyanogas "A" dust was carried on. Hillsborough County projects included ratproofing, rat eradication, DDT dusting, and the rendering of "Home Service." The latter phase provided for a thorough inspection of the premises for rat infestation, the furnishing of instructions for ratproofing the residence or business establishment, treatment with DDT dust, and the distribution of poisons to temporarily abate the rat nuisance. A charge of three dollars was made for a "Home Service" call.

Various types of equipment were used in dispersing DDT dust to meet varying conditions. For outside work the Model C-2 Challenge Root Duster was employed, and for inside treatment, a five-pound hand shaker. On the Hillsborough County project the Stauffer Knapsack Duster, Model 1A, was used in preference to the Root Duster for outside work. A Cyanogas foot pump equipped with a five-pound storage reservoir and a nozzle was designed by



project personnel in Escambia County for both inside and outside dusting. For use in evaluating the effects of ten percent DDT dust, 2,764 rats were trapped, of which 2,345 were examined for ectoparasites and 1,986 were bled. Positive complement-fixation tests were obtained from 26.3 percent of these rats tested. Data on the *Xenopsylla cheopis* index before and after dusting is shown on the accompanying graph. Many new records of the occurrence of mites on rats and new distribution records for this country were discovered in the course of routine identifications of rat ectoparasites. A total of 47,107 establishments was dusted during the year, poisoned bait was placed in 17,796 premises, periodic eradication trapping was carried on in 981 premises, 550 establishments were ratproofed on the CDC program and 221 by local owners, and 7,643 general inspections were made.

Blowing DDT and ANTU mixture into rat burrow with Stauffer duster.

Educational work was accomplished through newspaper articles, films, radio talks, and by speeches delivered to civic and official groups. A series of lectures was given for students during the summer course in physical education at the University of Florida (Gainesville) and the Florida State University (Tallahassee). The Alachua County Health Unit gave short courses for sanitarians and other public health personnel. Also, a booklet entitled "Roddy the Rat" was prepared for school children; requests for this booklet were received from all parts of the United States. Field investigations of the cases of endemic typhus fever reported in Florida during 1944, 1945, and 1946 were made this year and findings will be published at a later date.

***AEDES AEGYPTI* CONTROL.** Activities during this fiscal year definitely demonstrated the trend toward local acceptance of responsibility in the scope of domestic mosquito control. The *Aedes aegypti* control program was expanded to several additional cities this year on a matching man-power basis, and projects were arranged so that individuals were assigned to domestic mosquito control during the summer months and to general sanitation and typhus control during the winter months. This plan proved quite successful. In the cities of Key West, Miami, Tampa, St. Petersburg, Panama City, and Pensacola, 225,253 inspections were made and 17,538 premises were found to be breeding *aegypti* mosquitoes, an index of 7.79. CDC participation in *Aedes aegypti* control ended in April 1947, and only Key West and Miami continued active operations after that date. More than 68 percent of the labor man-hours expended on the program this year was contributed by the cities concerned. By the integration of *Aedes aegypti* inspection with other sanitation activities, local sanitary officers were trained in the field. Instruction in *aegypti* investigations and control was also

incorporated in the curriculum of the State Board of Health training school for sanitarians. Emphasis was placed upon insect control, particularly of domestic mosquitoes, for cities and communities not eligible for CDC funds. Aid was given those cities and counties in defining their insect problems and in establishing and organizing programs.

ENTOMOLOGICAL SURVEYS. Special entomological surveys were conducted to determine the distribution and density of *Anopheles albimanus* in the Florida Keys, and to obtain information on the distribution and host relationships of species of ticks occurring in Florida, together with facts pertaining to the association of these ticks with human disease. Light traps were operated throughout the full length of the Keys and a dipping program was begun. No indication was found that *A. albimanus* was spreading into south Florida, nor that any increase in malaria rates could be attributed to this species. From February through June, 487 collections of 5,170 specimens of ticks were submitted to the laboratory for examination from areas of origin of possible tick bites in connection with two suspected cases of spotted fever. Data were also being compiled pertaining to the effects of various types of insect control methods, especially the use of DDT mists and sprays for adult mosquito control on a county-wide basis. This information will be of value in making recommendations for particular methods of insect control to meet specific problems. Laboratory determinations of of 337,978 mosquitoes were made in connection with sampling studies to learn species occurrence and distribution in south Florida, and in evaluating specific mosquito control methods. A new species, to be named *Culex (melanoconion) mulrennani* Basham, was described from the Florida Keys.

Georgia

T. F. ABERCROMBIE, M. D.
Director of Public Health

The virtual termination of war malaria control and an expansion of the extended program on a local participation basis marked the introduction of CDC activities in Georgia this fiscal year. For the residual house spraying program the State Health Department provided over-all supervisory services; mapping, drafting, and reproduction services; office supplies; incidental travel costs; and telegraph and telephone tolls. Local authorities furnished all spray crew personnel and their transportation, office and warehouse facilities, and contact personnel in multi-crew counties (in 1947). CDC allocations provided salaries for State office, warehouse, and shops personnel, supervisory personnel, and contact personnel (in 1946); concentrate chemicals; transportation services; automotive repairs; spray and shop equipment; and rent and utilities. Of the total cost of the program, State and local participation amounted to 34 percent and CDC contributed 66 percent. The typhus control program continued on about the same level this year as in the previous fiscal year, with the exception of minor changes in operation plans. An average of 62 State and local personnel and 41 CDC personnel were employed on typhus control activities, which consisted mostly of residual DDT dusting and rat eradication in all or parts of 88 counties.

RESIDUAL HOUSE SPRAYING. All CDC personnel served under the direction of the State Health Department and concerned existing local health departments. Technical supervision was furnished by the Engineering Division of the State Health Department. Crews were composed of from one to three men, with a minimum of one spray crew and a maximum of five spray crews per county. During the fiscal year the program operated in 52 counties, in 36 of which householders were offered two spray applications. In the remaining 16 counties, in which the program operated only during one-half of the fiscal year, householders were offered one spray application. A total of 189,486 house spray applications were made; 69,225 in 1946 and 120,261 in 1947. During the first four weeks of the fiscal year DDT was applied at the rate of 200 mg. per square foot, and thereafter at the rate of 100 mg. Application rates were frequently checked and, during 1947, toxicity tests of sprayed surfaces were conducted in a number of homes whose occupants had stated that the spraying was ineffective. In every test ample toxicity was demonstrated by the early knockdown and subsequent death of flies which were exposed for periods of five to 30 minutes. An average of 0.85 pound of DDT was used at an expenditure of 1.50 spray crew man-hours per unit. The total cost per house spraying amounted to 2.69 dollars.

All residual spraying operations were performed with portable spraying equipment, using compressed air storage tanks as sources of pressure for the spray tanks. During 1946 working models of a new type of sprayer were developed by Georgia personnel, and in 1947 all spray crew members were furnished with these "regulated pressure" sprayers fabricated in the Macon shops. This sprayer was composed of two 500-cubic inch tanks, one of which was used for air storage and the other for emulsion. An air filling valve was incorporated in the air tank which, through a regulating valve and a shut-off valve, was connected to the emulsion tank. The emulsion tank was equipped with a one and a half inch filling opening whose cap could be removed by hand. With the regulating valve set at 40 psi and with an initial air tank pressure of approximately 85 psi, the entire contents (2-1/6 gallons) of the emulsion tank could be discharged at a uniform pressure of 40 psi. In addition to maintaining a uniform spray pressure

Man at extreme left is filling one of the two tanks of the "regulated pressure" sprayer with DDT emulsion from the drum on the truck. The other man is filling the air pressure tank of the sprayer with compressed air from the storage tank on the truck. Note regulating valve on the sprayer between the tops of the two tanks.

with consequent uniform discharge, this sprayer required a smaller volume of air per gallon of emulsion sprayed and also far less maintenance than the commercial types of sprayers.

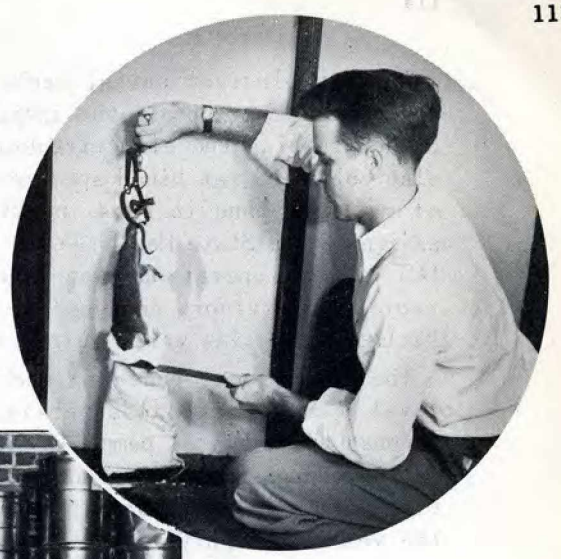
Malaria mortality in Georgia during 1946 reached an all-time low of 0.4 per 100,000 population, and the reported morbidity for the first six months of 1947 was the lowest on record. In addition to the malaria control benefits, the extended program was credited by most public health officials and private physicians with materially decreasing the incidence of enteric diseases, particularly among children.

WAR MALARIA. During the 1946 calendar year control programs about war establishments were limited to three zones: Robins Field in the Macon area; Oliver General Hospital in the Augusta area; and the Naval Hospital in the Dublin area. Five employees were engaged principally on inspection activities, and only very minor paris green and DDT larviciding operations were necessary. In the latter half of the fiscal year no CDC employees were utilized full time on war malaria programs. At Augusta the local health department carried out the control program around Oliver General Hospital, using CDC equipment and materials. At Dublin entomological services were provided by extended program personnel; no larviciding operations were required. Routine inspection activities about Robins Field were performed by Post personnel, by agreement with the Robins Field Post Surgeon.

TYPHUS CONTROL. Georgia typhus control activities consisted principally of DDT dusting and rat eradication. The Georgia Typhus Control Service supplied DDT dust, 1080 rodenticide, trucks, and certain small equipment and supplies to local programs. Local participation included labor, rodenticides other than 1080, rat bait, and office space, equipment, and supplies. Ratproofing projects were financed chiefly by charges made to building owners or tenants for work performed, through revolving funds established by local governments. The Typhus Control Service provided supervisory services for local ratproofing projects and supplied each project supervisor with a mobile workshop unit.

DDT dusting and rat eradication programs were conducted on a full-time basis in 40 counties, and on a part-time basis in 48 other counties. Services rendered to the 48 part-time operated counties were carried on by the State-wide mobile DDT dusting and rat eradication unit which operated out of the Macon Field Office. Ratproofing projects were conducted in Fulton County and the cities of Atlanta, Macon, Cordele, and Douglas. Experience has shown that the adoption of local ratproofing ordinances has given support to the successful completion of ratproofing projects; for this reason ratproofing ordinances were adopted during the year in the cities of Decatur, Cordele, Nashville, and Douglas.

A permanent rat control measure directed toward the elimination of the food supply and harborage of rats in communities was sanitary refuse collection and disposal. This control measure was applied through consultation services provided by the Typhus Control Service to cities and towns. With the increasing availability of refuse collection and disposal equipment and materials, many of the cities and towns have made improvements in the efficiency of their refuse collection systems. In addition, sanitary landfills were operated in Muscogee County and in the cities of Macon and Valdosta. Initial steps were taken toward establishing sanitary landfills by the cities of Thomasville, Augusta, Manchester, Cairo, and others. Many other cities have shown interest in this activity and have expressed willingness to improve their collection system and provide sanitary disposal of refuse when more equipment and materials become available.



RODENT CONTROL

ABOVE: Dusting rat burrow in basement with hand pump dust gun.

RIGHT: Placing cups of 1080 water in a rat infested building.

FAR RIGHT: Trapped rat being placed in bag, later to be bled and combed to obtain ectoparasite and blood samples.

SANITATION

BELOW LEFT: Garbage disposal by sanitary landfill method in Columbus city dump.

BELOW RIGHT: Sanitary refuse-collection truck used in Atlanta.

Three biological units, each consisting of a biological aide and a rat trapper, were employed to obtain the indices of the ectoparasite infestation of rats as a means of determining the effectiveness of dusting rat runs with DDT. The biological units also collected rat blood specimens for serological testing to determine the prevalence of murine typhus in rats, particularly in reference to DDT dusting. Each unit was assigned to a State Health Department region consisting of about six counties in which DDT dusting operations were conducted. In addition to the three biological units, project supervisors assigned to the dusting programs in Chatham, DeKalb, Fulton, and Richmond counties were trained to perform biological work.

The educational phase of the typhus control program was conducted on the county level by the regional supervisory personnel. Education material was disseminated through the media of pamphlets, newspaper articles, film strips, and motion pictures. Talks were given on the radio and before meetings of civic organizations, county and city officials, and farm and other interested groups. The educational program during the year was highly effective, as indicated by the great amount of interest shown by counties requesting participation in the typhus control program.

TYPHUS INVESTIGATIONS AND EPIDEMIOLOGY. Five percent DDT dust was applied, as a special investigative project, in four previously undusted counties. Results of entomologic studies in these counties indicated that five percent dust may be as effective in ectoparasite control as ten percent dust. From these observations, the five percent dust will be used in preference to the ten percent dust during the latter half of the 1948 fiscal year.

The Thomasville Investigative Project, initiated in 1945, is being operated directly by the Epidemiology Division of CDC to obtain information on the incidence of human and rodent typhus and the effectiveness of DDT dusting in destroying rodent ectoparasites. This project, which is being carried on independently of other investigative State studies, is in an area comprising Brooks, Thomas, Grady, and Decatur counties. The project is under the general supervision of the Georgia Typhus Control Service of the State Health Department. The administrative offices of the project are located in five buildings on the grounds formerly occupied by the veterans hospital in Thomasville, Georgia.

Medical epidemiologic investigations were conducted by the regional medical directors and county health officers. The limited time available for this activity by medical personnel created a need for lay investigation. These lay investigations were made by field supervisory personnel of the Typhus Control Service. Information gathered was supplementary to non-medical information. Location of the residences and business places of typhus fever cases were recorded on maps as a guide to determining areas in which DDT dusting and rat eradication should be applied. Human blood typhus fever surveys were conducted in Colquitt, Thomas, and Grady counties in conjunction with the State Health Department's TB-VD survey program. A total of 28,421 blood specimens were collected on the survey, and serological tests for typhus were performed by the Laboratory Division of CDC.

