PROCEEDINGS AND PAPERS

OF THE

Twenty-eighth Annual Conference of the

California Mosquito Control Association, Inc.

AT

HOTEL MARYSVILLE

MARYSVILLE, CALIFORNIA

JANUARY 25, 26 and 27, 1960

Edited by

C. DONALD GRANT

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1621 WEST HOUSTON AVENUE

VISALIA, CALIFORNIA

PUBLISHED JULY 29, 1960

PRINTED BY THE ABBEY PRESS, OAKLAND, CALIFORNIA

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CALIFORNIA MOSQUITO CONTROL ASSOCIATION

FIRST SESSION

MONDAY, JANUARY 25, 1960, 9:20 A.M.

President Smith: Can we come to order, please?

Welcome to the Twenty-eighth Annual Conference of the California Mosquito Control Association. We are already twenty minutes late, which I think is about par for the course, so we had better get started.

I will now call on Dick Sperbeck, Manager of the host District, Sutter-Yuba MAD, to introduce the welcoming speakers.

Mr. Sperbeck: Thank you, Gordon. I would like to introduce the Mayor of the City of Marysville, of whom we are very proud and who has done a wonderful job. This is Mayor Gavin Mandery.

Mayor Mandery: Thank you very much, Dick. Ladies and gentlemen and members of the Mosquito Control Association: on behalf of the City of Marysville, we would like to welcome you here today, and thank you for selecting our town as the location for this 28th Conference. I know that you have lots to do and it is going to be a busy meeting, so I won't take much of your time. I believe that you all know of the arrangements made to put the tickets on your cars so that you will not be tagged for overparking. Please use those tickets, because it gets a little complicated when we get into the higher legislative groups. So, if you will cooperate with us on that matter, we will appreciate it. If the official body of Marysville can be of any help to you during your stay here, please call on us. Thanks, and hurry back.

Dick Sperbeck: Thank you, Gavin. The next speaker is our Senator representing Yuba and Sutter Counties in the State Senate, Senator Ed C. Johnson.

Senator Johnson: Dick and President Smith—I guess there are some ladies present, at least we can—oh yes—Ladies and gentlemen: our good Mayor Gavin welcomed you on behalf of the City of Marysville, it happens to be my job to represent the two counties where all the mosquitoes are grown to come on in to the City of Marysville, so on that, I will welcome you to both Yuba and Sutter Counties. We are very proud of the job that our District has done locally and our good friend Dick here. We all respect him and know he has done a dickens of a good job with those he has to work with here. We welcome you to Marysville and Yuba City, to Yuba and Sutter Counties. We hope you enjoy your visit here. Thank you.

Mr. Sperbeck: Thank you, Ed. And last, but not least is the Representative and the President of our Board, who represents the City of Marysville and our Board of Trustees, who is pinch-hitting this morning for one of the other members that got the flu bug yesterday and had to cancel out. Mr. Marion Bew.

Mr. Bew: Mr. President, ladies and gentlemen: I was wondering what to say and now that Dick has taken me off the hook, I can just laugh, that's all; being the least, I am not expected to say too much. Gene Morrison, in point of service who is about the oldest trustee of the Sutter-Yuba District, has asked me to express his sincere regrets that he couldn't be here; but he was stricken yesterday, and just can't make it at all. From myself generally, as Board President, and the District as a whole, and for the two cities, I want to express our sincere happiness at having you here, and we place all of ourselves and the District and City and Counties at your disposal. If there is any way we can be of help, just hesitate not one second to call on us. Thanks for coming and come back. We are sorry to have missed you in 1955, but five years later you are here. Let's make it sooner than five years this time. Thanks very much.

Pres. Smith: I would like to thank you gentlemen for being present at the opening of our session, and I am sure that our stay in this area has been pleasant so far, with the exception of one weak-kneed table that Marion Bew provided, and that it will continue to be pleasant while we are here.

Now the program says recognition and introduction of visitors and exhibitors, and I have seen an awful lot of faces here that I can't even tie a name to, so I probably won't be as thorough as I should be. We have two out-of-State groups that I know of, Salt Lake— of what's that?—Nevada— Utah, oh yes, are present and in their usual goodly numbers, and we are always grateful to have them attend our meetings. I would like to ask Jay Graham to get up and introduce the Utah delegation.

Jay Graham: Thanks, Gordon. We have, I think, five here. From the Magna District, we have Evan Colledge and Lawrence Bowen. Glen Collett who needs no introduction, and then a Trustee from my board, Mr. Orlan Newbold.

Pres. Smith: And we have Mr. Multiple Retirement. Where are you Harry? The man who never quits, and I think Harry brought some visitors with him. Harry Stage would you get up and introduce your people.

Mr. Harry Stage: I would be very happy to, Gordon. I had the pleasure of coming down with two great men from Eugene, Oregon. One is John Stoner, from Lane County, and Al Warren, who is trying to do a wonderful job of controlling mosquitoes in log ponds.

Pres. Smith: And another Oregon contingency. I haven't seen Gaines here, but I am sure he is. Gaines, would you stand up. Gaines Eddy. C. M. Gjullin. Did you have someone else with you, C. M., from your group? Now who have I missed? Here is Gaines Eddy now. Stand up, Gaines. Do we have any other foreign visitors to our fair State? Bob Nichols, Nevada State Department of Agriculture, from Las Vegas. I should have recognized him.

(Mr. Matthews:) I am George Matthews from Minneapolis, Minnesota, and the Metropolitan Mosquito Control District. The rains foundered Mr. Akins in San

Francisco, but I am sure he will be in some time this morning. And there is our Mr. Buzicky from Minneapolis; I am sure he has many friends here. We are a new District. We are only two years old and we came out to California where they know how to do up everything.

Pres. Smith: Bryce Johns from Cook County, Illinois. *South* Cook County, excuse me. Where is North Cook County?

Mr. Stage: Gordon, here is an old friend and associate of mine from Nevada also, Mr. Chapman, who is with the United States Department of Agriculture. If the other agriculturists are embarrassed by his presence I would be glad to introduce him.

Pres. Smith: Mr. Chapman. Any other visitors. I would also like to introduce the representatives of the sustaining members, who are most welcome in our Association. They have exhibits in the hall behind the curtains, which you should all take a good look at. They will also have some demonstrations; I believe it is tomorrow at noon or thereabouts. Would you gentlemen please stand up and introduce yourselves. Chet Robinson said that some of the names on my list are wrong. Would you stand up and introduce yourselves as I call your company please.

(We are pleased to show our sustaining members and exhibitors in the front pages of the Proceedings.)

Now it gives me great pleasure to introduce a gentleman whom many of you have met, and who has had a long history of supporting our Association and mosquito control in general in his official capacity as the State Senator from Merced and Madera Counties. I think most of you already know him or know of him; so, without further ado, I will introduce Senator James A. Cobey from the Twenty-fourth Senatorial District. Senator Cobey, please.

"A LEGISLATOR'S LOOK AT MOSQUITO CONTROL"

STATE SENATOR JAMES A. COBEY (D)

24th District, Merced-Madera Counties

Mr. President, Distinguished Guests, Members and Friends of the California Mosquito Control Association:

I am greatly honored in being chosen to make the keynote speech to this 28th Annual Confrence of your Association. The subject assigned me is "A Legislator Looks at Mosquito Control."

As a great many of you know, my connection with the work of your association has been purely budgetary in the past. From the time that I entered the Senate in 1955 up until last year the Legislative Analyst has annually recommended the elimination of the operational subsidy to mosquito control agencies from the General Fund portion of the State Budget. He did this on the basis that mosquito control was not essentially a public health problem but more a matter of public convenience and that therefore the inclusion of this type of local subvention in the State Budget was unjustifiable. In this view, as you all know, he enjoyed considerable legislative support.

Many of you will recall with me the struggle we had before the money committees of the Legislature and in one case before the joint conference committee on the budget of the two houses in making sure that this annual subvention remained in the State budget. In this effort we were successful until the present Governor removed the item from his proposed budget and nullified our restoration of it by an item pocket veto after the close of the last session.

Budgetary-wise, the state is spending currently 191 thousand dollars. Of this, 101 thousand dollars is allocated on an arbitrarily equal basis of 3,600 dollars each to some 28 mosquito control agencies, for the purpose of mosquito surveillance and reporting, and $90,000 is devoted to research. This sum I am informed, that spent on research represents practically a doubling of the prior year's efforts.

Thus, the cooperative operational program of mosquito control which was inaugurated in California in 1947 on an approximately 50/50 basis as between State and local money, and which, during the decade or so of its operation had become a 90% local and 10% state program, monetarily speaking, was ended. Although again, as many of you know, I argued strenuously against this policy of its elimination on the ground that the mosquito control problem in California was bound to get worse rather than get better with the growth in our population, with the expansion of our irrigated acreage and with the increase in the use and extent of our recreational areas, and on the further ground that many of the areas with the worst mosquito problem had the lowest local capacity to pay, such as my own counties of Merced and Madera, however I am a political realist and I know that having knocked this item out of the budget it will be, as a practical matter, impossible to place it back in—certainly, at once. An ounce of prevention is sometimes worth considerably more than a pound of cure.

I repeat though, that in my personal opinion we had an equitable program of state assistance. I don't believe it was an adequate program because it failed to expand as the problem grew, but it was an equitable one because unlike many other state assistance programs to local government, its history was one of increasing local participation and decreasing state participation, and it demanded of the beneficiaries the maximum tax rate within their power as a condition of eligibility for more than the minimum grant. Finally, the grant itself was made on the fair basis of an incidence formula.

But I'm not here to cry over spilt milk. The past is past and the problem is what do we do about the present and more significantly what do we do about the future.