For the fiscal year 1947 the incidence of murine typhus fever for the State dropped to 602 reported cases as compared with 1,032 reported cases for the previous fiscal year, a decrease of 41.6 percent. Mortality dropped from 51 deaths in 1946 to 39 in 1947, a decrease of 23.5 percent. The five counties of greatest population (Chatham, Bibb, Richmond, Fulton, and DeKalb), comprising about one-fourth of the total State

population, reported 52 cases of typhus fever for fiscal year 1947 as compared to 394 cases in the previous year, a decrease of 342 cases or 86.7 percent. Deducting the total number of reported cases in these five counties from the State total, the remaining 154 counties reported 550 cases for fiscal year 1947 as compared to 638 cases in 1946, a decrease of 88 cases or 13.8 percent. From these data, the decrease in 1947 over 1946 in the five counties was significant and primarily responsible for the decrease of 41.6 percent in the State-wide total. The decrease of 13.8 percent in the other 154 counties could not be considered significant because 74 counties out of these 154 did not participate in any form of control operations during 1946 or 1947 but still reported about the same percentage decrease in morbidity as that for the controlled counties. It appears, therefore, that the DDT dusting operations played a major role in reducing the incidence of murine typhus fever in the five counties, and in the State as a whole.

SUMMARY OF TYPHUS ACTIVITIES. From 2,250 rodents trapped in dusted areas, a total of 2,971 fleas was recovered; 7,632 fleas were recovered from 2,051 rats trapped in undusted areas. These data indicated a 59 percent reduction of the flea index as a result of DDT dusting. Of 3,584 rodent blood specimens examined, 932 or 26 percent were found positive. Control measures included 2,617 business establishments surveyed for ratproofing and 734 ratproofed. Rat eradication was carried on in 33,028 business establishments and 94,718 urban and rural residences. DDT dusting was completed in 58,873 business establishments and 149,706 urban and rural residences, at an average of 2.6 pounds of ten percent DDT dust per premise. Poisons used included 618 gallons of 1080, 60,819 pounds of red squill bait, 747 pounds of ANTU bait, and 357 pounds of Cyanogas "A" dust. A total of 188,025 man-hours was expended in the 88 counties treated, of which 113,954 were local participation and 74,071 furnished by CDC.

Louisiana

W. L. TREUTING, M. D., M. P.H.
State Health Officer

The main effects of the inauguration of CDC activities in Louisiana this fiscal year were the elimination of larviciding, which previously had been the chief activity, and the increase in residual DDT house spraying, now the principal malaria control measure. War malaria activities, except for entomological surveillance, and extended program larviciding were completely discontinued by the second half of the fiscal year. An important development this year was the increased amount of local participation in the house spraying program, resulting in a 40 percent increase in operations over the previous year. The change from larviciding to house spraying necessitated a complete rearrangement of the State organization and requirements for personnel and equipment. Typhus control operations expanded as compared to the previous fiscal year by virtue of a marked increase in local participation in the program. No *Aedes aegypti* control activities were conducted this year in Louisiana.

EXTENDED PROGRAM LARVICIDING. During the first quarter of the fiscal year CDC larviciding activities were carried out in towns of over 2,500 population in spray areas in lieu of house spraying for reasons of economy. Seven towns received treatment: Bossier City in Bossier Parish, Minden in Webster Parish, Jonesboro and Hodge in Jackson Parish, Bustrop in Morehouse Parish, Tallulah in Madison Parish, and Lake Providence in East Carroll Parish. The total amount of No. 2 Diesel oil sprayed during the quarter was 11,618 gallons, at an expenditure of 4,957 man-hours. The seven towns contributed 35 percent of the total cost of labor and materials. CDC larviciding operations were discontinued entirely after January 15, 1947, and these and other towns conducted all of their own larviciding during the remainder of the year without Federal assistance.

RESIDUAL HOUSE SPRAYING. Four operational areas were set up for residual house spraying activities. Alexandria Area included the parishes of Catahoula and Concordia; Shreveport Area comprised Caddo, Bossier, and Webster parishes; Monroe Area was made up of the parishes of Tensas, Madison, East Carroll, West Carroll, Morehouse, Jackson, and Union; and Natchitoches Area had Natchitoches, Red River, and Winn parishes. In March, at the beginning of the 1947 spraying season, the Alexandria Area was consolidated with the Monroe Area and the Shreveport Area with the Natchitoches Area. Three parishes — Tensas, Jackson, and Winn — were eliminated for various reasons; activities in the remaining parishes in which only partial coverage was made during the 1946 season were increased to full coverage. This expansion was made possible by each parish participating to an amount aproximating 30 percent of the total field cost.

During the fiscal year a total of 70,304 house applications was completed, consuming an average of 0.89 pound DDT per house at an average expenditure of 0.96 man-hours. Of this total, 50,830 houses were sprayed once and the remainder received a second application. The spraying was done with 2½ gallon, pressure-type, hand spray cans. Each crew truck carried a 55-gallon drum of five percent DDT emulsion, which was pre-mixed by the foreman before starting out in the morning. A central mixing plant located at the State warehouse was used to mix powdered DDT into a 32½ percent concentrate, which was settled for 24 hours in 1000-gallon settling tanks before being drawn off into drums.

During the fiscal year 70,304 residual house spray applications were completed, using 2½ gallon, pressure-type hand spray cans.

During the 1946 season, spray crews consisted of three men; a foreman and two laborers. This was changed to two-man crews during the 1947 season, of which the foreman was paid from CDC funds and the laborer by the parish. This arrangement provided adequate supervisory control and also allowed CDC personnel to drive Federal vehicles. The spray crews were supervised by an assistant area supervisor, each of whom covered two parishes and reported to the area supervisor at area headquarters for policy and organizational guidance. This year all new spray crews were trained

by combining a new crew with an old crew for a week or two. In this way, working together, there was little or no production lost and the new crews rapidly learned the work and the different wall surfaces and speeds of application necessary for each to prevent running and streaking.

WAR MALARIA. Larviciding was utilized to protect seven military establishments in the New Orleans Area (Orleans Parish), including two veterans' hospitals, a naval airfield, two port of embarkation zones, a marine hospital, and a naval ammunition storage dump; and Camp Polk in the Natchitoches Area (Vernon Parish). By January 15, 1947, all larviciding was discontinued and entomological surveillance was instituted to check conditions which might indicate a return to control work. Camp Polk was deactivated at the end of 1946. No. 2 Diesel oil was used as a larvicide; small quantities of 2.5 percent pyrethrum were used in ornamental fish ponds. Altogether, a total of 13,780 gallons of oil was applied by hand and power equipment at an expenditure of 5.023 man-hours; application of 71 gallons of pyrethrum required 214 man-hours of labor. The Brown, four-gallon, pressure-type spray can was used for hand oiling, and the Bean Orchard type 50-gallon sprayer, mounted on truck or boat as conditions dictated, was used for power application. No DDT larvicides were tried during the year. Weekly entomological reports indicated that excellent control was obtained.

TYPHUS CONTROL. Typhus fever in Louisiana decreased from 463 reported cases in 1945, when the CDC typhus control program was inaugurated, to less than 70 cases by the end of this fiscal year. This also takes into consideration the much better case reporting from private physicians than was done in former years. A continuous program of rat ectoparasite and blood study was maintained on the year-round projects, and it was found that positive complement-fixation tests have shown a reduction in the State from approximately 70 percent to 28 percent in the fiscal period 1945-1947. The amount of local participation in the typhus control program increased markedly over previous years; the population of the State as a whole was sold on typhus control and it was believed that this kind of work was doing as much or more good for public health in Louisiana than any other phase of control work currently being conducted.

DDT dusting projects were carried on in 13 cities in the parishes of Iberia, Lafourche, Orleans, and Calcasieu. A total of 14,766 residences and 8,441 commercial establishments were dusted at an average of 0.71 man-hours per application. Results were uniformly good; it was estimated that the *X. cheopis* index was reduced by 97 percent in Iberia parish. All applications were made with hand dusters. Ratproofing projects were operated in the cities of Lake Charles in Calcasieu Parish, New Orleans in Orleans Parish, Hammond in Tangipahoa Parish, and New Iberia in Iberia Parish. A total of 1,035 commercial establishments were proofed, and rat eradication by dusting, poisoning, and trapping was conducted in each premise proofed to free it

Rat poisoning was carried on as separate projects as well as in conjunction with dusting and proofing, using red squill bait and 1080 water.

of rats. Rat poisoning was conducted in 40 cities located in 23 parishes, both as separate projects and also in conjunction with dusting and proofing. Over the year a total of 50,238 residences, 3,246 business establishments, and three entire towns consisting of 6,500 premises were treated. More than 11,000 man-hours were expended in spreading 3,305 pounds of red squill bait and 354 ounces of 1080 water.

Mississippi

FELIX J. UNDERWOOD, M. D.
State Health Officer

Malaria and typhus control operations were carried out under the supervision of the Division of Sanitary Engineering, Mississippi State Board of Health, with field work organized as an integral part of the county health departments. With the termination of war malaria areas, all larviciding projects were operated by the concerned cities or towns. No Federal funds were furnished to the ten municipalities which had larviciding operations during this fiscal year; the State Board of Health provided some funds, equipment, and technical assistance. Malaria protection through larviciding and residual house spraying was afforded to nearly twice the number of people in the State as compared to the previous fiscal year by virtue of the increased amount of local participation in the extended program. Sizeable contributions were also appropriated by the State, county boards of supervisors, and city administrations for continuation of typhus control projects initiated by CDC during the fiscal year.

RESIDUAL HOUSE SPRAYING. During the first half of the fiscal year, only Federal and State funds were used for residual spray operations. In September 1946, 16 counties set up funds for the next season's work: Bolivar, Carroll, Coahoma, Grenada, Holmes, Humphreys, Issaquena, LeFlore, Panola, Quitman, Sharkley, Sunflower, Tallahatchie, Tunica, Washington, and Yazoo. In DeSoto County necessary funds were not appropriated, but a private citizen underwrote the program for the delta section on his own initiative. Each county furnished storage and office space for the program, and labor and repair funds were provided jointly by the counties and the State Board of Health. Over the entire year 64 crews sprayed 191,156 houses, of which 108,746 received one treatment and the remainder were sprayed a second time. The average man-hours per residual house treatment, including labor and foreman, was 0.93, and an average of 0.62 pound DDT was used per application.

During the winter months, only key personnel were retained for making maps, numbering houses, preparing for renewed activities in the spring, and meeting with county boards of supervisors to secure the necessary appropriations for the next season's operations. At the beginning of the 1947 season, each area supervisor held training schools for his crews under the direction of the State Board of Health. The crews were taught the rudiments of a spray can, how to mix concentrate with water, how to make minor repairs to spray cans, and the proper technique of spraying. All personnel attended the schools. On June 16, 1947, the city of Louisville in Winston County started a larvicidal and residual spray program in which a civic

organization was the sponsor. All necessary funds were raised locally by the club, except for the DDT which was furnished by the State. In the northern part of Warren County an experimental program was conducted in which 179 houses were sprayed, half with five percent spray and the other half with 7½ percent spray. Final results are not yet available.

The Greenwood warehouse served as the distribution center for all materials and equipment, and all kinds of major and minor repair work on automotive and sprayer equipment was done here, as well as DDT mixing. A mixing procedure was developed, involving the settling of DDT and xylene overnight in 55-gallon drums before mixing, which doubled the output of concentrate from a single mixer. Lofstrand, Brown, and Hudson spray cans were used. The Lofstrand spray can gave considerable trouble when it developed a leak because silver solder was necessary to repair this type of can. Also, the rubber tip in the cut-off valve had to be replaced quite often. Field men preferred the Hudson sprayer over others. Westinghouse T-1 air compressors were installed on 48 vehicles, but considerable trouble was encountered with burned-out bearing and packing cups. The use of faucet-equipped 55-gallon drums on each truck for carrying diluted five percent spray was continued this year. War surplus concentrate, which could not be used on the extended program because it left a brown stain on interior walls, was allocated to county health departments for outside mosquito and fly control work. Highly complimentary remarks were received from citizens living in residual spray areas, and preliminary reports indicated that the rates of malaria, diarrhea, and enteritis were decreasing considerably and at a greater rate in sprayed as compared to unsprayed areas.

Air pressure for the hand spray cans was obtained from a Westinghouse T-1 compressor. Emulsion was carried in a 55-gallon drum on the truck.

TYPHUS CONTROL. During the 1947 fiscal year, the initial phases of CDC typhus control programs in 16 cities in Harrison, Forrest, Jones, Hinds, and Jackson counties were completed and the projects were turned over to local county health departments for continuation. Future work will be carried out by sanitarians who were trained on CDC projects and who are now on the staff of local county health departments. Sizeable contributions were made by the State, counties, and cities for the continuation of these projects.

A total of 31,542 premise dustings was completed during the year at an expenditure of 1.3 pounds of DDT per premise and 0.5 labor and foreman man-hours. On the ratproofing projects in Laurel (Jones County) and Hattiesburg (Forrest County), 231 establishments were proofed by a crew consisting of one carpenter and one carpenter's helper operating from a mobile workshop unit, under a project supervisor. A little over an average of 20 labor and foreman man-hours was required to ratproof each

Establishments were ratproofed by a crew consisting of one carpenter and a helper operating from a mobile workshop unit.

premise. Rat poisoning was carried on in conjunction with ratproofing and dusting programs. A total of 665 establishments received treatment at an average of 1.6 labor and foreman man-hours and 1.2 pints of 1080 water per premise. In Harrison County red squill was also used for rat poisoning. As in the previous fiscal year, rat eradication programs were carried on in many towns and counties throughout the State by a full-time State Board of Health-paid employee working with the State Plant Board. Local communities or counties received this service by supplying the necessary bait materials, poison, and labor, while the State Plant Board furnished supervision. Altogether, 55,652 residences and 11,346 business establishments in 33 rural areas, eight cities, and 81 towns in 52 counties were treated with 1080 water or red squill bait.

On the Hattiesburg ratproofing project a one-piece door channel, perfected by a project supervisor, was believed to be more substantial than the standard three-piece channel. Also, since 26 gauge metal for door channels was unobtainable, a 29 gauge metal, cut to a seven-inch stack and flat hemmed one-half inch on each edge, was substituted and found to be strong and durable. In Harrison County, where extensive DDT dusting activities were carried out, two dusting crews operated. Each crew was composed of one foreman and three laborers. On the other dusting projects, crews consisting of one foreman and two laborers were used. Members of these crews also allotted a part of their time to evaluation work.

Entomological evaluation of the dusting projects in Harrison County, based on 143 rats, indicated a reduction of 97.2 percent for fleas, 55.4 percent for mites, 78.2 percent for lice, and 82.4 percent for total ectoparasites. Of the rats trapped for ectoparasite counts, the blood of 17.5 percent were positive for typhus by the complement-fixation test. In Hattiesburg, 310 rats were trapped from dusted and 220 from undusted premises. Control data showed 96.6 percent reduction for fleas, 75.4 percent for mites, 22.3 percent for lice, and 73.7 percent for total ectoparasites. Of 105 bloods tested from rats from dusted premises, 31 were positive; of 77 bloods from undusted premises, 21 were positive. A reduction in the number of rats with positive complement-fixation bloods in certain dusted establishments from month to month was indicated, based on a small number of rats.

In November 1946 a State typhus blood survey was started on humans and rats. One epidemiologist and four, two-man rat trapping teams surveyed 41 counties in the State during the fiscal year. A total of 2,410 rats was trapped from 3,815 premises, of which 173 bloods were found typhus positive, 1,978 negative, and 62 unsatisfactory for testing. The CDC Virus Laboratory at Montgomery, Alabama conducted the complement-fixation tests. Eight counties in the southern part of the State and one in the northern half (one town) were found to have ten percent or more of the rat blood typhus positives, the highest percentages of positive bloods (36 percent) being found in Hancock and Amite counties. *Xenopsylla cheopis* was found in practically all of the counties surveyed. Identification of ectoparasites, and training, supervision,

and supplies for the typhus survey teams were furnished by the State CDC entomologist. The incidence of typhus has been reduced considerably in counties that have inaugurated control programs, and the rat infestation in most towns was very low because of the extensive poisoning campaigns conducted during the fiscal year.

Tennessee

R. H. HUTCHESON, M. D.

Commissioner of Public Health

Malaria control activities in Tennessee this fiscal year were carried on in two operational areas. Shelby County-Area A operations consisted of war malaria and extended program larviciding, and residual house spraying. Dyersburg-Area B included extended program larviciding and residual house spraying. Operations in both areas, comprising 12 counties, were supported by substantial local contributions in the 1947 season to replace reduced Federal appropriations. During the second half of the fiscal year a system of residual premise spraying was begun, which included treatment of all outbuildings in addition to the homes themselves. Local contributions to the typhus control program did not nearly match the CDC funds available, but progress was steadily being made toward more comparable local participation.

EXTENDED PROGRAM LARVICIDING. In Shelby County-Area A, extended program larvicidal activities were conducted in a one-mile zone around the peripheral limits of Memphis for the extra-protection of the population in and immediately adjacent to Memphis. Normally this area, involving 27 square miles, is not included in the local program, but high water conditions affecting some portions of the area during the earlier part of the season necessitated control operations. A total of 4,029 gallons of one percent DDT-fuel oil solution was applied at an expenditure of 13,035 man-hours. Hand methods were used principally, and power applications of larvicides from boats were employed in the areas affected by high water conditions. These areas, consisting of about 1,500 acres, present a difficult problem and can only be effectively treated by airplane.

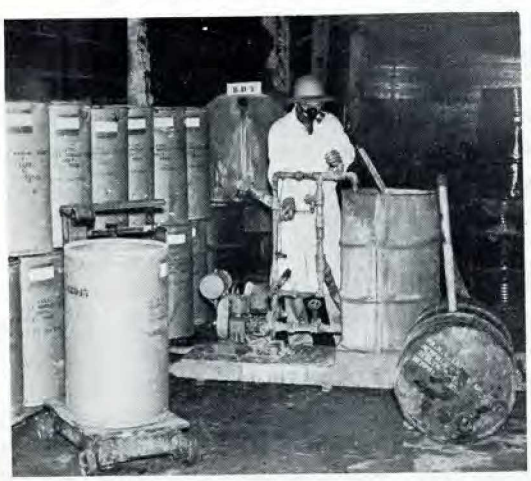
In Dyersburg-Area B, the towns of Dyersburg, Ripley, and Covington were protected by extended program larviciding during the first part of the fiscal year. DDT dissolved in No. 2 Diesel oil, to which a spreading agent was added, was used as the larvicide, applied with Lofstrand spray cans equipped with atomizing nozzles. Approximately 532 acres of potential breeding surface were treated with 1,270 gallons of larvicide at an expenditure of 2,273 man-hours. Larviciding was discontinued in Area B in the 1947 season.

AREA A RESIDUAL HOUSE SPRAYING. Four counties in Area A had extended program spraying activities. Shelby and Tipton county operations were conducted on a county-wide basis, but only special areas were covered in Hardeman and Fayette counties. The program was set up under the direct supervision of the assistant project supervisor, with headquarters in Memphis. One supervisor was assigned to each county, with responsibility for actual supervision of the crews, maintenance of equipment, recruitment of local labor, liaison between local authorities and headquarters, participation

in actual spray operations, record and report keeping, inspection to determine effectiveness of the work, and making public contacts. The crew unit was composed of a crew chief and one laborer. The crew chief operated the vehicle, contacted the public, kept reports, and also participated in the spraying. The number of crews assigned to each supervisor or county was dependent upon the number of houses involved, although one crew per 1,000 houses was generally used as a basis for crew distribution. One advance, contact man was employed in setting up schedules for two or more crews, depending upon local circumstances. In counties with a relatively small number of houses, the supervisor acted as contact man in addition to his other duties.

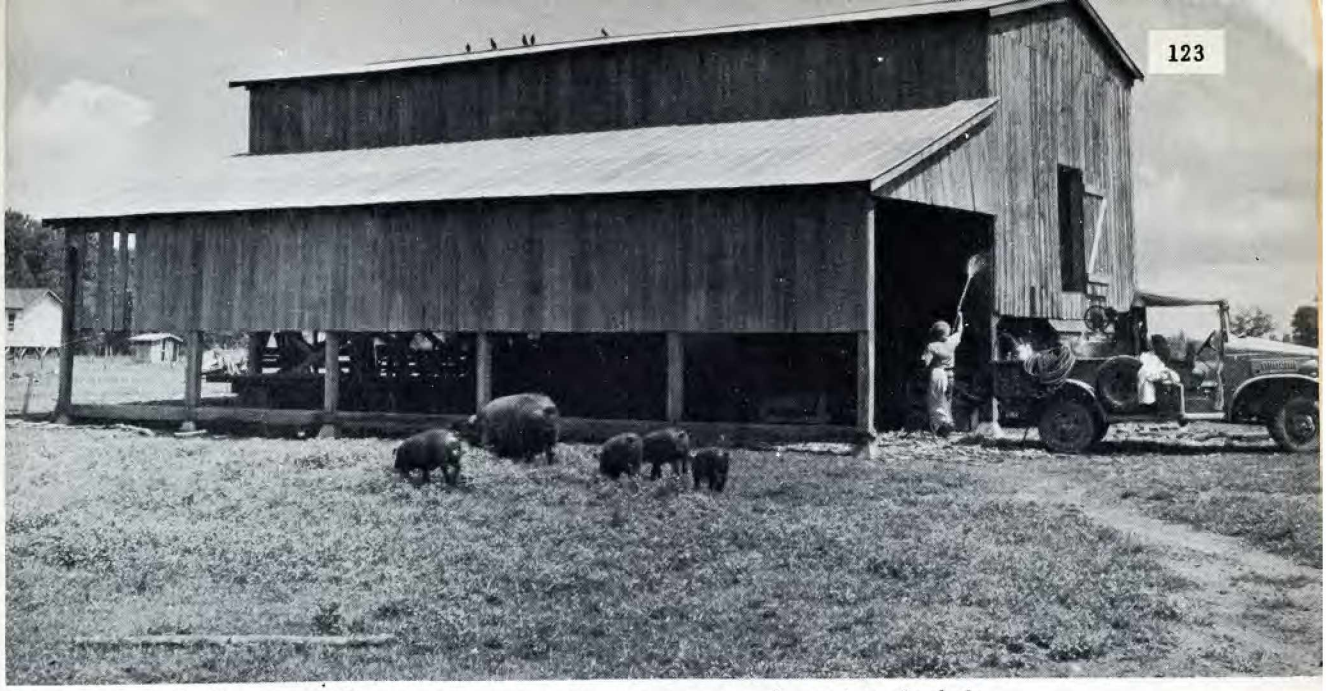
Crews were supplied with trucks carrying power spraying units equipped with two 100 foot sections of 3/8 inch spray hose, air pressure tanks, and Brown and Lofstrand 3 1/2 gallon hand sprayers modified to take compressed air. All trucks were also equipped with T-1 air compressors for charging the 50-gallon air pressure tanks and hand sprayers. The average daily production of one spray crew unit was 22 houses or 100 rooms where the project included living quarters only, and 65 rooms or 15 houses where the outbuildings were also included. In the 1947 season the program was revised to include only one application per house per year, but all outbuildings (barns, chicken houses, privies, etc.) were also treated. From July 1 to September 1946, 5,789 houses were sprayed at an average of 0.9 pound DDT per application and 1.0 man-hour. From March 1 to June 1947, 9,321 premises were sprayed, including outbuildings, at an average of 1.3 pound of DDT per application and 1.5 man-hours; the fiscal year total in Area A was 15,110 spray applications at an average of 1.1 pounds DDT and 1.2 man-hours.

In the early part of 1947 the Shelby County Health Department secured a decontamination unit through CDC. This unit was modified for use in fly control operations around three city garbage dumps. Semi-weekly spraying of the dump was commenced on May 15, using a four percent DDT Isomer-fuel oil solution. Excellent control was obtained on all the dumps treated within a short period of time, with fly counts dropping from 79 per square yard to two. Local participation in the CDC program included the operation of larviciding project in coordination with extended program activities, conducting fly control programs, and supplying a certain amount of equipment, labor, operating space, and supplies for the entire program. Publicity was obtained through local newspapers, the radio, and independent cooperating agencies such as the Farm Bureau Agriculture Extension Service, Parent Teachers Association, and others. Public response to the program generally was very good.



AREA B RESIDUAL HOUSE SPRAYING. The residual house spraying program in Dyersburg-Area B was carried on in the counties of Lake, Obion, Dyer, Lauderdale, Tipton,

All DDT solutions were mixed at the central mixing plant in Memphis and shipped to the field as needed. Mixing was done by one part-time employee, who also served as a mechanic's helper. A 50-gallon capacity, portable-type mechanical mixer was used.



During the 1947 spraying season the program was changed to include all outbuildings as well as houses.

Haywood, Crockett, Gibson, and Weakley. During the first part of the fiscal year 7,613 houses were sprayed at an average application of 0.86 pound of DDT per house and 0.82 man-hour. Of the houses contacted, 82 percent were sprayed, no charge being made to the householders during the 1946 season. Each spray crew was composed of two men; the crew chief was responsible to the county supervisor (who acted as contact man) for maintenance of equipment, keeping of daily records, etc. Army tactical vehicles were used by the crews for the most part, equipped with air compressors and tanks, modified Lofstrand spray cans, 55-gallon drums for DDT spray concentrate, and miscellaneous tools.

During the 1947 spraying season the program was expanded into additional areas in each county already being worked, and county-wide operations were begun in Lake, Dyer, and Lauderdale counties. Also, the program was changed to premise spraying, which included all outbuildings in addition to the houses. One application was planned per season instead of two, as previously practiced. Local contributions to the program consisted of storage and office space and all labor except supervision; one CDC supervisor was furnished for each county. All of the counties, except Lake, accepted a fee of two dollars from each householder, and this money was used to defray labor costs. In Lake County, the County Court appropriated sufficient funds to pay all labor costs, and consequently no charge was made to the individual householders. Under the system of fee collection from individual householders only 72 percent of the houses contacted were sprayed as compared to 82 percent when service was free. During the period March — June 30 a total of 15,899 premises was sprayed at an average of 1.33 pounds DDT per premise and 1.15 local man-hours and 0.41 CDC man-hours. The total number of houses sprayed in Area B throughout the fiscal year was 23,512.

WAR MALARIA. War malaria larvicidal operations were conducted in areas around three military establishments in Shelby County. These included the Naval Reserve Base at Millington, consisting of the Naval Air Technical Training Center, the Naval hospital, and the Naval Air Base; the Kennedy General Hospital, now a V. A. hospital;

and the Ferry Command and Air Support Base, which was deactivated in the first quarter of 1947. A total of 1,903 gallons of one percent DDT-fuel oil solution, applied at the rate of 1.8 gallons per acre, was used to treat approximately 42.5 square miles at an expenditure of 2.2 man-hours per acre. The larvicide was applied principally with Indian-type knapsack hand sprayers equipped with mist-type nozzles., DDT-impregnated para-dichlorobenzene pellets were also distributed through some of the larger canals having constant flow. These pellets gave good control of both anopheline and culicine larvae until the pellets became covered with silt.

TYPHUS CONTROL. Dusting and ratproofing projects were initiated in the cities of Knoxville (Knox County) and Nashville (Davidson County) in February 1947. Ratproofing was begun in Chattanooga (Hamilton County) in October 1946, and in Cleveland (Bradley County) in May 1947. Rat eradication was carried on in all buildings ratproofed. Each project was directed by the local health department, supervised and coordinated by the State Health Department. The State contributed the services of one engineer on an approximate full-time basis. At Nashville and Knoxville the local contribution consisted of office space, secretarial aid, full-time work of one inspector, and part-time assistance from other city personnel. Cleveland contributed office space, secretarial aid, and a part-time sanitarian. Chattanooga supplied office space and a revolving fund.

During the year 370 buildings were ratproofed at an expenditure of 37.2 man-hours for each, and 25,894 premises were dusted at an average of 1.65 pounds ten percent DDT dust and 0.27 man-hour for each application. A total of 111 buildings was freed of rats in conjunction with ratproofing at an expenditure of 1.7 man-hours for each, and poisoning was done upon request in 109 other buildings at an expenditure of 4.7 man-hours per premise. Poisoning was carried out principally with red squill and 1080 water, although 20 percent ANTU was also used experimentally. There was no system of education or publicity set up for typhus control, but educational campaigns were carried out at the various projects upon request. In Clarksville some work was done toward promoting a rodent control program. The response of the citizens appeared to be more favorable as the programs progressed. On the whole, cooperation of the public was excellent.

Hand dusting DDT for control of rat ectoparasites in the basement of a feed mill in Nashville.

Installing ratproof screens and pointing up brick around windows in building in Chattanooga.

District No. 5

Headquarters: San Francisco, California

CDC activities in District No. 5 this fiscal year consisted of State-operated programs in California and the Territory of Hawaii. There were no CDC control operations in the other States or territory comprising the District. Consultation services and technical advice were available from the District Office to those State and local health departments requiring such assistance.

California

WILTON L. HALVERSON, M.D.

Director of Public Health

Malaria has been a relatively unimportant disease in California in recent years, even though it once had been common in parts of the Central Valley. Only once since 1924 has the malaria rate exceeded five per 100,000 civilian inhabitants. During the war years, intensive measures against *Anopheles freeborni* were conducted around military establishments and airfields because it appeared possible that the advent of large numbers of troops might set the stage for explosive outbreaks. However, neither during the war nor afterward did such outbreaks occur to provide justification for extending USPHS control measures to protect civilians from malaria in returning servicemen; instead surveillance of anopheline populations was carried on from fiscal years 1943 through 1947 to detect the possibility of outbreaks. Another mosquito-borne

disease of greater current significance in California was encephalitis, some types of which were already present in the State. The introduction of this disease by troops returning by air from Japan and adjacent territories, where Japanese B encephalitis is endemic, seemed quite possible, especially in view of the fact that large troop carriers were landed in California at the International Airports of Entrance-Hamilton, Mather, and Fairfield airfields — within the incubation period of the disease. Because of the delay involved in the diagnosis of infectious encephalitis and the possibility that the Japanese B virus could be introduced without anyone's knowledge, the airplane quarantine procedures were supplemented by control measures against all mosquitoes in the vicinity of these airfields. The principal vector of encephalitis in California is believed to be *Culex tarsalis*, and this species was present around each of the airfields concerned.