You are pioneers. The role of a pioneer is a challenging but it is a difficult one. California has one quarter of the entire irrigated acreage of the nation and that acreage is due to be doubled as the State Water Plan becomes a reality. Furthermore, our population will, within the next two generations if present trends continue, quadruple. Finally, again if present trends continue, the use and extent of California's recreational areas will grow proportionately.

This means that you who have been pioneering in mosquito control work primarily because of California's

pre-eminence in the extent of its irrigated acreage are going to have to continue to pioneer and probably to pioneer much more aggressively, and more imaginatively, and with a considerably greater expenditure of public money than you have in the past. And in this connection we don't have to call to your attention the fact that with the tremendously accelerated growth in industries in this State. For example, in the years between 1950 and 1955 your problems in connection with the handling, the proper handling, of industrial liquid wastes are both together much worse.

This is not to criticize what you have done with the tools at hand. You have in reality a very drastic mosquito control statute giving you extremely strong policing powers. You have very wisely chosen to use these powers very sparingly and to depend instead primarily on public education and, in rural areas particularly, on farmer education. You have been notably successful in educating the farmers that it is to his economic interest as well as to the general public interest to cooperate with you in your mosquito control work.

But the time has come when your methods must be broadened and they must be improved. At the present time your operational work in mosquito control essentially consists of drainage programs and the application of insecticides and the provision of prompt drainage of standing water and the killing of mosquito larvae during the incubation stage or as adult mosquitoes by the use of insecticides. These insecticides are a constant problem because one by one they cease to be effective by reason of the various species of mosquitoes becoming resistant to them. This means that we are using every year more and more expensive insecticides and every year one or more families of insecticides in common use become ineffective. Also, the stronger we make these insecticides, the greater the public health problem in terms of the residual effects upon the food we eat or upon the food our livestock consume.

Furthermore the machinery that you use is basically for the most part merely adaptions from the agricultural field. I believe that what you need is mosquito control equipment designed and developed solely as such.

By broadening your methods, I mean this: you are going to have to investigate exhaustively and thoroughly the question as to whether or not we can treat the water and the soil in which the mosquito starts so as to either arrest its development or kill it at that stage. You are also going to have to develop predators and parasites on a mass production basis, as for example what was done with respect to the alfalfa aphid, so that we can destroy mosquitoes in the same way that we have done for various agricultural pests.

What does this mean so far as the future relationship between the State of California and your local agencies is concerned. It means this. The state is going to have to spend a great deal more money in the future for pure and applied research in this field so that we can provide for you who are on the firing lines, so to speak, much more effective weapons. Pure research can be handled by our great university, with the assistance undoubtedly of the other three components of our higher education system, our state colleges, our junior colleges and our private universities and colleges.

The greatly expanded applied research program which converts and transforms the results of pure research into weapons which you can use effectively in the field should be a cooperative venture essentially of the University of California—probably chiefly at Davis—and the State Department of Public Health through its Bureau of Vector Control.

This greatly expanded research program should be the state's major contribution in this field in the future. However, the state, through literally a multitude of its affected agencies should preach the gospel that mosquito control must be preventive rather than curative in its emphasis, and that it is a problem which will become more serious in California because of our expansion of irrigated acreage, our great increase in industry, our great increase in population and our tremendous extension of recreational areas and facilities. I believe that if this message is gotten across to the general public they will support the policy-makers of government at both the state and local levels in their efforts to provide all concerned with the public funds they need to make mosquito control effective throughout this great state of ours.

As you know, what I have presented to you here today is my personal view as a legislator. I am not authorized to speak for the present administration in Sacramento in this field. However, again as I think many of you know, I am rather closely identified with this administration and I think that I can give you a rather definite assurance that this administration is aware that mosquito control is a growing problem in California and one that will require new ideas, new methods and greater public money than it has in the past.

I believe also that the administration realizes that this means an increased use of state government resources in the way that I have indicated, and that this will require more state money rather than less devoted to mosquito control. The basic disagreement which I had with the administration during the past session was, I feel, a disagreement over how state money should be spent in this field rather than over whether it should be spent in this field. Only the future can tell whether I am right in this feeling.

But I pledge you that I personally will do all within my power to assure that the administration's viewpoint toward your work will be as I have stated it and that you will receive from the Governor, his staff and his departments a sympathetic and understanding reception of your efforts to cope with this increasingly serious public health problem, and of the responsibilities of the state government for effective cooperation with these efforts of yours as well.

It is up to you who are on the firing line in this field to get together and prepare, develop, present, and effectively support a unified legislative program. I promise you that if this is done and done soundly and well it will have the reception and success that it deserves in Sacramento in both the Legislative branch and the Executive branch.

The job is up to us and to each of us. Let's pull together and let's continue the successful job of pioneering in this public health field in which you have already achieved such world-wide distinction.

Thank you.

Pres. Smith: I think that we should all be gratified that Senator Cobey has taken time out of his many duties and interests to become as thoroughly informed on our problems as he has. I think that his paper just presented gives us a great deal of food for thought; or in the vernacular, Senator, you said a mouthful.

Mr. Gray: President Smith, may I ask a special question of the Senator? In the matter of financial policy we are faced with two things which are going to cause large expansions of water usage. One of them is the California Water Plan which is going to put a great deal more water upon more land for irrigation, and the second is the related expansion of various recreational projects which will be on new reservoirs. Would it not be logical that at least a considerable part of the cost of mosquito control in connection with these projects should be borne from project money or from recreational money rather than be loaded upon the general taxpayer? I just throw that out as a question of policy.

Senator Cobey: I don't know whether you knew it or not when you put the question, but of course, you are talking about matters that are pretty close to my heart. And I happen to be in agreement with the position you stated. I feel that with respect to the State Water Development Program the fundamental principle is that the beneficiaries of that program shall pay for all of its costs, including what I consider here to be a by-product cost in mosquito control. Those who create the problem ought to pay for its solution. I understand that you have had considerable success with the Federal Bureau of Reclamation in getting that recognized; and one of the things that we are trying to do in the State is to make very sure that we profit from the Federal Government's experience, and that we don't leave any of these side effects, incidental effects or whatever you want to call them, out of the State Water Development Program.

For example, I am talking about drainage in a little different way than you talk about it, but take the problem of drainage in the west side of the San Joaquin Valley. As you noticed that is given specific recognition in the State Water Development Program and the Burns-Porter Act, and we are also trying to get it in the Federal San Luis Bill, because it has been our experience in the past that that is one place that the Federal Government has been deficient. They haven't recognized the elementary fact that you can't have a good irrigation system unless you have good drainage; and that when you bring in supplemental water you must also provide means of getting rid of the tail water, and also the bad water; and in that particular case, it is a bad water problem.

Now, with respect to recreation. I have very strong views representing a farming area, that is if the farmers are going to have to pay for the cost of the water, for which there is considerable public sentiment, then those who make the recreational use of the water shall also pay their fair share. Thank you.

Pres. Smith: We have time for a few announcements. Mrs. Durkee, would you care to present your information at this time?

Mrs. Durkee: First there are a few more out-of-State delegates that have not been introduced. I wonder if the Colorado delegation has been acknowledged? At least Louis Ogden is here from the U. S. Public Health Service at Greeley.

Pres. Smith: Excuse me. I had just thought of Louis as being one of us. Thank you.

In connection with Louis, he gave me a letter this morning stating that Archie Hess expressed regrets that he was unable to attend our meeting. He says "this is the first time since I returned from the Philippines in 1954 that I have been unable to attend the annual meeting of the California Mosquito Control Association. Unfortunately it conflicts this year with an interdepartmental meeting on water resources and mosquito control problems, which I must attend in Washington." I understand his boss took precedence over our meeting. "Louis G. Ogden, however, will represent our group and will report back to us the highlights of your proceedings. All of the staff here at Greeley Station join me in extending best wishes for a very successful meeting. May your Association continue to hold its enviable position of national and international leadership in the field of mosquito control." Signed, "Archie Hess."

Are there any more announcements? Don Grant?

Don Grant: I would like to make mention of the coming American Mosquito Control Association Conference to be held back in Boston this year, March 27-30th. I understand we already have a considerable number of Californians who are planning to attend. I hope we can encourage others to go and attend the meetings at the Somerset Hotel in Boston. I am sure that more information on transportation and other arrangements will be coming out pretty soon. Thank you.

Pres. Smith: Don is our area representative for the A.M.C.A.

We are still ahead of schedule and I'd like to keep it that way, so we will adjourn for recess now and reconvene in fifteen minutes.

RECESS

Pres. Smith: Before we start the next session of the program I would like to have a few more introductions. I think I have seen as many trustees, if not more, at this meeting than at any previous meetings we have had. It is gratifying to see the trustees come, to show their interest, also to talk to other trustees and managers.

I would like to start off by introducing my own two trustees who accompanied me. Roy Holmes, I don't know if he needs any introduction to this audience as he has come to the last fourteen meetings; and Harold Jolliff, who is right in Roy's footsteps.

(Each district manager present introduced district trustees in attendance.)

Gentlemen: welcome; and I hope to see you at all of our meetings.

We next have a film and some remarks on "Encephalitis and Research," Harald N. Johnson, M.D., Director of Arthropod-borne Vector Studies, Viral and Rickettsial Disease Laboratory, State Department of Public Health (Rockefeller Foundation), Berkeley. It sounds like a Federal job.

ENCEPHALITIS AND RESEARCH

HARALD N. JOHNSON, *Director*

Arthropod-borne Virus Studies, Viral and Rickettsial Disease Laboratory, California State Department of Public Health[1]

Thank you Gordon. Members of the Association. Before we show the film on Western equine encephalitis in children, I will review the history of equine encephalitis viruses and St. Louis virus and then mention some of the gaps in our knowledge of the life history of these viruses.

There was a small epidemic of horse encephalitis in Massachusetts in 1831 and another in southern Louisiana in 1908, but the first large scale epidemic of horse encephalitis developed in central United States in 1912 and the disease was called the Kansas-Nebraska horse plague. The disease recurred on a larger scale in the same region in 1918-1919. These two large epidemics of horse encephalitis were associated with periods of unusually heavy rainfall and snowfall. I was born on a farm in Nebraska and I remember the cases of horse encephalitis which occurred in 1918-1919. The extensive mortality among horses and the sequelae left in those horses that survived the disease made it difficult for some farmers to get their field work done.

I am sure you are familiar with the history of the 1930 epidemic of horse encephalitis in California and the discovery of Western equine virus by Dr. K. F. Meyer and his associates at the Hooper Foundation. In 1933 there was an epidemic of horse encephalitis in Virginia, Delaware and New Jersey. The virus isolated from horses in New England proved to be different from the Western equine virus and it was called Eastern equine virus. During the same year there was an epidemic of encephalitis in St. Louis and a virus was isolated from human brain specimens. This virus was named St. Louis virus.

In 1938 there was an epidemic of encephalitis in eastern as well as western United States affecting both man and horses, and during that year the Eastern equine virus was isolated from brain specimens of persons who had died of encephalitis in Massachusetts, and Western equine virus from brain specimens of persons who had died of encephalitis in California. This showed that these viruses could produce encephalitis in man as well as horses. Kelser, in 1933, showed that *Aedes aegypti* mosquitos could transmit the Western equine virus, and in 1934 Merrill reported that the marsh mosquito, *Aedes sollicitans,* could transmit the Eastern equine virus.

In 1941 there was an epidemic in central United States and south central Canada. There were more than 3000 cases of encephalitis in Nebraska, the Dakotas, Minnesota, Montana, Manitoba and Saskatchewan. There were many cases of encephalitis where the sequelae of the disease were severe, similar to what you will see in the encephalitis film taken by Doctor Finley. During the same year there was an epidemic of encephalitis in Yakima Valley, Washington. In the course of a study of this epidemic Hammon and Reeves isolated both Western equine virus and St. Louis virus from wild caught *Culex tarsalis* mosquitos. This was the first definite proof that mosquitos were natural vectors of these viruses.

During the epidemic of 1941, Cox obtained the Western equine virus from a prairie chicken shot on August 27 near Rugby, North Dakota. Studies of blood serum specimens from wild birds at the Hooper Foundation and the laboratories of the U. S. Public Health Service revealed that a variety of wild birds had antibodies to Western equine, Eastern equine and St. Louis viruses. The theory that bird mites were the natural reservoir of arthropod-borne viruses received much attention during the period 1944-1955, but the studies of the vector potential of bird mites by Reeves and Chamberlain showed that there was little if any multiplication of the virus in the mites after they had ingested an infected blood meal and there was no evidence that they could transmit the virus after a two weeks incubation period. Therefore, the viruses obtained by Reeves from mites collected from wild bird nests in Kern County, California, undoubtedly came from the adult birds or nestlings which had occupied these nests. Thus we know that during the period 1946-1949 Western equine virus was isolated from yellow headed blackbirds, Brewer blackbirds, and tri colored blackbirds; and St. Louis virus was obtained from yellow headed blackbirds and tri colored blackbirds. All of these isolations were obtained from mites collected between June 6 and July 20.

Sooter has reported the isolation of Western equine virus from two nestling red winged blackbirds and a nestling magpie collected in Colorado between June 26 and June 30, 1950. Holden obtained Western equine virus from two immature English sparrows collected in New Jersey in September, 1953. Stamm has reported the isolation of 24 strains of Eastern equine virus and 10 strains of Western equine virus from wild birds. Both Eastern equine virus and Western equine virus were obtained from purple grackles collected in Louisiana. An interesting feature of the isolations of arthropod-borne viruses from wild birds in Massachusetts and New Jersey is that all of these were obtained from birds collected between August 13 and September 11.

We have isolated 23 strains of Western equine virus from wild birds collected in Kern County, California. All of these have come from birds collected in June, July and August. The nestling birds collected during the main nesting season of wild birds during April and May have all been negative for virus. Western equine virus was isolated from 18 English sparrow nestlings, 4 barn swallow nestlings and from 1 immature house finch caught in a mist net. We collected sparrow nestlings at four study sites where *Culex tarsalis* mosquitos had yielded Western equine virus and we found the same virus in nestling sparrows at each of these study sites. Western equine virus was isolated from three nestling sparrows found dead in the nest. It is evident that nestling birds, especially English sparrows, are an important source for the infection of *Culex tarsalis* mosquitos during the epidemic cycle of Western equine virus.

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[1] This is a joint project of the Rockefeller Foundation and the California State Department of Public Health.

As you know, the current concept of the ecology of Western equine virus and St. Louis virus is that they are maintained in nature in wild birds or over wintering mosquitos. If the virus regularly passes through the winter months in birds or mosquitos, we would expect to find the virus in mosquitos and birds earlier in the season than we find it in most of the epidemic foci of the virus. We must consider the fact that Western equine virus is not found in *Culex tarsalis* mosquitos collected in northern Montana until late July or early August.

We have noted that Western equine virus can be found in nestling birds near the end of the nesting season but St. Louis virus is not apt to be found in mosquitos in California until August when the post nesting migration of wild birds is in full swing. What I am trying to emphasize is that the sites of repeated epidemic activity of a virus may not be the natural focus of the virus. Irrigated farmland having an abundance of sparrows and *Culex tarsalis* mosquitos is extremely receptive to the introduction of arthropod-borne viruses. If a migratory bird with virus in the blood spends a single night in this type of environment several hundred mosquitos may obtain an infective blood meal. The population of susceptible birds in this type of environment will vary from year to year depending on the level of virus activity during the previous year. Birds soon lose the immunity acquired from the egg of the parent bird and therefore there are always susceptible wild birds after the nesting season.

If we assume that migratory birds bring arthropod-borne viruses from certain natural foci to the site of epidemic activity there is one group of birds which I consider as prime suspects in California, that is, the blackbirds. I have mentioned the isolation of arthropod-borne viruses from blackbirds, so we know they are found infected in nature. The Brewer and red winged blackbirds have the population numbers and ecology which would serve to make them ideal hosts for moving a virus from one region to another. They breed in a great variety of habitats; for instance, some of the Brewer blackbirds nest in the desert brush of the Great Basin Plateau, and others nest in the trees of the river valleys and the Central Valley. Red winged blackbirds which breed in northern United States and Canada migrate to California in the fall. There are also great numbers of red winged blackbirds which nest in the river valleys of the mountains and along ditch banks and in marshland of the Central Valley. Some of the male red winged blackbirds do not find mates because others are polygamous. Therefore, some of the male birds will move about during the nesting season. The blackbirds that breed in the mountain valleys and the Great Basin Plateau finish their nesting cycle early and then flock to the marshland and irrigated fields of the Central Valley to feed on insects. The subsequent movement of blackbirds from one marsh or irrigated field to another creates an optimum situation for the transmission of a virus from one flock to another. Both Brewer blackbirds and red winged blackbirds are attracted to cattle feeding pens and irrigated pastures about dairies and feed lots for beef cattle. They are also attracted to the irrigated grass lawns of farms and cities, especially city parks. Their natural feeding grounds in the lake marshes have been eliminated by the development of lowland for agriculture. They are apt to roost in the trees on farmyards and in cities and this provides an opportunity for the spread of arthropod-borne viruses to the local sparrow population. You have seen the flocks of 50,000 to 100,000 blackbirds which congregate in the Central Valley during the late summer and fall. These flocks may contain birds which have come from Canada, northern United States, the Great Basin Plateau and the mountain valleys. Therefore, they could bring a virus from any one of these areas, either directly or in a stepping stone fashion. The arrival of flocks of Brewer blackbirds in the Central Valley coincides with the appearance of Western equine virus in *Culex tarsalis* mosquitos. The flocking of the red winged blackbirds is later than the Brewer blackbirds and they may be responsible for the spread of the St. Louis virus which is known to appear late in the summer, usually after the first of August.

There is one basic question which we must consider in the study of the ecology of arthropod-borne viruses, that is, are they present from year to year in the agriculturally developed farmlands of the Central Valley of California or is this area extremely receptive to the introduction of these viruses? The same question is applicable to the Great Plains states. The early epidemics were associated with periods of high rainfall and snowfall. When the precipitation was high, the slight depressions in the plains filled with water, forming shallow ponds which did not dry out for two or three years. Such ponds were ideal for mosquito breeding and they were also attractive to resident and migratory insectivorous birds such as blackbirds and swallows. The introduction of irrigation in the plains states duplicated the mosquito breeding potential of the collections of standing water created by excessive natural rainfall, and now there are cases of horse encephalitis each year, with an increase in the number of cases during the periods of high rainfall.

When Western equine virus was first discovered, it was regarded as a natural virus infection of horses. At the present time we regard the horse as an aberrant host and recognize that the virus must come from wildlife. What wildlife source do we have for the maintenance of arthropod-borne viruses in the agriculturally developed farmlands? There is little left of the original wildlife population. With the exception of the English sparrow, there is no resident wild bird or mammal which can be regarded as abundant, and the sparrow is a semi-domesticated bird. It is my opinion that the foci of epidemic activity of a virus may be far removed from the natural focus of the virus. The presence of the virus in the natural host is difficult to determine because it is not likely to produce a recognizable disease in the long term host or complex of hosts. Arthropod borne viruses may be carried by man, migratory birds or bats from one region to another and from one continent to another. For instance, consider the prospects of finding the wildlife source of yellow fever in Louisiana and Alabama. Yet these states were the site of repeated epidemics of yellow fever. I believe that Eastern equine virus can maintain itself from one year to the next in Louisiana by a mosquito-bird-mosquito cycle, but I do not believe that the virus will be maintained for many years in this manner, even in the tropics. We know that this virus cannot be found each year in mosquitos and birds in the foci of epidemic activity in New England. Furthermore, during the years

when the virus was found, it was obtained from birds only during the months of August and September.