STATE MOSQUITO CONTROL SECTION. During the war, State mosquito control work in California had been carried on by USPHS personnel assigned to the Bureau of Sanitary Engineering of the State Department of Public Health. In March of 1946 a bill was passed allocating State funds on a matching basis to local mosquito control agencies in areas showing the presence of diseases carried by mosquitoes, either malaria or encephalitis. A Mosquito Control Section was established as a unit within the Division of Environmental Sanitation, and all CDC personnel were assigned to this Section for coordination of the entire State program. One of the most important activities of the new Mosquito Control Section was the distribution of subvention funds to local mosquito abatement districts to improve and enlarge their activities. Other responsibilities of the Section included advisory services, demonstration and study projects in areas endemic to both malaria and encephalitis, and control of any localized outbreak of mosquito-borne disease. Consultation was rendered in 29 counties and subvention contracts with 20 mosquito abatement districts covering all or parts of 16 counties were established. Under the guidance of the Mosquito Control Section the areas included in mosquito abatement districts expanded to almost twice the number of square miles protected in 1945.

With the enlargement of the State-sponsored mosquito control program, CDC activities in California were utilized more profitably along the lines of operational research rather than in actual control measures. The encephalitis control activities around the International Airports of Entrance were terminated on October 31, 1946. Planes then entered the country at Fairfield-Suisun, within the Solano County Mosquito Abatement District which is under subvention contract. The Northern California Mobile Unit, which had been reactivated in March 1946 to cope with this problem, was deactivated again when the local abatement district took over. The other project, around Castle

Mosquito Control at International Airports. In flat, dry pastures a nail keg was used for a mosquito collecting station.

Field (Merced) Army Air Base, called for control of anopheline larvae through the summer of 1946; this activity was suspended on November 15, 1946 with the development of the Merced County Mosquito Abatement District. Inspection of buildings in the vicinity of the airfield, which had been given a DDT residual treatment in 1945, was continued until the end of the fiscal year in order to determine the length of effectiveness of the residual application.

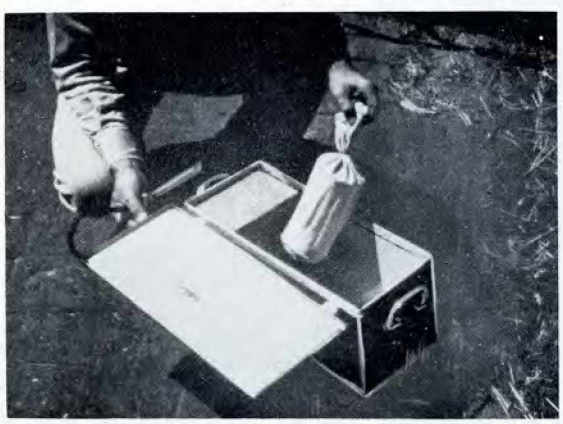
RICE FIELD STUDIES. It was found desirable to gain more accurate knowledge of the factors affecting the occurrence of mosquito larvae in rice fields, and therefore a project was initiated in March with the objective of following the mosquito ecology in a rice field through an entire season in controlled as well as untreated fields. This was especially needed because of the increased use of airplane sprays in aerosols. The project was carried on by CDC personnel with the district doing the control work and furnishing office and laboratory space. Except by dipping from the levees, it was difficult to inspect rice fields for mosquitoes. Wading through rice was not only difficult in itself and likely to affect the number of larvae to be found at the surface, but it was destructive to the crop and changed the environment of the mosquitoes by toppling stems into the water. It was therefore decided to construct bridges from which detailed observations could be made on the abundance of larvae and on the penetration and other factors relating to aerial sprays. The region selected for this project was in Modesto near the boundary of the East Side Mosquito Abatement District. One field was to be left unsprayed for comparative purposes, and two others were to serve as test areas for airplane spraying. As the season advanced, it became apparent that the simple plank bridges were an ideal solution to the difficult problem, and with the analysis of data during the winter months there is every reason to believe that some very significant information will be gathered.

(LEFT) The bridges across the rice fields were constructed before the ground was seeded.

(RIGHT) This rice paddy was bridged to study the effect of cattails on the mosquito population.

STATE ENCEPHALITIS SURVEY. Another project employing CDC personnel was an encephalitis vector survey in the Central Valley, begun in June 1947. This program, which formed part of the State encephalitis study, involved field collection and identification of mosquitoes to be tested for virus at the State Laboratory. No virus had been isolated from the material previously collected from the San Joaquin Valley in a preliminary survey made by the State CDC entomologist in August 1946, so that up to the start of this work the only infected mosquitoes from the Central Valley had been obtained in Kern County. The equipment and techniques used were those developed by the Hooper Foundation of the University of California. Until each day's collecting could be prepared in a laboratory, the mosquitoes were kept alive in a camp ice box. Then, in as rapid succession as possible, each lot was chloroformed, the males were removed, and the females were sorted according to species into chilled tubes. These, when sealed by an acetylene flame, were placed in a freezing container with dry ice to preserve the virus. Before the end of June, the State Laboratory had already isolated encephalitis virus from these collections. When the material collected during the entire summer is completely studied there will be much new information as to where, when, and in what species mosquitoes carry encephalitis in the Central Valley.

OTHER CDC SERVICES. Another CDC service to the Mosquito Control Section was assistance in developing the training program conducted from January to March at the headquarters of various mosquito abatement districts. Besides reviewing the fundamental principals of mosquito control, CDC personnel provided districts with a summary of the new approaches to the subject, especially in the use of DDT. Training films and film strips furnished by CDC were extensively used in the training program. Other CDC services included surveys of proposed U. S. Engineer's reservoirs; developing simplified keys for the principal California mosquitoes; provision of automotive and other equipment to the Mosquito Control Section; and provision of services, personnel, equipment, and financial aid to the Hooper Foundation of the University of California for assistance on their encephalitis research project in Kern County. Cooperation was also given to the U. S. Navy at Mare Island in the control of saltmarsh mosquitoes. A CDC entomologist made an extensive survey of the breeding areas involved and furnished technical guidance all through the control operations.



To keep collected mosquitoes alive in the dry, hot climate of the Central Valley, it was found practical to use a camp refrigerator for the temporary storage of the collections.

Between camp refrigerator and isolation of the virus, the mosquitoes were chloroformed, identified, recorded, sealed in Pyrex tubes with an acetylene flame, and shipped in dry-ice cartons to the State Laboratory.

Territory of Hawaii

C. L. WILBAR, JR., M.D.
President, Board of Health

All control activities in the Territory of Hawaii this year were directed against rodent-borne diseases. A total of 130 persons was engaged in rodent control throughout the Territory, under the direction of the Territorial Board of Health. Of this number, 115 were associated with plague surveillance or control and 15 participated in the Honolulu typhus control program. The territorial legislature appropriated 58 percent of the funds required for DDT dusting operations. CDC contributed some labor, DDT dust, rat poisons, and other materials and equipment. Plague surveillance and control was carried on almost entirely with local funds.

RATPROOFING. The Honolulu typhus control program was inaugurated August 23, 1946. During the remainder of the fiscal year two crews of two men each ratproofed 82 commercial establishments and six residences. Each premise required 34.5 labor and foremen man-hours to complete necessary modifications, at an average cost to each owner of 98.60 dollars. Eradication measures and DDT dusting were accomplished in conjunction with ratproofing as a free service. Of the 3,033 man-hours worked, 58 percent was paid for from local funds. A third crew was scheduled to begin operations in the next fiscal year.

Surveying, estimating, and re-inspection of buildings requiring ratproofing were done by trained rodent control inspectors. The Bureau of Rodent Control also investigated all complaints received relating to rodent infestations and followed up on typhus cases. Inspections were made of buildings under construction to determine if marginal walls were being correctly installed. Standard methods of ratproofing were followed whenever possible in the installation of curtain walls, door flashings, vent stoppage, etc., utilizing the most durable materials.

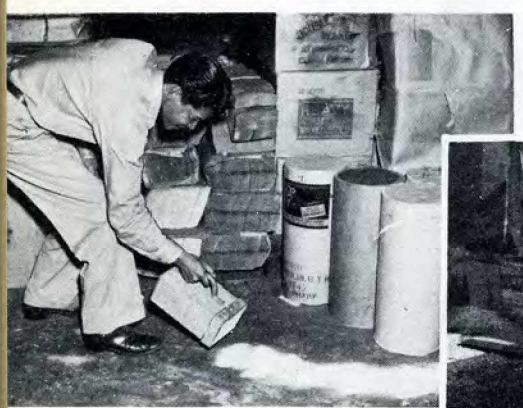
TRAPPING. A total of 409 rats and 265 mice were snap-trapped in 81 establishments ratproofed by the two Board of Health work crews. Trapping as an eradication measure was routine wherever rodent infestations existed. All rats trapped were combed for ectoparasites and examined for plague infection. Rats and mice were also snap-trapped by 14 other trappers engaged solely in plague surveillance activities.

RAT POISONING. Rat poisoning with 1080 began in April 1947 on an experimental basis to test and confirm established methods and techniques. At the beginning of June, 1080 poisoning was incorporated in the typhus control program. During June, four establishments received the 1080 treatment, each of which required an average of 11 labor and foremen man-hours to place and recover 1.5 pints of 1080 water. Good results were obtained with this rat poison and extensive use will be made of it during the next fiscal year.

RESIDUAL DUSTING. Dusting with ten percent DDT was carried on in the City of Honolulu only in those premises which were heavily infested with rodents and were later ratproofed. A total of 63 premises was dusted, requiring an average of 2.08 pounds

of ten percent DDT dust and 0.87 labor and foremen man-hour per application. Large scale dusting in selected areas, where the incidence of typhus fever had been high over a period of several months, was scheduled for the peak "typhus months" of August, September, and October. In preparation for this program the pamphlet, "Kill That Flea," was distributed throughout these areas. Zero steel traps were used to obtain additional ectoparasite data.

EDUCATIONAL ACTIVITIES. Five films on rodent control were available for showing to the general public through the Bureau of Health Education. News releases were issued throughout the year reporting progress in the ratproofing and eradication program and requesting public assistance and cooperation. In addition, the Bureau of Rodent Control in cooperation with the Bureau of Health Education formulated and inaugurated a long term educational program to inform the public of the extent of the typhus problem and the control measures indicated. Typhus control film strips furnished by CDC were utilized during the year for in-service training of rodent control personnel.



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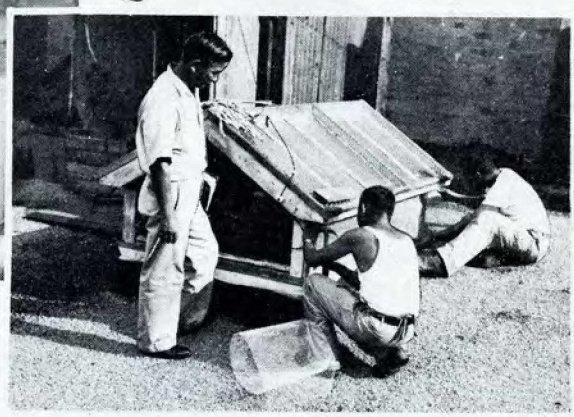

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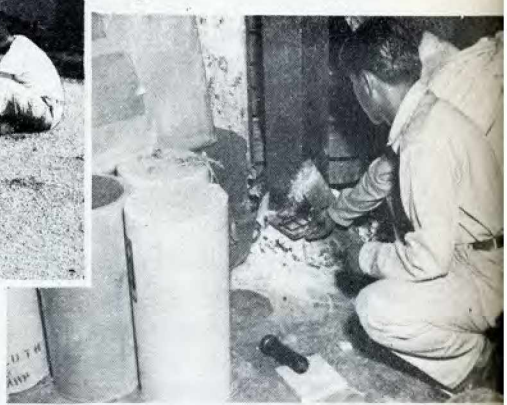

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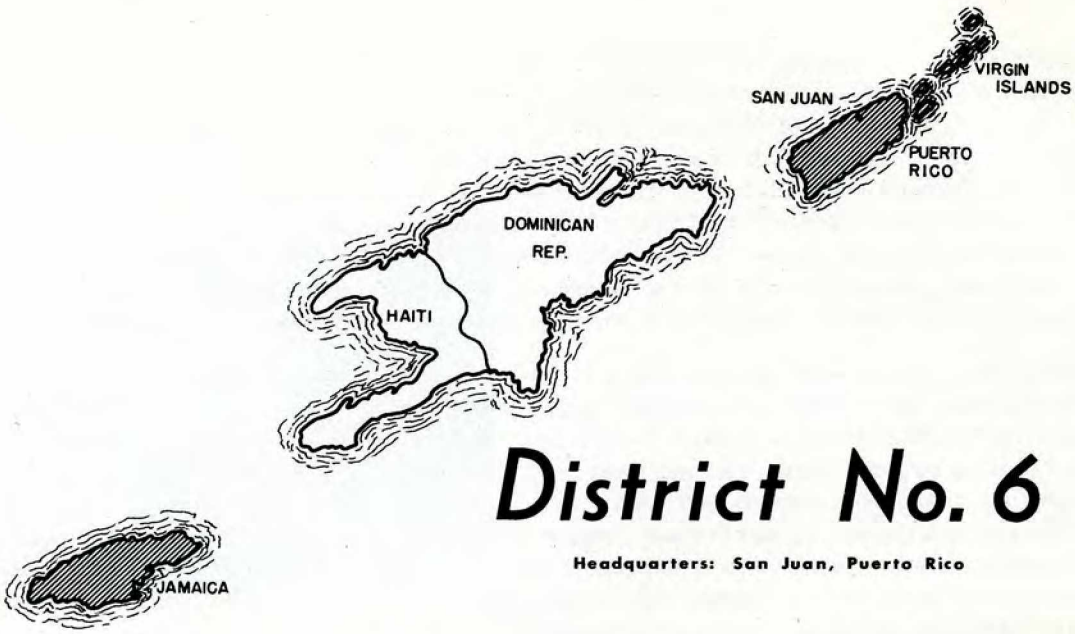
1 Applying ten percent DDT dust with a hand shaker along a rat runway in the basement of a bakery.

2 Ratproofing a dry goods store adjacent to a restaurant by sealing louvres on roof with hardware cloth.

3 Setting a snap trap in a spot just dusted with ten percent DDT in the basement of a bakery.

4 Honolulu store window display prepared by the health department as part of an educational campaign to secure control of typhus fever.