In looking for the wildlife source of arthropod-borne viruses, I would consider first those areas having a large and relatively stable population of small mammals and birds, for example, the Great Basin Plateau, where the desert brush-grassland meets the coniferous forest. Disturbance of the forest margin by fire or wood cutting may produce ecological changes leading to variation in the population of both arthropods and vertebrates. This can be expected to have something to do with the spread and regression of a parasite in the natural host as well as in aberrant hosts. River courses would provide for a greater diversity of arthropods and vertebrates for the dispersion of the parasite to new hosts. It is necessary to be alert to disease in wild animals in areas subject to sudden ecological disturbances and to collect arthropods in such regions for virus studies.

There is ample evidence that wild birds are the principal source of Eastern equine, Western equine and St. Louis viruses during epidemics caused by these viruses. The impression I have gained from studying the ecology of these viruses in the United States is that they are carried by birds from north to south, rather than from south to north. The investigations of mosquito-borne viruses during the first half of the 20th century encouraged the acceptance of the idea that the tropical forest is the source of most of these viruses and that they are carried to the more temperate zones by man or migratory birds. The epidemics of equine encephalitis in central and northern United States appear during the southward migration of land birds, and the large epidemics of Eastern and Western equine and St. Louis encephalitis have occurred along the flyways of migratory birds. We must consider the possibility that some of the arthropod-borne viruses may exist in small mammals of the forests of northern United States and Canada.

The horse is a sentinel animal for Western equine virus and it is important to follow up the cases of horse encephalitis that occur in the river valleys or the mountains in the spring and early summer, because such cases may indicate the location of a natural focus of the disease. We have had cases of Western equine encephalitis in *Citellus beecheyi* ground squirrels and *Sciurus griseus* tree squirrels. These isolations were obtained from animals submitted to the State Health Department for examination because they were suspected of having rabies. All of these animals were obviously ill and the diagnosis of encephalitis was determined by the isolation of the virus from brain tissue. The ground squirrel and tree squirrel encephalitis cases have occurred in Marin, Sonoma, Lake, Napa, Butte, Tehama and Tuolumne Counties. Several of these were in areas of pine forest mixed with grassland at an elevation of more than 2000 feet A.S.L. The obvious disease produced, and the late seasonal occurrence of the cases of Western equine encephalitis in ground squirrels and tree squirrels, favors the view that they are aberrant hosts for this virus. One possible explanation of the cases of encephalitis in squirrels in the foothills of the mountains in the fall is that the virus is introduced by the house finches which migrate to the foothills in the fall. Having found Western equine virus in at least one house finch that was collected from a flock of house finches in the Central Valley in August, there is evidence to substantiate this theory. However, we must not discard the idea that the tree squirrel may be a sentinel host for Western equine virus in the mountains and that they are not infected with the disease unless there are *Culex tarsalis* mosquitos in the area.

We do not know where Western equine and St. Louis viruses exist in wildlife during the winter and spring months. There have been no isolations of these viruses from wild birds in California during the period September to June. I believe that we should look for a cycle of Western equine and St. Louis viruses in small mammals. We have already isolated two group B viruses from small mammals in California. The Rio Bravo virus was obtained in 1954 from the salivary glands of asymptomatic Mexican freetail bats collected in Kern County, California. The same virus was isolated from bats collected in the same area in 1957. A total of six different bats have yielded this virus. Tests of brain and spleen tissue from these bats were negative for virus, indicating a carrier state. Another group B virus called Modoc virus was isolated in 1958 from the lactating breast tissue of a wood mouse, *Peromyscus maniculatus*, captured in the Modoc National Forest, Modoc County, California. The testing of breast tissue of wild mice was initiated when it was discovered that Western equine, St. Louis, Rio Bravo and Colorado tick fever viruses localized in the breast tissue of experimentally infected laboratory mice and that the virus could be obtained from the breast tissue for several days after the virus had disappeared from the blood.

I bring this story to you so as to have a basis for my recommendation that we have come to the time when we had better begin a new line of investigation to determine whether we can find Western equine and St. Louis viruses in small mammals, as well as birds and mosquitos. Having already found two new viruses in small mammals, which are serologically related to St. Louis virus, I believe that this is sufficient evidence to warrant a long term study of small mammals and the role that they may play in the ecology of the arthropod-borne viruses.

In 1958 we obtained eight isolations of Colorado tick fever virus from *Dermacentor andersoni* ticks collected in Modoc and Nevada Counties. Thus we know that we have two viruses, that is, Colorado tick fever virus and Modoc virus which exist in nature in the Great Basin Plateau. This indicates that this is a good place to study arthropod-borne viruses. The viruses as they exist in the natural focus may not produce any obvious disease in their natural host. This is characteristic for parasites as they exist in a stable environment. For example, there has been no evident disease in small mammals or birds in the area where Colorado tick fever virus is found in ticks. We know that infant mice die when they are infected with Western equine and St. Louis viruses by peripheral inoculation. Adult mice inoculated in the same manner seldom become ill, but they all become infected, as can be shown by demonstration of the virus in the blood. The period of viremia in the adult mice infected in this way is from three to five days, but the titer of the virus in the blood is higher in infant mice, and the virus is found in the blood up to the time they die of the infection. Adult mice that eat infant mice infected with these viruses

become infected and the virus is found in the blood in the same way as if they had been inoculated with the virus. The experimental studies of these viruses indicate that the breeding season would produce the maximum turnover of the viruses.

My personal impression is that Western equine and St. Louis viruses have two cycles in nature. They have one which is their normal one in small mammals. This can go on for an indefinite period without producing any obvious disease. However, if a set of fortuitous circumstances arise which lead to the presence of an abundance of the right kind of mosquitos and a large population of migratory birds such as blackbirds, breeding in the same area at the time of high population of the natural reservoir host, then the virus may spread to the birds and be distributed widely in nature. Some years the Brewer blackbirds have a successful nesting and migrate early, and in other years they nest twice. This may be crucial in the dispersion of the virus.

I suggest that we embark on a rather new type of program in which we study the mosquitos that feed on small mammals during the spring breeding cycle. It is important to know the feeding habits of the various mosquitos of the mountain and high plateau regions, such as the *Culiseta* and *Aedes* mosquitos. They may be the ones which unearth the viruses and move them over to birds, which in turn carry them to the Central Valley.

The results obtained in the surveillance studies of mosquitos as vectors of Western equine and St. Louis viruses in California show that the *Culex tarsalis* mosquito is the only important vector in the Central Valley during the epidemic cycle of these viruses. Therefore, the control of the diseases caused by these viruses depends on erradication of *Culex tarsalis* mosquitos in the foci of epidemic activity. Knowing this, I suggest that we now survey the mosquitos which feed on small mammals and birds in the mountain river valleys and the Great Basin Plateau. Study sites should be selected to include each distinct habitat type along the course of the large rivers draining the Sierra Mountains, for example, the high plateau desert brush-grassland, the mountain coniferous forest and meadow, and the deciduous forest and grassland with different types of brush. Mosquitos which are attracted to and bite man and horses should be collected and identified. Birds and small mammals may be used in mosquito traps to determine which species of mosquitos feed on one or the other or both. Mosquitos should be collected from natural resting places such as bridges, caves, rodent burrows and under rock ledges so as to have a wide range of species for testing for viruses.

I believe that it is of great importance to a state and nation to study wildlife and to conduct surveys of small mammals and birds on a long term basis in all of the characteristic habitat types. We recognize many protozoal, bacterial, rickettsial and virus diseases in California which are known to be derived from wildlife. Yet we know very little about the factors which serve to maintain and spread such diseases. Small noctural mammals constitute the largest population of wildlife in California and they are the major source of wildlife diseases transmissible to man and domestic animals. The Bureau of Vector Control of the California State Health Department has one of the best programs that I know of in the United States for the study of public health in relation to small mammals. Certain of the small mammals exhibit cycles of abundance. The microtus outbreak in California and Oregon in 1957-1958 is a good example. Over-population of small animals such as this may serve to disperse parasitic infections of wildlife. We do know that both plague and tularemia organisms were isolated from meadow mice which were found dead during the microtus outbreak. Population studies of small mammals in the major habitat types have been under way for several years in California and the information obtained is becoming increasingly valuable. It is now the time to correlate the mosquito and small mammal studies.

Having discussed the wildlife aspects of the arthropod-borne viruses, I will summarize our knowledge of the disease producing potential of these viruses. The moving picture film you will see shows sequelae of Western equine encephalitis in children. Western equine encephalitis in California is primarily a disease of young children. For example, in the epidemic of 1952 there were 100 cases in children under one year of age. I suspect that there are 10 undiagnosed cases of Western equine encephalitis for each one where the diagnosis is determined by complement fixation tests of acute and convalescent serum specimens. Of the children that develop fever and convulsions in July and August, some will be taken to a hospital. It is the practice to do a lumbar puncture if a child is admitted with such symptoms. If the doctor finds a high white cell count in the spinal fluid and no bacteria are found by smear, the diagnosis will usually be "viral encephalitis." Blood specimens will be taken during the acute illness and again when the child leaves the hospital, and these are sent to the Viral and Rickettsial Disease Laboratory of the California State Health Department. After the laboratory has received both the acute and convalescent blood serum specimens they will be tested at the same time against a variety of viral antigens. If the patient had Western equine or St. Louis encephalitis, the tests can be expected to show a rise in the level of antibodies to one of these viruses. The majority of children with encephalitis will be treated in their homes and small private hospitals and blood specimens will not be taken. Therefore, when you see the figures for the reported cases of encephalitis keep in mind that this is but an index of the presence of the disease and not a good estimate of the total number of cases.

St. Louis encephalitis is more of a problem in the upper age bracket in California. A high percentage of the cases occur in people 50 to 70 years of age. Such patients often enter the hospital with an admitting diagnosis of cerebral hemorrhage because they will be stuporous and often show some facial paralysis. It is important to do a lumbar puncture in cases such as this, because a high white cell count in the spinal fluid will make it evident that the diagnosis should be "encephalitis." High fever, headache, somnolence or coma are symptoms common to both Western equine and St. Louis encephalitis in adults. Twitching and paralysis of eye and facial muscles are the most important of the other symptoms which may be observed. Paralysis of the extremities may be noted in some of the cases of St. Louis encephalitis. It is possible that Western equine and St. Louis viruses may produce disease as the result

of infection of the kidney and pancreas, because in laboratory animals these viruses often invade and multiply in these organs. We must be alert to the possibility that diseases such as nephritis and pancreatitis may at times be caused by Western equine and St. Louis viruses.

The pictures you will see are of children that had encephalitis early in life and were then followed by annual checkups for several years. Although it is known that most of the children that had encephalitis recovered without any serious sequelae, there are some that were permanently disabled and some had to be admitted to state institutions. The serious sequelae of Western equine encephalitis are illustrated in the film.

The people of this State depend on this organization to carry on a very intensive program in studying the main mosquito vector of Western equine and St. Louis virus, *Culex tarsalis*, so that we can prevent the occurrence of cases of encephalitis such as those illustrated in the film on encephalitis. Are you ready with the film? (Moving picture film, "Western Equine Encephalitis in Children,' by Dr. Knox H. Finley).

Are there any questions? You have seen the sequelae of Western equine encephalitis. St. Louis encephalitis may result in emotional and personality changes but these are not apt to be severe enough to require institutional treatment. We have a maximum of 97 reported cases of St. Louis encephalitis in one year in California. We had 41 cases in 1959 with one death.

Mr. MacFarland: About how much does it cost from the time a child comes down with the disease until when it dies?

Dr. Johnson: It may be a great expense, as is any disease which requires a long term hospitalization.

Question: What groups would you show this film to?

Dr. Johnson: Primarily public health workers, nurses and medical students. I would not advise showing this film to Parent-Teacher or other general lay organizations. I believe that this organization should see it because of the responsibility it has for the control of the disease.

I believe that in the future, research will have to be directed more towards the source of the viruses in nature. Control work directed at the mosquito vector is very effective, and with the amount of irrigation used in this State, if we did not have any mosquito control program, the disease would be a very serious problem.

Question: I would like to ask whether or not in this St. Louis form of the disease, do the adults get affected the same way: loss of speech, etc.?

Dr. Johnson: In the acute phase of the disease there may be difficulty in speaking. There may be tremor of the face and lip muscles, incoordination and also disorientation. The majority of patients recover without any residual speech disorder, muscle twitching or loss of memory. There may be personality change as mentioned previously, especially a tendency to vulgarity.

The movie film on encephalitis will be available for rental from the California State Health Department film library.

There was a case of horse encephalitis in Sacramento County with onset of the disease on April 1, 1959. A diagnosis of Western equine encephalitis was made by testing blood serum specimens of this horse. Why is it that a horse can develop encephalitis so early in the season? We have had several cases of horse encephalitis in April and many more in May. It is of interest to study the mosquitos in an area where there are cases of horse encephalitis so early in the year. It is possible to determine which species feed on horses at this time; and then by testing mosquitos for virus, it is possible to discover which species is the source of the infection. The mosquito that transmits the virus early in the year may not be the same as the summer epidemic cycle vector. We know from the work that Doctor Reeves has done, which mosquitos are susceptible and there are several that can become infected and transmit Western equine and St. Louis viruses. The questions that must be answered are: where does the virus come from? How is it maintained in the natural host? A variety of birds are able to move these viruses. There are successive movements of migratory birds through the Central Valley—not just a few but millions. A mosquito such as *Aedes nigromaculis* may be abundant in the Central Valley and it is a good vector for the encephalitis viruses. However, you can have many birds migrating through such a region with virus in the blood and there is no danger that the virus will be picked up by the *Aedes nigromaculis* mosquitoes because they do not feed on birds. However, if *Culex tarsalis* mosquitos are abundant it would be remarkable if the virus was not picked up by mosquitos.

Dr. Reeves: May I make some comments? Actually, as usual, Harald and I don't agree on everything, but this is a healthy situation. The day we do it is going to be very poor. I would like to comment on a couple of remarks that Harald made; also on the film, very briefly.

I am sure you all appreciate how very valuable this film is in documenting an aspect of encephalitis that we had no documentation on before, or nothing so effective as this film. We have always appreciated how important the acute cases were when they came into the hospital, and deaths were always fully appreciated; but the real long range public health importance for individual families and communities, is now documented by this film and is very important and impressive. I am very pleased that you have had a chance to see it.

With regard to Harald's horse case in April, I don't have to look for an explanation for this horse case if the situation in Sacramento is anything like it is in Kern County, because we have found *Culex tarsalis* infected with the virus from mid-January right on through the summer. We also have very good evidence that *C. tarsalis*, in the very early spring, at these lower temperatures, are perfectly capable of maturing virus and transmitting it, although the levels of transmission at this time are extremely low. We don't expect to see human cases at this time because we have to have a lot of infected people in order to have any cases at all, and it isn't until we get up to the very high levels of transmission that human cases begin to show up. However, a horse exposed in the field in the spring is going to have *tarsalis* biting it, we know this; and the vector can store the virus and transmit it effectively at this time. If the majority of our horses were not immune, which they are, then we would undoubtedly have more cases in the early spring up and down the State. We have areas in the field in Kern where we know transmission must take place in April and May, and

experimentally infected mosquitoes held out of doors transmit virus at this time.

As far as the source of the virus for mosquitoes at this time is concerned, this is where Harald and I really disagree. Harald is on a rodent binge and I am on a bird binge. This is our privilege, and I think it it very good, because he is beating the rodents to death, and I am still beating the birds to death, although there are a lot of them to beat to death. However, the finding that the virus can persist in birds, up to nine or ten months, we feel is significant. The other thing is that when we begin to find the virus in mosquitoes in January and February, the *tarsalis* are feeding practically one hundred percent of the time on bird blood. Whether the blood source of these feedings are migratory birds or residents remains to be proven. It is true that there may be other sources of the virus in the area, such as rodents, that may also serve to carry the virus. Most of the parasites that we know have alternate means of persisting in areas and these viruses may be no exception to this rule. However, I do not agree with Harald that in areas where we have made careful studies, that we still must make an extensive search to fill a complete vacuum in the knowledge of which mosquito is involved in the spring; because we have tested all the mosquito species which we could find in our study areas for years, and the only mosquito in which we found either Western or St. Louis virus in the winter and spring time was *Culex tarsalis.* I would hate to think of having to do that all over again because "we know nothing about it at this stage." Now Harald is smiling and I am sure he appreciates my comments.

Pres. Smith: Thanks, Bill and Dr. Johnson. I think we owe Harald Johnson a debt of appreciation on that. He was speaking on rather short notice. We appreciate his efforts very much. I didn't want to cut in on him, but as I said I was going to be hard-headed, and you could talk encephalitis all day, and I think between Bill and Harald, they could use the whole day very nicely.

The next item on the program is a discussion by Don Grant on Research and its values in California.

RESEARCH IN CALIFORNIA VECTOR CONTROL

C. D. Grant, *Manager-Entomologist*

San Mateo County Mosquito Abatement District

In many ways the foregoing film on Western encephalitis and its effects speaks for itself. Dr. Johnson has brought forth some important points leading to the development of our knowledge of this cruel disease and a background of patient work and investigation that has made such a documentary film possible. It is an impressive testimonial that immeasurably transcends the many statistics and words as to the need for finding a control for this disease and for the invaluable role of research.

This is one portrayal of a very significant health problem and vector problem in California; yet it is far from being our only problem, and the extreme significance of one does not detract from the importance of others. I wonder how many of us have had the opportunity to view documentary films on some of the other vector borne diseases which occur here in California, or presentations on the full scope of misery and health hazards suffered by many thousands of our residents each year through vectors such as flies, mosquitoes, biting gnats and ectoparasites. Must we dig very deep to justify the search for means of controlling and preventing these depredations on our people? What is the price per life? What evaluation can we put on physical suffering, mental anguish and time loss by these great numbers of our people?

Does it leave us with a feeling of complacency knowing that adequate control of the vector could very appreciably reduce the incidence of this Western encephalitis . . . a vector for whose control we use vast sums each year? Complacent or not, the fact remains that currently our best control techniques and state of knowledge cannot provide adequate control of this vector within the cost levels attainable in many portions of the State. Review of the obvious water developments and new mosquito sources certainly doesn't indicate that *C. tarsalis* is going to reduce its own potential. Improved efficiency at lower cost levels through research and its attendant development appears to be the one obvious means.

Senator Cobey has admirably portrayed the role of research in California vector control. Previous polls and the lengthy history of research needs and efforts to attain adequate studies by the CMCA clearly indicate that the great majority of our members do recognize this need and desire the information that may be gained through proper research programs. Achievement of the objectives has been unfortunately slow for basically two major reasons:

(1) lack of agreement as to the procedures and objectives for such efforts, and

(2) resulting disagreement on the means of financing such work.