District No. 6

Headquarters: San Juan, Puerto Rico

CDC activities in District No. 6 during the fiscal year were concerned mainly with the control of malaria in areas contiguous to military establishments in Puerto Rico and Jamaica, B. W. I. Active operations and collaboration were maintained with the Bureau of Malaria of the Insular Health Department in carrying out civilian malaria control projects in Puerto Rico. The very close cooperation with the malaria control agencies of the Army and Navy has become increasingly important. A joint Army, Navy, AAF, and U. S. Public Health Service Malaria Control Board was formed to further coordinate activities and utilize equipment and manpower as economically as possible to secure the most efficacious results for the protection of military personnel against the malaria hazard. The malaria rate among military personnel in Puerto Rico declined to a new low of only two per thousand in 1946. This compares with a rate of five per thousand in 1945 and 88 per thousand in 1940. Of special significance has been the recognition by the Army and Navy of the part played by District No. 6 CDC activities in realizing the tremendous progress made in the fight against the malaria hazard in Puerto Rico. Typhus control activities and a demonstration spraying project for filariasis control also were carried out in the Virgin Islands.

Puerto Rico

JUAN A. PONS, M. D.
Insular Commissioner of Health

At the beginning of the fiscal year there were six larvicidal and minor drainage projects in operation and surveillance was being maintained at two locations. Reductions in the number and size of military establishments during the year left four

larviciding and three surveillance projects at the end of the year. In addition, a major drainage demonstration project was continued in the Ponce area in cooperation with the Insular Bureau of Malaria Control until May 31, 1947. Of the total sum spent on this project, the Health Department and the War Emergency Program Agency of the Insular Government contributed 75 percent and CDC 25 percent. Almost all significant *A. albimanus* breeding places within the two-mile zone of this malarious city were eliminated during the period since April 1945, when the project was begun. Work was continued on a reduced scale by the Bureau of Malaria Control at this location, and CDC continued to furnish consultant service and some equipment on a loan basis.

During the fiscal year an average of 125 persons per month were employed by CDC on the various activities, representing an average monthly reduction of about 105 persons under fiscal year 1946. In the last half of the fiscal year a 50 percent reduction in expenditures of manpower and materials at the several projects was achieved by the almost exclusive use of DDT larvicide. Spraying equipment and chemicals became available in sufficient amount to enable the gradual discontinuance of paris green larviciding, which had been the chief method in use up to this year. Limited paris green power dusting was still practiced in some locations to cope with special problems which were particularly suitable for this type of treatment. Another great advantage in the use of DDT larvicide was its ability to maintain adequate control in adverse weather conditions, an important consideration in the tropics where showers occur repeatedly during the day to nullify the effects of applied paris green dust.

The entomological phase of the malaria control work was reduced to some extent with the use of the new larvicide and also because of the lessened need for field entomological surveys to guide major drainage activities, which were greatly reduced this year. Essential data on larval and adult mosquito populations, as determined by weekly animal bait trap and nightly light trap collections, were of increasing value in guiding DDT-thermal aerosol plane spraying operations of the Army and Navy at some locations in District No. 6. With the reduction of major drainage projects on which various construction machinery had been used, the item of machine maintenance was not of such great concern as during previous years. Over-age motor vehicles, however, continued to require major repairs to keep them in operating condition.

WAR MALARIA CONTROL. The Fort Buchanan project was reorganized during the year. A

Anopheles albimanus breeding area in a Puerto Rican village within two-mile zone of a war establishment.

Hand larviciding *A. albimanus* breeding area with 1.25 percent DDT.

civilian project manager was employed and the area was divided into three zones to provide for greater efficiency in the application of the DDT larvicide in place of the paris green heretofore used. Some control acreage was eliminated after entomological findings revealed that certain sections were of little importance in the over-all control program. A Navy-operated DDT thermal-aerosol plane continued regular scheduled flights to control breeding in a large swamp common to Fort Buchanan and San Patricio, thus allowing for a reduction in personnel. Early in the fiscal year the Navy Hospital at San Patricio was transferred to the Veterans Administration. In January a request was received from this organization to provide extra-cantonment protection for the hospital. As this location was within existing controlled areas, and adjacent to a 500-unit Navy housing project, no additional action was necessary to comply with this request. It was thus possible to furnish adequate vector control to Fort Buchanan, San Patricio housing, and the Veterans Administration under single project direction. However, the control at each location was subdivided to effect separate unit functioning. Also, CDC maintained close contact with Navy airplane spraying operations, the flights being conducted in accordance with entomological findings by CDC.

Losey Field remained the only project operating under CDC on the south coast of Puerto Rico. The control area remained unchanged during the year. The substitution of DDT larvicide for paris green was especially revealing at this location; labor and material requirements were greatly reduced with the use of the new larvicide. A high degree of efficiency was developed at this project through working cooperation with Post Engineer intra-reservation control. Excellent results were demonstrated, with a great reduction in manpower.

The District CDC office was advised in January that Fort Bundy Army Post, on the east side of the island, would be reactivated in the near future. On the basis of this information, a project was initiated with a view towards effective vector control by the time of expected troop arrivals. A civilian manager was hired to assume charge of the local CDC activities and actual operations were developed on the basis of entomological findings in the last part of the fiscal year. The area is par-

Removing aquatic vegetation from drainage ditch at Ft. Buchanan.

Power spraying oil larvicide from an Army decontamination unit in the Losey Field control area.

Spraying DDT from a truck equipped with a thermal aerosol attachment on the exhaust pipe.

ticularly suitable for DDT plane spraying, and recommendations of the District CDC office resulted in spraying operations to effect satisfactory control. It was expected that this location will be of greater importance operationally in the next fiscal year as increased numbers of personnel are to be stationed here.

The Ceiba Unit at Roosevelt Roads Navy Base was reduced and certain areas were combined with Fort Bundy surveillance. Entomological data obtained here were used to enlist the cooperative action of an Army plane in spraying Navy control areas. The Salinas Training Area, a highly endemic malaria location on the south coast, was reduced to a surveillance project during the year and closed out completely in April 1947. The anticipated use of the area by the Army did not materialize because of general personnel restrictions. Surveillance at Borinquen Field was discontinued by mutual agreement with the military authorities. Cooperative surveillance continued at Henry Barracks and Camp O'Reilly to the extent of light trap collections. The use of the DDT thermal aerosol plane for the protection of Navy installations in the San Juan area was highly successful. CDC maintained close contact with the Navy on this program, and at times made emergency loans of needed larvicide materials and equipment to insure continuation of regular scheduled flights.

A summary of operations at the Fort Buchanan, Fort Bundy, Losey Field, and Salinas Training Area projects included: 11,246 pounds of paris green dust distributed by hand over 25,068,000 feet of ditches and 3,175 acres of breeding area at an expenditure of 32,482 man-hours; power dusting of 1,707 pounds of paris green over 1,658 acres, requiring 654 man-hours; 6,770 gallons of oil hand larvicided over 2,255,100 feet of ditches in 5,447 man-hours; 1,446 gallons of oil power sprayed over 208 acres in 228 man-hours; and 15,056 gallons of 0.625 percent DDT larvicide hand sprayed over 18,345,200 feet of ditches and 5,345 acres of breeding area at an expenditure of 35,183 man-hours. Supplementary control measures included the removal of 2,291,800 square feet of aquatic and semi-aquatic vegetation, 1,205,800 square feet of land vegetation cleared, 519,749 linear feet of ditches cleaned, and 8,000 linear feet of ditches constructed at a total expenditure of 34,485 man-hours. DDT residual spraying was carried out in 773 premises at Losey Field and 44 premises in the Salinas Training Area. Of the total of 169,169 man-hours worked, which included supervision, entomological inspection, repair and maintenance, and miscellaneous time, 88 percent was furnished by CDC.

At the Ponce demonstration drainage project a total of 193,382 linear feet of Panama concrete inverts, flat concrete slabs, and four to 30 inch concrete tile was manufactured. Drainage construction and maintenance included 224,865 square feet of cleaning and grubbing; 105,607 cubic yards of ditch excavation by various methods; 34,561 cubic yards of earth fill moved by bulldozer for filling and diking; 15,178 linear feet of Panama inverts and 49,768 linear feet of flat concrete slabs for permanent ditch lining; and additional amounts of fill, spreading soil, ditch bank stabilization, rip rap, concrete, reinforcing steel, etc. Two pumping stations with a combined capacity of 20,000 gallons per minute were constructed to drain 750 acres of swamp land. Some 21,655 man-hours of supervision, survey, construction, and machine operation were furnished by CDC up to May 31, 1947, at which time CDC participation in the cooperative project was terminated.

TYPHUS INVESTIGATIONS Evaluation of typhus control operations in San Juan was continued. A total of 470 rats was caught and 401 ectoparasite samples were submitted to CDC headquarters in Atlanta for identification. Beginning on April 21, 1947, blood sera were submitted to the Virus Laboratory at Montgomery, Alabama for complement-fixation testing; 66 were sent up to the end of the fiscal year. Typhus control operations were conducted by the Insular Health Department.

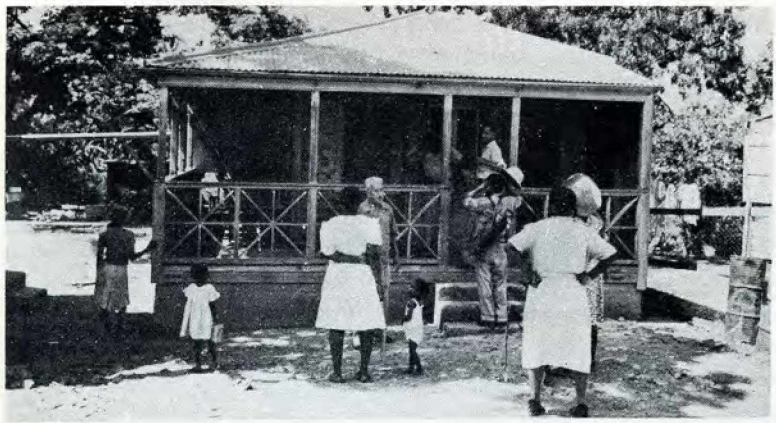
MISCELLANEOUS ACTIVITIES. The District CDC office assisted the Quarantine Service in establishing an *Aedes aegypti* surveillance project around the San Juan airport. Inspectors were trained and the routine procedures established. All insect identifications relating to this program and aircraft inspection of the Quarantine Service were made by the CDC district entomologist. During the year the branch laboratory of the CDC Laboratory Division, located at the School of Tropical Medicine, continued operations. This branch laboratory was inaugurated in April 1946 for the purpose of collecting fresh and preserved specimens pertaining to tropical and parasitic diseases, and to conduct field investigations in cooperation with the Laboratory Division. The laboratory conducted a number of small malaria surveys and cooperated with the malaria control activities of the Insular Health Department and the CDC district office in providing facilities for processing blood films taken in the annual surveys done in Humacoa, Loiza Aldea, and Santa Isabel, P. R. It also participated actively in the typhus investigation program. The cooperation of the Army Medical Laboratory and the Department of Parasitology of the School of Tropical Medicine, San Juan, has been invaluable in aiding the laboratory in its accomplishments.

Virgin Islands

KNUD KNUD-HANSEN, M.D.

Commissioner of Health

FILARIASIS CONTROL PROJECT A large scale demonstration project of residual DDT house spraying for the control of filariasis was started on the island of St. Croix, V.I., during the year in cooperation with the St. Croix Health Department. A team from Columbia University performed the epidemiology surveys, which revealed a filariasis infection rate of 13 percent among school children on the Island in 1946. The spray crew consisted of five laborers, two foremen, and one supervisor. The equipment used



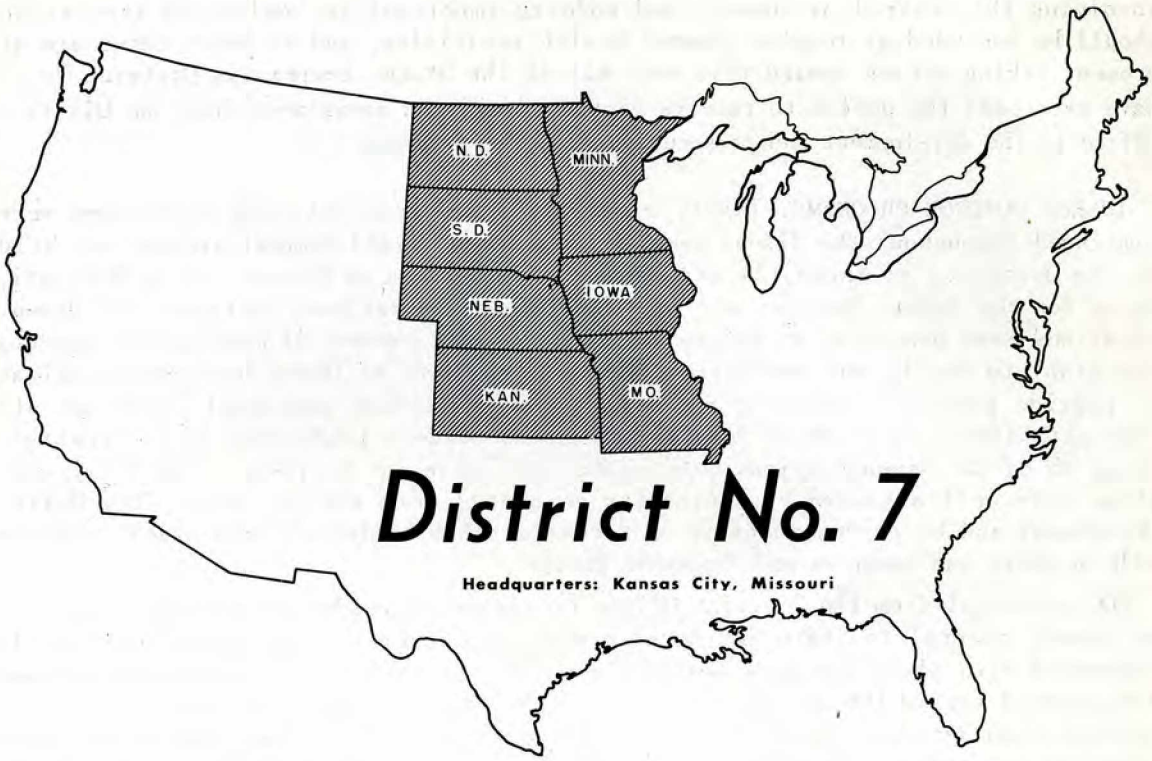
DDT residual spray crew preparing to spray house on St. Croix for filariasis control.

included a Hardy 50-gallon power sprayer mounted on a one-ton truck and four-gallon Hudson hand sprayers. A one-half ton pick-up truck was used as transportation for the crew of hand sprayers. A total of 5,385 houses was sprayed in the towns of Christiansted and Frederiksted, and in rural areas. Each treatment required 2.3 man-hours to apply 1.01 pounds DDT in a five percent emulsion concentrate.