For two years the Association has had a Research Committee charged with the study of this problem and directed to make recommendations as to procedure, needs and objectives in this regard. Such initial studies and recommendations were submitted to the Association's Board of Directors and received unanimous endorsement with the directive to further develop such concepts into an integrated proposal for an adequate research program. The resulting draft of such proposal in gross form has been endorsed by this Board and sent out at their request to the Corporate membership of the Association for review and familiarization. The initial draft of any such proposal should of course be presented for discussion and subject to modification in hopes of best meeting the many objectives of the aggregate members of the Association. If any proposal can possibly meet with the diversity of opinion to the extent of satisfying even seventy-five percent of this Association, there must be some merit in it. Should such a proposal, in any modified form, be so acceptable with this Association and with other affected parties within sufficient time limits this year, it has been the intent to submit the proposal to the State Legislature and other agencies for review long before the next legislative sessions in 1961 so that the many necessary steps

prior to its ultimate legislative consideration may be effected.

By title and somewhat lengthy text, it would appear that several misconceptions and doubts can be naturally expected to arise. However, even yet, the principal body of substantiating needs, background analysis of other research facilities and contributions, justifying data and step by step logic behind such a proposal is too extensive for practical duplication. It is only normal that the several hundred people considering the proposal will not find it expedient to wade through such a bulky effort. Yet, some will, and preparation must be made for providing correct answers to any of the pertinent questions which may be asked on such proposal.

Though the development of concepts and considerations may be complex, the essence of the proposed plan is not.

The proposed expansion calls for about double the cost of the current research effort now expended under the BVC, representing about one-third increase of research personnel, but also providing funds for study grants at other institutions and cooperative projects with other agencies as well as adequate equipment and supportive needs.

It calls for the establishment of adequate laboratory and supportive facilities at Davis to supplant the overcrowded and woefully lacking housing at Fresno. Such costs would entail a request of the State legislature for a maximum estimate of four to five hundred thousand dollars with a matching request to the National Institute of Health.

The program calls for needed research in many fields of vector control to provide for the rapid increase of problems facing various public health interests besides that of pure mosquito control. It submits the concept that 16 million people (likely to be doubled or even trebled in California) necessitates a rapidly growing expenditure of funds for the many aspects of fly, gnat, midge, mosquito and ectoparasite control in association with this population which already far more than justifies the cost of the proposed research expansion and constitutes a serious responsibility to the State to safeguard such expenditures through determining reliable knowledge for us in advising upon the many unknowns with which control agencies are faced.

It is not anticpated that such a program would inhibit, interfere or overlap other research efforts. To the contrary, by policy a coordinated center will serve to stimulate and cooperate with other studies where possible and at the same time have the awareness to avoid unnecessary duplication of effort. There are so many research needs and priorities that all proposed projects will be subject to intensive review before receiving the green light.

It is recognized that research costs money, how much is often grossly underestimated; but you get what is paid for. With inadequate funds for a great deal of needed work, you receive either a lot of poor work or an inadequate amount of good work in relation to the needs. The acceptability of any program must be measured in efficiency for dollars and cents expended. It is here that the concepts of the proposed program of research may be best upheld. Adequate facilities and rounded program not only are conducive to greatly increased work accomplishment of higher quality, but also serve to entice the most competent workers for employment at such facilities and professional interest at less cost as well as providing greater eligibility for grants available from many sources. It serves in many ways to compound the rate of return for money invested.

Doubling of the program effort in dollars and cents may be well expected to increase the productivity fourfold. Even without moneys that are planned to come from other than State funds, it would appear not only a wise, but a good investment for the people of California.

The report of this Research Committee has been prepared with sincerity in accord with the directions received and has been put forth for open review and invited suggestions. Modifications, acceptance or rejection is in your hands. It is only hoped that reason, judgement and the people of California are not sacrificed—whatever the ultimate course.

SECOND SESSION

MONDAY AFTERNOON, JANUARY 25, 1:30 P.M.

Pres. Smith: I don't know whether Gardner MacFarland doesn't like me or thought maybe I was a tired old man, but I am going to thank him and let someone else be chairman for the rest of the afternoon. Jay Graham, Manager of South Salt Lake County Mosquito Abatement District, Utah, will now take over for this session.

Jay Graham: Thank you, Gordon. After that introduction I really believe that Gordon is tired and needs a rest. Now the only reason I am up here as chairman is because Gardner wanted to make sure I was awake while he was talking. And I understand that through talking with Gardner, there is plenty of time on the program, so if he runs over here, we will know whose fault it is, and I will take it upon myself to remind him that we want to keep on schedule and get through on time.

Before we start, if you will forgive me, Gardner, for taking just a minute of your time, I would like to say that those of us from Utah come here to try to learn something. We appreciate what we do get here because it is quite considerable, and I don't think there is any other area where we have more interests and more envy of California Mosquito Abatement Districts than we have in the question of salary. So. Gardner, if you will take over and introduce your panel.

POSITION AND SALARY SURVEYS AND EVALUATION FOR MOSQUITO ABATEMENT DISTRICTS

GARDNER C. MCFARLAND, *Moderator*

Manager, Southeast Mosquito Abatement District, South Gate, California

Our panel is one it was thought would give information on the practical side of district internal operations. The first consideration of any mosquito abatement district, or anyone involved in mosquito control, is to eliminate mosquitoes. It takes people to do this, employees of various classifications and skills. As mosquito abatement gets more complex, more employees are needed so that more internal relationships have to be taken into account if we are to obtain maximum efficiency at the lowest cost. This is nothing new, since we know that many corporations and public bodies have classification and/or civil service with working conditions spelled out, such as holidays and vacations. Mosquito abatement agencies have classifications and working conditions spelled out also, but on the informal side. There is more and more thinking that we should at least formalize things a bit so employees will know where they stand.

There are several subjects that cover classification, working conditions, and other internal management problems that will be handled by our panel of experts. This panel includes Lester Brumbaugh, who has taken a great interest in personnel problems involving civil service and unions and will give us the benefit of his experience and very latest particulars. For several years a comprehensive study of position classification has been going on within our Association. When the study was completed, it was submitted to David Kleinman of the State Health Department, who completed the study. We are fortunate in having Dave Kleinman, Assistant Chief, Bureau of Personnel and Training, on the panel. And last but not least of our panel, is our esteemed Secretary, Don Murray, who has done a marvelous job of compiling statistical information which is so valuable to all of us.

Before calling on Mr. Brumbaugh, I will discuss salary resolutions.

Mosquito abatement districts do not have ordinances but can use resolutions. The Board of Trustees of the Southeast Mosquito Abatement District requested preparation of a salary resolution that would formalize employees' working conditions and salary schedules as much as possible, so that employees of the District would know where they stood and know at least that they would be guaranteed a salary. It is my opinion, if some districts were to analyze their minutes and official actions taken, that it would be found that there are certain things lacking. Salaries might not have to be paid, as an example, since formal action had not been so taken. This might be important in case of disaster where several of a governing body might be wiped out with consequent loss of verbal policy. We compiled a number of salary ordinances from several cities in Los Angeles County, the State Salary Ordinance, and the County of Los Angeles Salary Ordinance (a two volume tome) and drafted a salary schedule and certain working conditions that were passed by resolution.

The resolution covers basic salary steps or schedules. Included are efficiency increases over a 4½ year period, with the first due in 6 months and the remainder at yearly intervals. Employees become more skilled and efficient and consequently more valuable, so merit these increases. After 4½ or 5 years, a level is reached that provides adequate pay for the particular skill.

Working conditions are also covered for temporary employees. They are given certain guarantees and step raises if they return, since temporary summer employees are a very important part of mosquito control.

The resolution has provisions that allows changes in the salary resolution by another resolution if the interests of the district so require. In other words, a board is not giving away its rights or the taxpayers rights. If the resolution was properly and fairly prepared there will be little or no reason for changing very much of it. Our resolution has been used for several years without change. Copies of our model resolution will now be handed out for your study and files.

RESOLUTION NUMBER.....

A resolution of the Board of Trustees of the ..... Mosquito Abatement District adopting a five-step salary range schedule, fixing the salaries and compensation to be paid to non-appointive officers and employees of the ..... Mosquito Abatement District.

The Board of Trustees of the..... Abatement District does resolve as follows:

Section 1. Five-step Salary Range Schedule. The following Five-step salary range is hereby adopted as the basic salary and wage schedule for the non-appointive officers and employees of the ..... Mosquito Abatement District:

BASIC FIVE-STEP SALARY SCHEDULE

Range Number	Hourly Equivalent of Minimum Rate	Monthly Rate				
		A	*B*	*C*	*D*	*E*
1	1.57	273	288	303	319	337
2	1.66	288	303	319	337	355
3	1.74	303	319	337	355	375
4	1.83	319	337	355	375	395
5	1.94	337	355	375	395	417
6	2.04	355	375	395	417	440
7	2.16	375	395	417	440	464
8	2.27	395	417	440	464	489
9	2.40	417	440	464	489	516
10	2.53	440	464	489	516	545
11	2.67	464	489	516	545	575
12	2.81	489	516	545	575	608
13	2.97	516	545	575	608	641
14	3.13	545	575	608	641	677
15	3.30	575	608	641	677	715
16	3.49	608	641	677	715	755
17	3.68	641	677	715	755	797
18	3.89	677	715	755	797	842
19	4.11	715	755	797	842	889
20	4.34	755	797	842	889	940
21	4.58	797	842	889	940	992
22	4.84	842	889	940	992	1048
23	5.11	889	940	992	1048	1107

Section 2. Compensation of Employees. Each employee of the ..... Mosquito Abatement District shall be entitled to receive, and there shall be paid to him for his services, the salary or wage established for his classification, in accordance with the Basic Five-step Salary Schedule, except as otherwise provided herein or as may hereafter be provided by action of the Board of Trustees.

Section 3. New Appointments-Beginning Rate. The first step (A) in each salary range is the minimum rate, and it shall normally be in the beginning rate for the classification to which assigned; provided, however that in cases where properly qualified personnel cannot be recruited at the minimum rate, the Board of Trustees may, by motion, designate the step within such salary range at which new appointments shall be made.

Section 4. Increase in Salary Rate. Employees who have satisfactorily completed six (6) months service in their classification shall, upon recommendation of the Manager, be eligible for an increase in salary of one step in the assigned salary range. Employees shall be eligible upon recommendation of the Manager, for additional step increases upon completion of each additional year of satisfactory service until the maximum (Step E) is reached, after which no further increase shall be granted except by promotion to a higher classification. Temporary full-time employment in a given classification immediately preceding probationary appointment to the same classification shall constitute service in the classification for purpose of computing eligibility for salary increases.

Section 5. Temporary and Part-Time Employees.

Beginning Compensation and Increases.

(a) Employees who are employed on a part-time or hourly basis shall be compensated at an hourly rate equivalent to the range and step which assigned.

(b) Employees employed temporarily on a full-time basis shall be compensated for their services at the rate designated for full-time employees in the same classification, and they shall be eligible for salary increases in the same manner as regular full-time employees.

(c) Employees temporarily or regularly employed on a recurring seasonal basis and who complete at least two months' continuous full-time employment in each calendar year, shall receive credit toward regular step-increases of one year for each calendar year of employment.

Section 6. Transfer or Promotion to Classification to Which a Higher Salary Range is Assigned.

(a) Any employee receiving promotion to a higher classification to which a higher salary range shall have been assigned, shall receive compensation at the *step* within the assigned range which will result in a one-step increase in salary over that being received by him immediately prior to such promotion.

(b) After promotion to a higher classification, or transfer to a classification to which a higher salary range shall have been assigned, such employee shall be eligible for regular step increases in accordance with Section 4 of this resolution. Provided, however, that any employee so promoted or transferred whose compensation was less than the maximum established for the previously held position and who otherwise would be entitled to a regular annual increase before completion of six-months in the new classification, shall be eligible for a first-step increase on the anniversary date of his last regular annual increase notwithstanding he has not completed six-months' service in the new classification.

Section 7. Board of Trustees Action on Step Advancement or Change of Salary Range.

(a) Step advancement or increase in the salary or other compensation to be paid to any employee shall be made only after approval of the Board of Trustees based upon the recommendations of the Manager and as shall be determined by the Board of Trustees to be in the best interests of the District.

(b) The salary range to be assigned to any given classification may be changed as the Board of Trustees may determine to be in the best interests of the District as the Board of Trustees may, from time to time, direct by resolution.

(c) The salary or compensation of any employee may be reduced or changed as the Board of Trustees may determine to be in the best interests of the District and as the Board of Trustees may direct by resolution.

Section 8. Classification of Positions and Allocation of Salary Ranges.

The following employees of the District shall be paid the salary herein set forth for their classification in accordance with the Basic Five-step Salary Schedule.

Classification	*Range*
District Foreman	
Entomologist	
Inspector-Operator	
Manager	
Senior Inspector-Operator	
Stenographer	

Section 9. Amendment or Repeal.
The Board of Trustees reserves the right to alter, amend, or repeal this resolution or any part thereof at any time by subsequent resolution.

Section 10. All previous resolutions or actions in conflict with any of the provisions herein contained are hereby expressly repealed.

Section 11. Effective Date. This resolution shall take effect immediately on its passage by the Board of Trustees.

, President
Board of Trustees
_____ Mosquito Abatement District

/s/ _____
, Secretary

State of California)
ss
County of _____)

I, _____, Secretary to the Board of Trustees of the _____ Mosquito Abatement District, do hereby certify that the foregoing Resolution, being Resolution Number _____, was passed and adopted by the Board of Trustees of the _____ Mosquito Abatement District, signed by the President, Board of Trustees and attested by the Secretary, all at a regular meeting thereof held on the _____ Day of _____, 19_____, and that the same was passed and adopted by the following vote, to-wit:

Ayes:
Not voting:
Not voting:
Absent:

/s/ _____
, Secretary

PERSONNEL PROBLEMS

LESTER R. BRUMBAUGH, *Manager*
San Joaquin Mosquito Abatement District, Stockton

Good afternon, ladies and gentlemen, it is a pleasure to serve on this panel with Gardner McFarland, Dave Kleinman and Don Murray. Your chairman, Gardner McFarland, certainly used all the tricks of the trade in preparing for this panel. He mailed letters, sent cards, and even used the telephone to remind us to be prepared.

In recent months, undoubtedly you have been reading in the newspapers how management has had to work with union organizations in solving labor problems. Salary rates, working hours, promotions, grievances, sick benefits; can all be classified as personnel problems. The stand any particular company or agency should take on these problems is not an issue to be answered here. However, the branching of the labor movement into new fields leads to this question, "Are unions going to try to organize mosquito district employees?" This could be answered in two ways, "Yes or "No." The real answer depends upon unions, employees and management.

Several months ago, the American Federation of Labor and the Congress of Industrial Organization, commonly called the AFL-CIO, contacted the San Joaquin Mosquito Abatement District and asked permission to talk to District employees regarding membership in the union. They stated they were trying to organize city, county, state, special districts, or any group of government employees. Their representative offered many advantages to the employees; such as, increased salaries, establishment of seniority rights, representation in settling grievances with management, establishment of fair working rules, and many other benefits. Promises of this nature to any group of employees can certainly create a multitude of problems. The question was asked, "Could government employees legally join or belong to a union?" The answer was, "Yes." Many different laws were cited, giving the union the right to solicit any government employee. They particularly quoted state laws, national labor laws, and the Taft-Hartley Act, which provides individual rights to employees and employer, as well as members of unions; and provides unions with the right to act as agent in negotiating labor contracts. For those of you who wish to explore further into labor laws or labor contracts, many of the city and county libraries have excellent reference material on these subjects.

When you have labor officials knocking at your door, contacting your employees after working hours, and mailing literature to their homes, it is only natural to

assume that union organizations are interested in any group of employees.

What do employees think of unions? Since we are dealing with individuals, opinions will vary considerably. Some employees just like to belong to any organization. Others want someone outside of the Company or District to represent them in personnel matters; and then there are others who are interested in higher pay. A few are interested in the health plan, or other miscellaneous fringe benfits that might be gained. However, in most cases, the majority of employees want a fair living wage for the work performed, some type of seniority rights established, and job security. They do not seem to be particular who accomplishes these desires as long as they are established. If this were true, would it not be logical to assume that this should be one of management's responsibilities?

Any agency with poor working conditions, below average salaries, and no established personnel rules, is certainly encouraging their employees to join a labor organization. There should be no doubt in anyone's mind that employees are interested in improving their job positions and will try any means to reach this goal. The intelligence and combined strength of one's employees should never be underestimated.

There are a number of approaches that may be used by management in tackling these different personnel problems. Perhaps they may be classified into two large groups: The first is the policy of doing nothing—letting the problem occur and then trying to find a solution. The second, having a plan in readiness and developing it, to minimize or eliminate the problems before they happen. The establishment of a personnel program, using job evaluation techniques, and providing for a merit system, are all points to consider. By working out related values in job specifications for any company, it is possible to show the employees why their jobs are given different pay ratings in comparison with other, or similar, jobs. Thus, wage grievances that might otherwise arise may be minimized.

Another way to approach these personnel problems is to note the methods used by different companies or agencies in solving them. Rather than use one's own experience, which is sometimes limited, would it not be wiser to add the experiences of others before reaching a decision? There are many ways in which management can broaden its views; such as, attending management conferences, consulting with various personnel experts, studying business literature and visiting different companies in the area where you live. It is surprising the amount of assistance one can receive just by asking. Most personnel experts highly recommend the establishment of personnel policies, not only for employees but for management too. If you make rules for employees does it not seem logical that rules should be made for management? This would apply to transfers, promotions, handling grievances, job evaluations, wage classifications, etc. If these policies are to be understood, they should be presented in simple form and made available to all employees. After all, the employee is interested in these matters and should have a means of communication with management.

No attempt has been made here to indicate how management should react to the labor movement. This involves board policies and decisions, whose analysis requires much more time than is available here. It is essential in these changing times to establish good personnel practices, rules and policies if management is to survive—unions or no unions. Remember the old adage, "An ounce of prevention is worth a pound of cure."

Mr. McFarland: Thank you, Les—I can see that you have been forced into quite a study of unions. Now, as I mentioned before in my introductory remarks, the CMCA Ways and Means Commitee worked for a good many months on position analyses. Bob Peters was the individual on this Committee who should be given the credit for this study and for readying it in form for submission to experts in the field of position classification and analysis. We are very fortunate in having the man who actually completed the work for presentation to us today. It gives me a great deal of pleasure to present Dave Kleinman, our next panel speaker.

CLASSIFICATION SURVEY OF LOCAL MOSQUITO CONTROL AGENCIES

DAVID S. KLEINMAN, *Assistant Chief*

Bureau of Personnel and Training

State Department of Public Health, Berkeley

Thank you, Gardner. That introduction, by the way, embarrasses me a little because I don't know that I am a real expert, you might say, in the field of personnel management. Every organization, sooner or later, comes to the point where it takes some time off from operations, program research and other activities, and tries to evaluate how they are using people. Now actually this is an important element in the success of any program since it is people who are going to do the jobs to achieve the goals which an agency sets for itself. By and large most organizations, either private or government, come up with something which they call a personnel or classification and pay plan. This is a description of how the work is being divided in the organization, how it is to be evaluated, how the people who are doing the work are going to be paid and how they should be recruited; from what specialties, what type of people you are going to need to do the various jobs you have to do. And I guess that this has become an important concern to mosquito abatement agencies. Now classification and pay plans take various forms. The form we have chosen to use in the report we have submitted, is essentially the one that is used, by and large, in most California local and State jurisdictions. It varies somewhat from federal plans and somewhat from private industry plans, but I think experience has shown that this is the best approach to personnel classification in our California governmental agencies.