TYPHUS CONTROL. Typhus control activities were conducted in St. Thomas, V.I. The project was operated with local funds, with CDC furnishing one supervisor. The active cooperation of the Virgin Islands government was maintained to produce significant results in the ratproofing of most of the business establishments. During the fiscal year 69 establishments were ratproofed, 31 were rat-freed, and three establishments received 1080 poison treatment. CDC participation was curtailed at the end of the fiscal year. The project will be continued on a reduced scale by the local health authorities, and CDC headquarters office personnel will provide any requested consultation service.

Jamaica, B.W.I.

CDC activities in Jamaica consisted of larviciding operations for the protection of Vernam Field, a "lend-lease" Army Air Force installation. During the fiscal year 3,443 pounds of paris green were hand dusted over 8,363,700 feet of ditches and 538 acres of breeding surface. Supplementary measures consisted of 18,700 square feet of aquatic and semi-aquatic vegetation removed and 16,057 linear feet of ditch cleaning. A total of 32,881 CDC man-hours was expended for control activities, which included also surveillance, entomological inspection, clerical work, repair, etc. Significant reductions in the number of personnel stationed at Vernam Field occurred toward the end of the fiscal year. Negotiations were initiated by CDC headquarters in April to discontinue ground operations. An Air Force airplane was assigned for aerial spraying as a substitute for ground control measures in the latter part of June, and CDC participation in the project was officially terminated June 30. CDC continued to provide surveillance for the guidance of the aerial spraying. Entomological reports and close liaison with the local AAF headquarters served as a basis for the aerial control operations.



CDC activities in District No. 7 this fiscal year included several programs continued from the previous year and additional new activities which were developed under the stimulation of promotional work conducted in 1946. Malaria control and insect control programs were continued throughout the year, supplemented by insect control field demonstrations to provide practical training for health and sanitation personnel. Consultation services on insect control were offered to State and local health departments, and to the U. S. Engineers relative to impounded water developments. District CDC personnel conducted several insect control surveys, and State and local sanitation personnel carried on demonstrations in the use of DDT with DDT Isomer obtained from the District Office. About the middle of the fiscal year, active rodent control programs began in the States comprising District No. 7. The extent of this interest and the demand for consultation services warranted the assignment of rodent control personnel to the District CDC staff. This assignment enabled the provision of much-needed consultation to the States relative to rodent control and made possible the better utilization of other CDC personnel for the greatly expanded fly suppression activities which had developed.

The 1947 season was characterized by a growing interest and demand on the part of the general public and private industry for planned action in regard to insect and rodent control. State and local health departments received an increased number of requests for aid and assistance of all kinds, and two States had personnel who spent a considerable amount of their time in these activities. However, none of the seven States has yet incorporated rodent and insect control as planned programs into their regular health activities. District CDC personnel have for the most part acted within the respective States in these programs. Most of the States recognized that programs

involving the control of insects and rodents important to health and sanitation should be included as regular planned health activities, and at least three are at present taking action toward this end. All of the States comprising District No. 7 have expressed the desire to receive continued aid and assistance from the District Office in the development and prosecution of these programs.

INSECT CONTROL PROGRAMS. Insect control field demonstrational activities were continued throughout the fiscal year. A total of 64 field demonstrations was held in the District; of these, 24 were given in Iowa, ten in Kansas, 19 in Missouri, seven for the Indian Service, and four for interstate railroad carriers. All demonstrations were practical in nature and included the control of most of the insects important to health and sanitation. The main purpose of these demonstrations was to provide practical training for health and sanitation personnel, although all demonstrations were attended by numerous civic leaders interested in fly control. About 15 of the demonstrations held in Missouri were in the vicinity of St. Louis. These were well attended by sanitation personnel from the St. Louis City Health Department and by representatives of a considerable number of industries, such as milk products and beverage and wholesale groups.

CDC personnel from the District Office continued to render consultation services on insect control to State and local health departments. States were especially concerned with plans for pest mosquito control, fly control, malaria control, and the general use of DDT as an insecticide. The States which requested the bulk of consultation services included Kansas, Missouri, and Iowa. Consultation was also rendered on several occasions to the U. S. Marine Hospital at Kirkwood, Missouri. Consultation services relative to impounded water developments were continued with the U. S. Engineers. Participation in this activity was given particularly for the planning of recreational developments for the Upper Mississippi River Pools and for the development of the Harlan County Reservoir, Nebraska.

District CDC personnel were available throughout the season for the completion of insect control surveys. During the year malaria control surveys were completed at the request of the Army for Fort Crook, Nebraska, and vicinity. Also, a mosquito control survey of Dry Lake, Kansas, was made at the request of the Kansas State Board of Health.

DDT ISOMER DISTRIBUTION. The District Office continued to receive requests from various State health departments for DDT Isomer concentrate. A significant amount of activity was carried on by State and local sanitation personnel in demonstrating the use of DDT and other insecticides for the control of insects important to health. Iowa conducted a State-wide fly suppression campaign in which scores of cities participated. In Nebraska many communities were engaged in similar activities. Sanitation-fly control programs were also started during the latter part of the fiscal year in Kansas and were continued throughout the fly-breeding season. In all of these States the promotional phases of the programs, together with the supervision and direction of the various campaigns, were completed largely by local sanitation personnel. The ability of these individuals to carry through with such programs was mainly affected by the distribution of DDT Isomer concentrate and the loan of equipment by the District CDC unit. A total of 136 drums of 28 percent concentrate was distributed to health departments within the District, of which 32 drums went to Iowa, 42 to Kansas, four to Nebraska, 12 to Minnesota, 32 to Missouri, 11 to North

Dakota, two to South Dakota, and one to the Warm Springs Indian Agency in Warm Springs, Oregon.

RODENT CONTROL PROGRAMS. In order to meet requests from States concerning training of personnel in rodent and insect control, a practical, formal, four-day course of instruction was organized by the District CDC staff. The purpose of this course was to give concentrated practical instruction to assembled groups of sanitation personnel. It was also designed to be given during the off-season when the reduced load of sanitation work in the States would permit full attendance. One school was conducted in South Dakota and reports from that State Health Department indicated that the instruction and practical training given were most helpful to sanitarians in the prosecution of their rodent and insect control activities.

From December to June CDC personnel from the District Office rendered rodent control consultation to four States in the District. Visits were made to six cities in Iowa, two in Nebraska, and three in Kansas, all of which were interested in establishing rodent control programs. In Missouri two cities, St. Louis and Kansas City, began active rodent control programs. District Office personnel maintained close contact with each of these cities throughout the season to assist in the development of the respective programs. Consultation in rodent control was also extended to Federal agencies within the District; surveys and recommendations were made for the Federal Bureau of Prisons at Leavenworth, Kansas. Also, as part of the rodent control work, 14 rat surveys were made in various cities throughout the District.

Field assistance and supervision were furnished to St. Louis and Kansas City in the development of their rodent control programs. The initiation of typhus and ectoparasite surveys within these programs was largely made possible by the field activities of CDC personnel from the District Office. At times during the year the organizational planning and ratproofing were also conducted under the supervision of District CDC personnel. Such direct aid in rodent control was reduced as soon as personnel within these programs were sufficiently trained to take over the work.

SANITATION-FLY CONTROL. During the winter and early spring months several cities and towns within the District became interested in community sanitation-fly suppressive programs. Iowa initiated a State-wide program, and five cities in Kansas and one in Minnesota planned similar activities. At the request of the States, District CDC personnel met with civic leaders in these cities for the purpose of organizing the communities to carry on the work, and also provided field supervision and other direct aid to these campaigns. It was felt that most of these programs were very successful and that a considerable number of permanent improvements in basic sanitation were accomplished. Probably this activity will be expanded during

Spraying a city garbage dump with a four percent DDT isomer—fuel oil solution for fly control.

the next fiscal year, but field supervision and direct aid will be contracted only as the State health departments acquire and develop personnel to furnish such assistance.

EMERGENCY PROGRAMS. District CDC personnel played a considerable role in the prosecution of emergency programs during the year. Throughout the month of June, a representative of the District Office was engaged in supervising sanitation activities initiated following the Texas City, Texas disaster. Because of the 1947 midwestern flood, District CDC personnel initiated an emergency insect control program for residents of the flooded areas. Extensive residual house spraying, ground larviciding, and airplane spraying were started in the flood area in four States at the close of the fiscal year.

Missouri

R. M. JAMES, M. D.

Director, Division of Health

In order to conduct malaria control activities in Missouri this year as extensively and completely as in previous seasons, it was apparent that an increased amount of local participation in the program would have to be secured. Public opinion was enthusiastically in favor of continuing the program and there seemed little doubt that local funds would be provided if a method of securing collection could be worked out. Every effort was made to encourage counties to pass tax levies to finance the program, but only one county (Mississippi) chose this means of raising funds. In the other counties, a DDT Fund Committee was appointed by the County Court, and this committee, with the assistance of CDC personnel, appointed subcommittees in various localities which collected contributions from the residents. Many civic organizations voluntarily assisted, and many business men sponsored advertising. Almost without exception the participation was successful. However a continuing effort is being made to encourage local taxation as the most practical means of raising funds.

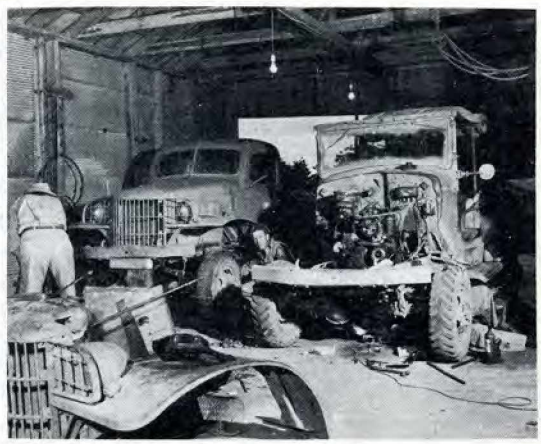
RESIDUAL SPRAYING PROGRAM. The extended program was continued in eight counties in southeast Missouri: Butler, Ripley, Scott, Stoddard, Dunklin, Mississippi, New Madrid, and Pemiscot. Only the delta regions and areas of most severe malaria incidence were sprayed in the first four above-mentioned counties, so that control for these entire counties was not maintained this year. However, it was anticipated that increased local participation will provide funds for county-wide operations next year. Local funds raised this

Spray crew going to work in house in Sikeston.

year were used primarily for defraying labor costs and miscellaneous expenses. Selection of personnel was made by CDC supervisors so as to eliminate undesirable employees over whom supervisors would have no control in regard to employment or termination. During the first half of the fiscal year 31,123 homes were sprayed at an average expenditure of 1.04 man-hours per application. In the 1947 season 39,935 homes were sprayed, with a drop in man-hours to 1.00 per application.

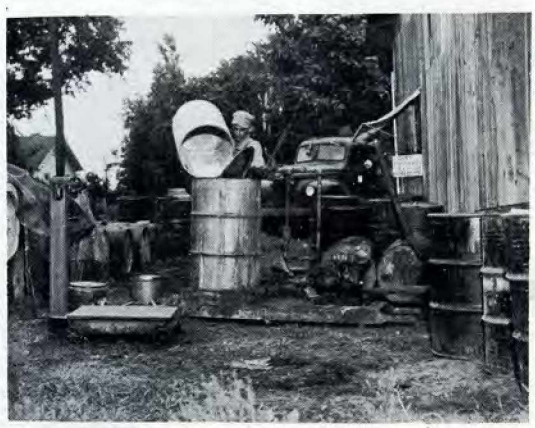
Repair and maintenance jobs of automotive and sprayer equipment was done in the mechanical shop. During the winter each vehicle was completely overhauled and painted. Good maintenance and overhauling paid dividends during the busy spraying season in better vehicle operational efficiency. Breakdowns were held to a minimum, resulting in little time being lost by spray crews on this account. Hand sprayers were modified in the mechanical shop for use with air compressors, thus saving initial sprayer costs, lengthening the life of hand sprayers, and reducing labor time formerly required for hand pumping. The T-1 Westinghouse compressor was found to cause excessive wear and tear on the generator of the vehicle to which it was attached. To obviate this, the 50-gallon air tank was filled at service stations when available, and the compressor on the truck was used only to supplement air pressure in the tank when service station air was not available. Experiments were also tried with a small spark plug compressor, which was found satisfactory. In these ways, compressor costs were reduced to about one-seventh of the T-1 air compressor.

A small power mixer was maintained to take care of mixing DDT concentrate and DDT Isomer. Only 6000 gallons of 35 percent DDT concentrate were mixed because a larger amount of prepared concentrate was used this year. However, it was the opinion of the supervisors that the prepared ready-mixed concentrate was inferior in quality to the material prepared at the central



Automotive and sprayer equipment were repaired in the mechanical shop in Clarkton.

The 50-gallon air tank, which furnished compressed air for the spray cans, was filled at service stations.



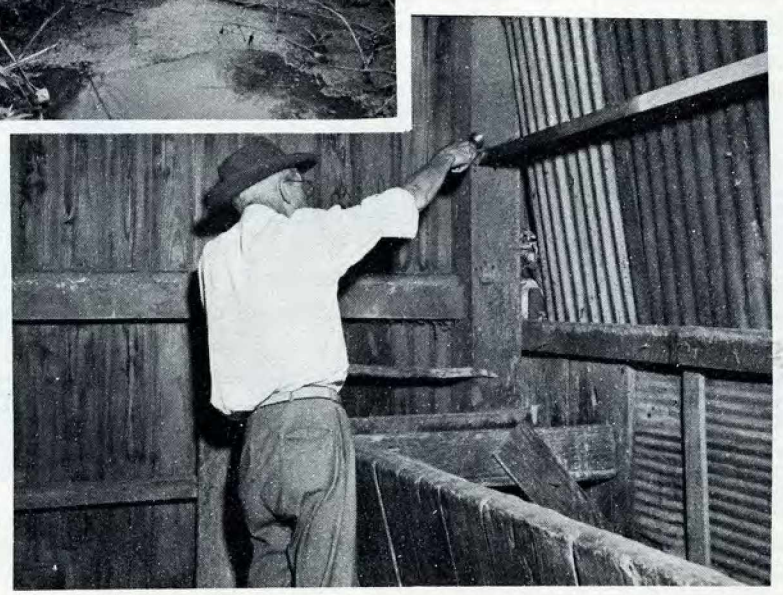
DDT concentrate and Isomer were mixed at Clarkton and shipped throughout District No. 7.

mixing plant. A large amount of DDT Isomer was mixed and shipped to various States as directed by USPHS District No. 7. Also, shipments were made to many public health officers and engineers throughout the State of Missouri.

Inspections were made of 1,555 sprayed houses during the year, and in no instance was even one of these homes found to be infested subsequent to spraying. Inspections in areas adjacent to control areas revealed the presence of large numbers of mosquitoes, flies, and other insects which were not present in sprayed residences. The State CDC entomologist was in the process of securing and assembling data to be used in compiling a bulletin, "Mosquitoes of Missouri." In order to obtain additional data light traps were operated in nine counties chosen to give representative catches from the entire State. Biting collections were made in 31 counties.

WAR MALARIA. Requirements for war malaria programs diminished greatly, with activities being conducted only in four military areas this year. The Veterans Administration Hospital area near Excelsior Springs and the O'Rielly General Hospital area in the vicinity of Springfield were protected by surveillance only. In the Fort Leavenworth — Wadsworth Hospital and Jefferson Barracks areas DDT larviciding with

Entomological inspector dipping for mosquito larvae in roadside ditch within controlled war area.



Inspector searching for resting adult *quadrimaculatus* in a barn.

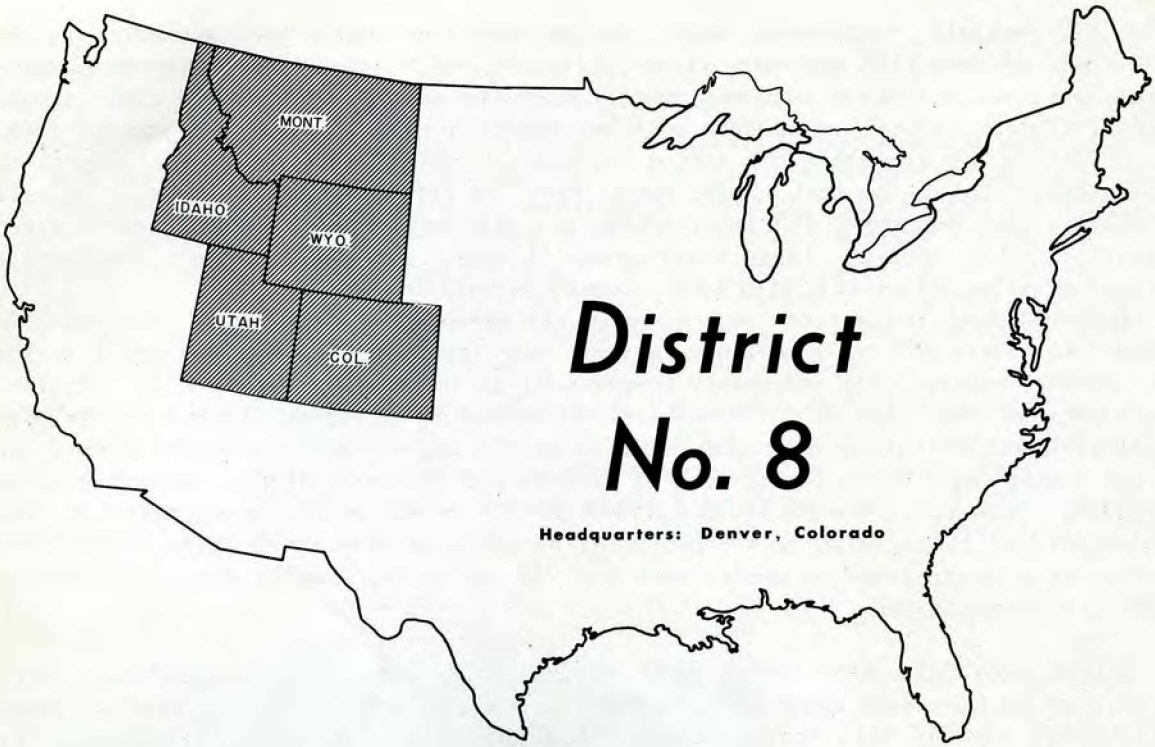
No. 2 Diesel oil, a spreading agent, and an atomizing nozzle was continued, at the rate of 0.05 pound DDT per acre. It was definitely established that a trained sprayer-inspector could furnish adequate control over the scattered limestone sinks around the Jefferson Barracks area. This post was deactivated at the end of September 1946, eliminating the necessity for active control operations. However, surveillance was maintained during the rest of the fiscal year. At Fort Leavenworth (Kansas) several laborers were engaged in DDT larviciding, and also made extensive use of paris green power dusting over the large water areas throughout the fiscal year. Inspectors reported an excellent kill with both types of larviciding.

Entomological inspections were made in war areas which were being larvicided in order to insure effective control. In each case the project supervisor acted as the inspector, making daily and weekly inspections at the various stations. In addition, inspections were made by the State CDC entomologist at varying intervals for more detailed entomological data than secured by the supervisor-inspector. During the year a total of 329,024 linear feet of ditches and 150 acres of more extensive water surfaces were treated with 1,215 gallons of DDT in oil at an expenditure of 4,216 man-hours of labor. Also, 2,477 pounds of paris green were power dusted over 1,890 acres of mosquito-breeding ponds, requiring 736 man-hours. A small amount of clearing was also accomplished.

EPIDEMIOLOGY DATA. From 1937 to 1942 approximately 50 percent of all malaria deaths occurred in the seven southeastern counties now included in the extended program. From 1943 to 1946 this figure dropped to 16 percent, due in part perhaps to the effects of the malaria control program. By the end of 1946 the malaria deaths in the entire State dropped to one-eighth of the 1937 number, with a total of only 12 during the year 1946; in the southeastern counties the deaths dropped to one-thirtieth the number in 1937, with two deaths in 1946. Mortality from dysentery — amebic, bacillary, and others — followed the pattern of malaria deaths, with a sharp decrease in 1943. While no special emphasis could be placed on the decrease in typhoid as a result of malaria control operations, it might be assumed that successful control of insects in southeast Missouri had played a major role in decreasing typhoid morbidity. In 1946 no deaths from typhoid were reported in southeast Missouri.

In 1937, 50 percent of all infant deaths (under two years) from diarrhea and enteritis occurred in the southeast Missouri counties. By 1942 this had dropped to ten percent, and by 1946 to less than three percent. For the entire State, by 1946 infant deaths from diarrhea and enteritis had decreased to little less than half the number in 1946, but these deaths in southeast Missouri had dropped to *one-thirtieth* the 1937 number, indicating a much sharper decline in the southeast than the rest of the State as a whole. Morbidity for the group over two years of age followed a similar trend. From this it could be assumed that residual spraying operations were helping to decrease diarrhea and enteritis morbidity by controlling insect populations.

County, State, and district health officers encouraged the use of DDT for general sanitation rather than for malaria control alone. Several fly and other insect suppression campaigns were inaugurated at the end of the fiscal year. Public opinion overwhelmingly favored the use of DDT and other insecticidal materials for the elimination or suppression of mosquitoes, flies, and other insects. Should local participation continue as during this fiscal year, it is anticipated that CDC activities will be expanded and extended into areas not at present covered by operations.



District No. 8

Headquarters: Denver, Colorado

The beginning of CDC activities in District No. 8 this fiscal year was marked by a shift in emphasis from war malaria control to a broader community-protection program. War malaria operations were conducted around two military establishments only during the first half of the fiscal year. The new aspect of CDC activities included assistance to city, county, and civic groups in establishing local mosquito control projects; demonstrations of DDT spraying; rodent control investigations; and the collection of data on mosquito distribution throughout the district.

WAR MALARIA. During the first half of the fiscal year malaria-mosquito control operations were conducted in the vicinity of the Army General Depot and Prisoner-of-War Camp, Ogden, Utah, and around Bushnell General Hospital, Brigham City, Utah. The control operations, which included larviciding and minor drainage work, were carried on at Ogden during the period May 15 to October 1, 1946, and at Brigham City from May 15 until the middle of July 1946, shortly after the closing of Bushnell General Hospital.

MOSQUITO ABATEMENT DISTRICTS. In Utah assistance was given to city officials of Ogden, Brigham City, Magna, and Redmond, and to county officials of Weber and Box Elder counties in the organization and operation of mosquito abatement districts. Similar assistance was rendered to city officials and local civic groups of Alamosa and Craig, Colorado.

MOSQUITO DISTRIBUTION. Mosquito light traps were operated and general collections made in the mosquito abatement districts and other areas in District No. 8 to secure information on the distribution and abundance of mosquito species. As a result of

these activities it was possible to assemble and publish the first general study on the mosquitoes of Idaho and to further supplement knowledge concerning the mosquitoes of Utah, Colorado, Wyoming, and Montana.

DDT DEMONSTRATIONS. A series of demonstrations of DDT residual spraying were conducted at the Uintah-Ouray and the Consolidated Ute Indian Agencies, and at Fort Duchesne, Utah, and Ignacio, Colorado, respectively. The purpose of these demonstrations was to stimulate the establishment of local mosquito control programs.

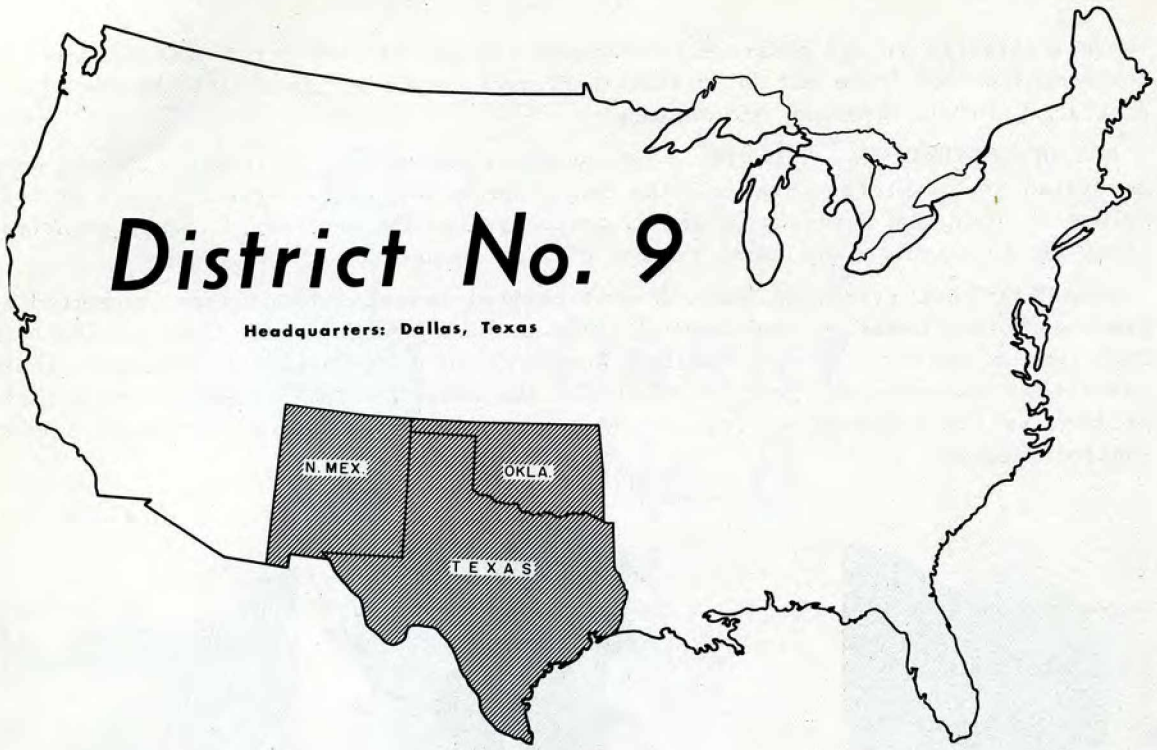
RODENT CONTROL INVESTIGATIONS. Rodent control investigations were conducted at Preston, Boise, Lewiston, and Coeur d'Alene in Idaho; at Salt Lake City and Logan in Utah; and at Pueblo, Colorado Springs, Greeley, and Fort Collins in Colorado. These investigations were designed to determine the extent of the rodent-borne disease problem in the respective cities, and to make recommendations for local rodent control programs.

ABOVE LEFT: Residual DDT spraying demonstrations.

ABOVE RIGHT: Removing collection jar from mosquito light trap.

ABOVE: Applying DDT-fuel oil larvicide with hand knapsack sprayer equipped with mist-type nozzle.

LEFT: Planning the organization and operation of mosquito abatement districts.



CDC activities in District No. 9 this fiscal year consisted of State-operated programs in Texas and Oklahoma. There was no need for control operations in New Mexico.

Oklahoma

GRADY F. MATHEWS, M. D.

Commissioner of Public Health

The beginning of the fiscal year 1946-1947 found malaria control in Oklahoma far advanced in the transition from an emergency effort restricted to war areas into an extended program of widespread benefit in malaria mosquito and other insect control. Emphasis was progressively given to the DDT residual house spray program, aiming particularly toward increasing local support and participation, and by this means extending the program to new areas. Other State CDC activities included the larviciding program around the environs of the Veterans Administration Hospital at Muskogee, and the special entomological surveys in addition to the routine inspections in controlled areas.

RESIDUAL HOUSE SPRAYING. The greatest effort in malaria control this year was directed toward the residual house spray program. The first spray period in 1946 had included five counties: McCurtain, Pushmataha, Choctaw, Sequoyah, and Haskell. A plan of local participation made possible further extension of the program into three additional counties – Latimer, LeFlore, and Muskogee – in the second 1946 spray period,

and into two other additional counties — Wagoner and Okjuskee — in the first 1947 spray period. The plan was designed to secure from county sources approximately 50 percent of the cost of bringing the DDT spray to each house. Both county budget sources and direct charges to the householders were used in obtaining means to spread the available budgetary allotment as far as possible through malarious areas. During the fiscal year 35,279 houses were sprayed with five percent DDT-xylene-emulsion in the ten southeastern counties, at an expenditure of 1.32 crew man-hours per application. A by-product of the extended program was the use of DDT Isomer in demonstrations by county health units. A total of 55 demonstrations was given, with 461 attendance, using 78 gallons of 28 percent DDT Isomer.

Local participation meant an increased drive for public cooperation and support. Newspaper articles, radio talks, slide films, and motion pictures, various printed materials, and talks at schools, local clubs, and other organizations were among the means employed to carry to the people the spirit and the requirements of the malaria control program. Each spray crew was not only trained in the technique of spray application, but was also indoctrinated with the malaria control objective and was coached in the approach to the householder. The response of the public provided 31 percent of the total cost of residual spray operation; additional values in public experience and participation accrued not only to malaria control but to other phases of county health programs as well.

Entomological surveys in connection with the extended program were related to control operations by the use of range, township, and section numbers, with each house numbered in each land section. For convenience and speed in the field surveys, a colored DDT sticker bearing the spray date and house number was placed by the crews in a conspicuous position on each sprayed house. Although the entomological surveys began with an inspector planned for each county, at the beginning of the fiscal year the State was divided into three, three-county districts with an entomologist or entomologist-inspector assigned to each. Counties were then inspected once each month.

During the first 1947 spray period anopheline production did not reach significant totals until June. The survey plan for this season called for at least one inspection of each county during peak anopheline production. Accordingly inspection began in the southeastern Red River area in June, with the objective of working north to cover all

Table I
ENTOMOLOGICAL SURVEY DATA
FOR RESIDUAL SPRAY PROGRAM

	1946			1947		
	JULY	AUGUST	SEPTEMBER	JUNE	TOTAL	PERCENT
Sprayed Houses Inspected	378	239	245	236	1098	1.8
Sprayed Houses With Mosquitoes	5	2	9	4	20	
Unsprayed Houses Inspected	80	24	14	16	134	28.4
Unsprayed Houses With Mosquitoes	15	10	8	5	38	
Resting Places Inspected	547	300	303	293	1443	65.9
Resting Places With Mosquitoes	347	164	181	259	951	

residual spray counties through the season, alloting approximately one week to each. Short surveys of one day each in the more northern counties accompanied the complete surveys of one week each in the southeastern counties in June.

WAR MALARIA. At Muskogee, the one surviving zone of war malaria control in Oklahoma this fiscal year, 2,047 gallons of oil and 99 pounds of paris green were used in treating 136 acres of water surface around the VA hospital. Larviciding began in the first week of June 1946 with the first significant production of *Anopheles quadrimaculatus*. Control operations continued for 16 weeks; during this period entomological inspection showed peak mosquito production (exceeding 50 in an "E" station) in the area from the second week in August to the third week in September. Only three records showed more than 10 *quadrimaculatus* in an "A" station during this period, indicating effective control. A State Veterans Administration Hospital area was surveyed at Sulphur, but the local malaria and *Anopheles* problems were not found sufficient to justify control operations.

SPECIAL ENTOMOLOGICAL SURVEYS. Special entomological surveys were made in cooperation with the CDC Impounded Water Section and the U. S. Engineer Department. These surveys were brief seasonal studies at the sites of the Oologah, Hulah, Tenkiller Ferry and Wister reservoirs, and at the completed Fort Supply and Great Salt Plains reservoirs. The State CDC office also cooperated in survey and recommendations in connection with the survey and control program at Lake Texoma, and in potential problems of similar nature at other proposed reservoirs in Oklahoma.

Mosquito light traps added greatly to the knowledge of the geographical and seasonal distribution of mosquitoes in Oklahoma. Traps were operated at 27 locations in 1946, and at 24 locations in 1947. This survey work was planned to continue in cooperation with the University of Oklahoma until at least one seasonal record has been obtained for every county. A cooperative arrangement between the State Department of Health and the University was initiated in the fall of 1946 permitting the State CDC entomologist to enter teaching and research duties in medical entomology at the University during the winter, returning to full duty with CDC activities during the summer months.

Texas

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State Health Officer

The general program in the State this year centered around malaria, typhus, and *Aedes aegypti* control operations. In the fall of 1946 plague control work was initiated in west Texas, and in the spring of 1947 aid was given to two projects under the plan of epidemic aid. The first six months of the year saw very little local participation, but contributions were solicited in earnest during the last half of the fiscal year. The response of the cities and communities in local participation was above expectations, especially since this was the first time these communities were called upon to actively participate financially in the program. State, county, and city contributions included labor, office and storage space, DDT, red squill and 1080, office

The extended program in Texas included spraying of entire premises.

supplies, etc., and substantial sums of money. Plans were formulated to further increase local participation during the next fiscal year.

RESIDUAL HOUSE SPRAYING. During the period July-October 1946 operations were carried on in 32 counties, of which 18 had complete county-wide coverage. There were 45,648 premises sprayed at an average of 0.73 pound DDT per application. A total of 87,354 man-hours was expended, with an average of 1.91 per premise. During this period there was no local participation in the program. In the winter seasonal equipment was cleaned, repaired, and stored, and field maps were brought up to date. Plans were formulated for presentation to the Commissioner's Court of each county calling for local participation, and agreements were signed to the extent of full utilization of available equipment. These agreements also called for the matching of crew labor on the program.

Residual spray operations were resumed on April 1, 1947. During the period April 1 to June 28, complete operations were carried on in 26 counties and partial operations in one. There were 41,934 premises sprayed, using an average of 0.85 pound of DDT per premise. Of the total of 73,845 man-hours expended, 49 percent was local labor; an average of 1.76 man-hours was required for each premise application. Entomological inspection work was carried on in extended program counties largely by local area inspectors, with the assistance of the State office personnel when necessary.

EXTENDED PROGRAM LARVICIDING. During the first half of the fiscal year larvicidal operations were conducted in two counties, with the major portion of the work being performed by CDC. The City of LaFeria in Cameron County, and the cities of McAllen, Donna, Edinburg, Mission, Weslaco, San Juan, and Mercedes in Hidalgo county were covered. Similar work was carried on in these cities during the last half of the fiscal year, but the majority of the labor was furnished locally during this period. Also, during the latter part of the year, the cities of Palestine, Henderson, and Center (in Anderson, Rusk, and Shelby counties, respectively) requested aid in larviciding and ditch cleaning work. The cities furnished the required labor and insecticides and CDC provided the technical supervision. The summary of operations included 12,143,100 feet of ditches larvicided with 3,117 gallons of oil; 2,459 additional acres of breeding surface treated with 4,494 gallons of oil; 118,770

Larviciding was carried on for both extended malaria and war malaria control.

feet of ditch cleaning; and 349,000 square feet of vegetation clearing. Entomological inspection was provided for the larvicidal program in Hidalgo County.

WAR MALARIA. Five military establishments were protected this year. Larvicidal operations were carried on in 1946 at the Fort Worth Army Air Field and the Seagoville Correctional Institute. The USPHS Marine Hospital, Love Field, and the U. S. Naval Air Station were on periodic entomological inspection. In the spring of 1947 the Seagoville Correctional Institute was placed on inspection and Love Field was dropped from the program. The larvicides used included fuel oil and paris green applied by hand and power, and hand application of 0.05 percent DDT and kerosene. A total of 29,000 feet of ditching and 562 acres of breeding surface were larvicided, 164,300 square feet of vegetation cleared, and 1,000 feet of ditches cleaned at an expenditure of 1,378 labor and labor-foreman man-hours. Larviciding operations kept mosquito breeding at a minimum. During the last part of the year an entomological survey was made of all veterans' hospitals in the State to determine their needs for malaria control. So far it has not been necessary to carry out malaria control measures around any of the veterans' hospitals.

TYPHUS CONTROL. During the first half of the fiscal year all results were reported from a project area level. In this period 31,502 premises in 47 counties were dusted with ten percent DDT, at an average of 0.76 man-hours to place 2.55 pounds of dust. There were 1,188 buildings rat-proofed, requiring an average of 47 hours to fully modify each building. Rat poisoning was conducted in connection with both proofing and dusting operations. A total of 1,790 premises received poison bait at an average of 0.48 man-hour to distribute 0.68 pound of bait. An additional 11,628 premises were freed of rats with 1080, requiring 1.46 hours to place and recover an average of 0.88 pint of poisoned water.

DDT dusting was carried on for typhus control and plague control. After dusting, poison was used for eradication of domestic and wild rodents.

During the last six months all data were reported on a county basis and the respective operations could be reported singly. Rat stoppage activities were conducted in 1,155 premises in 21 cities in 15 counties, at an average of 54.9 man-hours per premise. Dusting was done in 17,792 premises in 43 counties, requiring 1.89 man-hours and 3.18 pounds of ten percent DDT per premise. Of the 33,636 hours of labor expended, 62.5 percent were local man-hours. General poisoning operations were conducted in 38 counties. Poisoned water was used in 9,442 premises in 33 counties, with an average of 2.09 man-hours per premise to place and recover 0.78 pint of 1080 water. Of the total 19,762 man-hours expended, 59.5 percent were locally contributed. In the five counties receiving both poison bait and 1080, there was a total of 3,999 premises treated with bait and 894 with 1080. It required 0.47 man-hour per premise to distribute 1.0 pound of bait, and 2.89 man-hours to distribute and recover 1.13 pints of water.

Entomological evaluations on typhus control projects consisted of trapping and combing rats, both before and after dusting, to determine the necessity for dusting operations and to evaluate the effectiveness of the dusting. In addition to the ectoparasite evaluation work, blood specimens were collected for typhus complement-fixation tests. In order that a sufficient number of rats would be trapped, it was arbitrarily decided that each typhus supervisor engaged in control operations should trap in at least eight percent of the buildings to be dusted, and secure at least one rat, if possible, from each building. Identification of ectoparasites was done at the State CDC headquarters office in cooperation with the Division of Entomology of the State Health Department. Several new species records of fleas, mites, and lice were obtained, and distribution records of all parasites were greatly increased. Some progress was made towards establishment in the State Health Department of a permanent collection of ectoparasites.

***AEDES AEGYPTI* CONTROL.** *Aedes aegypti* control operations continued to be integrated with the general sanitation program, which also included rat poisoning, DDT dusting, and fly control. During inspections for *Aedes* breeding places, it required very little additional time for the inspector to search for rat signs, and to dust or drop poisoned bait in appropriate places. Projects were carried on in seven cities: San Antonio, Corpus Christi, Laredo, Brownsville, Houston, Galveston, and McAllen. During the first six months of the fiscal year there were 183,319 inspections made of premises, of which 18,071 were infested, and all but four corrected. Corrections were made by the tenants, or by direct removal of tin cans, old tires, etc. A total of 49,589 man-hours were expended during this period. In the last half of the year spraying of privies and dumps was added to the program at San Antonio, Corpus Christi, and Houston. All insecticides and equipment were furnished by the respective cities. During this period 121,453 inspections were made and 10,014 premises were found infested; 8,358 corrections were made. Also, 14,816 privies and dumps were sprayed, using, 6,258 gallons of five percent DDT. A total of 38,085 man-hours was expended, of which 71 percent was local contribution.

Space spraying at city dump for the diarrhea-dysentery fly control project. Dumps were also sprayed to control *Aedes aegypti* breeding.

PLAGUE CONTROL. In August 1946 the USPHS Plague Suppressive Laboratory in San Francisco, California, informed the Texas State Board of Health that plague had been found in wildlife in several places in Cochran County, and it was recommended that a control program be set up in Cochran, Lamb, Hockley, Youkum, Terry, Gaines, and Lynn counties. The first control program was activated in Cochran County in August. Because there were no funds available for this purpose, and because of the emergency, the State Health Officer authorized and instructed the State supervisor of typhus control to meet with the Commissioner's Court in Cochran County in order to initiate a control program. A mobile dusting and poisoning crew from the typhus program was dispatched to the area; their travel and per diem expenses were paid by the Commissioner's Court and the incorporated cities in Cochran County. A supervisor was assigned to this pro-

Ectoparasites collected from domestic and wild rodents were identified and checked for the presence of plague bacilli.

gram for one month, during which time he trained and qualified a local man hired by the Commissioner's Court.

Every business building and residence in the incorporated and unincorporated villages was dusted with ten percent DDT if there was any rodent infection. After dusting, poison was placed for eradication purposes. The local supervisor then started extending the control program to the farm homes and ranches in the county. Another local sanitarian in Hockley County was trained by the Supervisor of Typhus Mobile Unit No. 4. The two local supervisors rotated in the different counties until all of the counties in the program were treated for plague control. A total of 2,258 premises was dusted and 1,167 premises had poisoned bait or water or traps placed.

The Commissioner's Court of each county and city officials cooperated fully in the program, and the U. S. Public Health Service made an emergency fund available. A well-equipped laboratory was established at Brownfield in cooperation with the State Health Department. Plague evaluation work was done in cooperation with the Bureau of Laboratories of the State Health Department in checking parasites collected from domestic and wild rodents for the presence of plague bacilli. Most of the ectoparasites were collected from domestic rats. During the last part of the year trapping and combing activities were expanded in order that more wild rodents could be tested. The Division of Entomology of the State Health Department performed most of the necessary ectoparasite identification, and the Division of Bacteriology carried out typhus complement-fixation tests on blood samples.

EPIDEMIC AID. A severe cyclonic storm struck the small towns of Higgins and Glazier, in the northern part of the State, in the middle of April 1947. Immediately after the storm a hard freeze covered the ground. There were 22 blocks completely destroyed, and under the debris there was much garbage and dead chickens and pet animals. As the weather began to warm the odor became potent, and the flies, gnats, etc., became a problem. A mobile unit was dispatched to the area on April 22. The 22 blocks were sprayed with five percent DDT along with the 114 premises still standing, at an expenditure of 136 CDC and 115 local man-hours. Two, one and a half ton trucks were furnished locally to remove debris.

On April 16, 1947, a fire started in the hold of a nitrate ship at Texas City. The cargo exploded, fragmenting the ship and setting fire to the dock, the adjacent chemical plant, and some oil storage tanks. The next day a second nitrate ship exploded, causing new fires. All available CDC personnel and equipment from the Galveston and Houston projects were rushed to the scene, and by mid-afternoon 15 trucks were in service to transport bodies to temporary morgues and to spray and dust. During the remainder of the week 46 premises and the dock and warehouse areas were sprayed with five percent DDT and 840 premises were dusted with ten percent DDT dust. All restaurants and temporary morgues were also sprayed by hand for fly and other insect control. An emergency allocation was made by CDC to set up a special sanitation proj-

ect in cooperation with the State Health Department. Plane spraying, using 12½ and 17½ percent DDT, was performed over 650 acres. Up to the end of the fiscal year 13,401 premises and 22,395,000 linear feet of ditches were sprayed and 485 premises were dusted with CDC and some local labor, and two inspectors were assigned to fly control.

EDUCATIONAL ACTIVITIES. Perhaps the most effective educational work done during the year was in connection with the State-wide program of incorporating rat-stoppage features in new buildings. More than 50,000 letters, blue-prints, and instruction sheets were mailed out to engineers, designers, city officials, architects, contractors, and lumber yards. As a concomitant of this campaign, State-wide attention was directed to the Texas typhus problem. The campaign inspired much voluntary newspaper and radio publicity. Further educational work was done through the Dallas Fair, and at meetings of civic clubs. Considerable use was also made of the film strip, "Typhus Fever in Texas." Material was prepared for the State public health publication, "Texas Morbidity Reports," on the probable effectiveness of anti-malaria work done in Texas by USPHS. This revealed an apparent 25 percent decrease in malaria rates during the period coinciding with preventive measures taken by the USPHS and CDC since 1943. The most potent educational work was that done by field men, foremen, and supervisors in their direct door-to-door explanation of residual spraying and dusting. Without doubt, the greatest public good will has arisen where such contact has been carried on. Consultative services were also given to private institutions concerned with conducting training in public health and preventive medicine.

MOSQUITO SURVEY. In order to obtain further mosquito distribution records in Texas approximately 50 light traps were operated during the summer of 1946, continuing into the mosquito-breeding season of 1947. The specimens collected now have to be identified, and preparations made for a permanent collection. The collecting part of the project will be terminated at the end of September 1947.

USPHS worker spraying DDT on the site of a dock restaurant, demolished in the Texas City disaster.