All classification and pay plans have one thing in common. They try to group the jobs that are being done in the various agencies into categories so that we have an idea what we are talking about when we call a job, let's say, a mechanic. We know, or at least try to describe, what a mechanic's responsibilities and duties are. It is kind of hard to state responsibilities and duties in a definite fashion, but if the specification, which is the write-up of the job, is good it will give you a pretty fair idea so that you can evaluate that job in comparison to other jobs in the organization. And the pay

plan sets forth the standards upon which you will evaluate jobs, i.e., the basis on which you will pay for the various types of work being done. There are some pay plans that are based on comparable salaries. You look around the community, find jobs that you seem to think are comparable to those you utilize, and I say seem to think, because it is very difficult to compare one job level against another; you find jobs that appear to be of the same level and type and try to determine what these jobs pay. You then set your salaries accordingly, making adjustments to recognized internal relationships.

Other approaches, used in industry very frequently, are evaluation systems, where you try to analyze the jobs on the basis of, let's say, how much schooling is needed, how much experience is needed, what salaries are needed, what are the difficulties involved in training for the job, and you set salaries accordingly. We haven't tried to get into pay considerations in this report.

There are many factors that are involved in evaluating jobs for classification purposes, and I am not going to go into them to any great extent. I remember that when I first got a job as a junior personnel technician, my boss set me down at a table which was loaded with books. He had me read, or skim over, about 3,000 pages in a week, and ever since then I have tried to avoid technical material. I feel that I actually learned more by working with people who are responsible for getting jobs done. These are essentially people like yourselves who develop programs, divide up work assignments, assign this work and choose the people who are going to do this work. And as you do this you set up the pattern which is the basis for position classification. The question is really not whether you are going to clarify positions or whether you are not going to classify positions; you are doing this when you hire a man and tell him to do a certain job at a certain salary, and call him by a certain trade name. You are classifying his job and when you choose people with specific qualifications, you are setting the patterns that you will use to recruit and develop the people you are hiring. The question is whether you'll do this off the top of your head or whether you will put down some guidelines to assist you.

Well, why write all this up in a fancy write-up; why take this trouble. The reason is, as with so many other things, that when an organization gets to a point, or a program gets to a point where it becomes somewhat complicated; it is kind of difficult to do any planning or analysis without using paper. I remember some of the problems in a county which now has a pretty good classification system, and I remember the things that led up to this system. I remember this as it was told to me, and let me be honest, it may be embroidered a bit to make a point as one does in a fable. As it was told to me, every year around salary setting time the Board of Supervisors would sit at a hearing and the various department heads would come up with their salary pitches. One might plead, "We ought to get a raise for sanitarians." And the Board would not be too sure what a sanitarian does. They are doing different kinds of jobs and the jobs aren't too well described; they weren't at that time we are talking about. So they would say, "Sanitarians, who are they? That red-headed fellow who comes to us every now and then with some complaint or other? Is he a sanitarian?" The department head would say, "Yes, that is one of our better men." The Board said, "Well, he is a pretty good guy, I think we ought to give him a raise." And the whole group would get a raise. After they had gone through this for about half a day or so, they would turn to their clerk and ask the clerk to tot up the amount of money they had spent so far on raises for the next year. They would come back for the afternoon session and the clerk would tell them they had spent 100,000 dollars, so far. And they would respond, "100,000 bucks!", and just fold their arms and it would be rough going for anybody else who paraded in front of them with any kind of request that cost money. Well, some of these Board members were re-elected several times, and over a period of years. The Board began to realize this as a problem. So they decided they were not going to pass out raises just like that. They were going to consider the whole package deal, they would take notes, figure out how much of a pie they had cut, and divide it up as they see it. This worked all right for a while so long as things were simple. Then somebody came up with the idea– "Well, I am going to hire an orthoptician, and I am going to need so much money." And the Board said, "An orthoptician, what is the matter with a regular optician?" And the department head said, "Well, an orthoptician is something different from a regular optician. He is an orthoptic technician." And the Board said, "That doesn't help us one bit. What is an orthoptic technician?" "An orthoptic technician is a person who is trained to give exercises to cross-eyed children." Well, they got madder at that. "So what is the difference in the exercises that cross-eyed children get?" And, finally, the department head said, "Well, these are eye exercises, and it takes special training and what not." And the Board didn't have any choice at that time and said, "Well, let's get it over with. Next." And so it went on. But after a while they said, "Let's stop this confusion. Let's have a classification plan, let's get these jobs down on paper, so that when we talk about them, and talk about what they are worth, we will know what they are."

Well, I think this is a pretty good reason for getting jobs down on paper. But there are other reasons too, and that concerns your own operation. It is difficult, as I noted before, without some written record to evaluate how you are using your people. I would draw a parallel, let's say, with financial record keeping. Everybody agrees that you need an accounting system to know how you are spending your money and what you are spending it on. And although the agreement in that instance is pretty universal, I don't think it is as well recognized in personnel classification. And actually this is what personnel classification is—an accounting system, a way of recording, a way of putting down the information as to how you are using your people, how you plan to use those people, how you are going to develop them, what sort of people you are going to hire, and how you are going to pay them. Now in doing this, you want to know four things: (1) What the purpose of the organization is; (2) what does each employee in that organization do; (3) what does their boss think they are doing–this sometimes doesn't jive with #2; and (4) what would their boss like them to do if he weren't limited either by–let's say, emergencies popping up all the time, so he has to be using people

to put out fires, so to speak, rather than on a well-planned and smoothly functioning operation. Well, we tried to do this in the report that we are presenting to you today.

I am not going to discuss the report very much; I figure that it would be much better if everybody got it the hard way, and I mean by reading it. But then I would like to point out certain things about the report. It wasn't meant to be a description of how a mosquito abatement agency should organize. It wasn't meant to be a description that anyone could sit down and take up and say, "Yup. Tomorrow I am going to go out with this report and put labels on all the different desks and tell the employees, "You are now such and such. Read the specifications and start doing the job." It wasn't meant to be applied that way. What we tried to do was find a common frame of references that could be a starting point. We tried to word and develop it in such a fashion that you could use this report in working up your own classification findings. And, the best judge of this is the consumer. I think the ultimate value of the report will not be determined by how it stands today, but by how it is used and applied by you people from this point forward.

Mr. McFarland: Thanks, Dave. I think we all realize how valuable this report is. I had the experience some years ago of working on a committee for an employee's association that hired a classification expert at very reasonable cost. We obtained but a fraction of the work that is here, and I think it cost us around $10,000. This work is really valuable, and I am sure we will realize its value as time goes on.

Our last member of the panel is no stranger to any of you. He is Don Murray, Secretary of the Association, who has been doing a tremendous job of compiling statistical information that is sent to us.

CMCA SURVEY OF PERSONNEL AND WORKING CONDITIONS

W. D. Murray, *Manager-Entomologist*

Delta Mosquito Abatement District

Visalia

I. INTRODUCTION

For many years the CMCA has prepared and circulated to the members a schedule of salaries of the mosquito abatement district personnel. Several years ago this schedule was expanded to include certain working conditions and other items of general interest.

The earliest submitted survey I have been able to find has no date of record, however it represents the salary schedule of the 1947-48 fiscal year. Eleven districts participated. At about the same time, a committee of the association prepared a list of suggested titles, with job descriptions and recommended salary ranges.

The next survey of record was chairmaned by Edgar Smith of the Merced M.A.D. in 1951. The CMCA subsequently established the Forms, Records and Statistics Committee which has continued the survey annually to the present time. In 1959, 45 agencies participated, compared to the 11 on the first survey.

The purpose of these surveys is to provide an exchange of information to all cooperating agencies. The included items represent many policy decisions, and it behooves trustees and managers to consider them carefully if they desire to maintain the employees' confidence. Unions and labor organizers can gain a foothold if they discover that practices are unfair or out of line with other agencies.

II. REVIEW OF POSITIONS AND TITLES

It has been my hope that improvements could be made in the preparation of the information. The presentation by David S. Kleinman, the result of a study made by him and Thomas D. Mulhern, should assist mosquito control agencies in titling, and their reports should be used as a guide in future salary surveys. There are still several areas of confusion, and guidance and recommendations from the membership will be appreciated.

1. Assistant Manager–Superintendent–General Foreman.

For internal reasons, the various districts have selected one or the other of these titles for what is more or less the same job. The titles assistant manager and superintendent are used interchangeably by Kleinman and Mulhern, while the title of general foreman is reserved for a job with somewhat less responsibility.

For the preparation of the salary schedule, the title of assistant manager has not been satisfactory, since it has included persons in operational, technical and administrative positions. This title has been used internally in at least some cases to indicate chain of command, without relation to the individual's specific duties. For clarity in compilation, therefore, it would be preferable to avoid the title of assistant manager, unless the specific duties are listed.

The separation of superintendent from general foreman is a valid one, the difference being primarily a matter of degree. For the salary schedule these positions are sufficiently similar that they may be listed together.

2. Administrative Assistant.

This title is used in a few districts, primarily for a man who functions as office or business manager. In the salary schedule this position has been included in the general category of secretary; however, if the districts who use this title would prefer that it be kept separate, such wishes can be followed. Inasmuch as this position has been filled only by males, such was noted in the compilation.

3. Entomologist.

This title is used loosely. A person who has had a course in bookkeeping does not require the title of accountant, neither should a person with a course in entomology acquire the title of entomologist. It is true that fine technical assistance can be provided by a person with a minimum of technical training, but additional titles would be preferable.

4. Source Reduction Superintendent.

The same statement may be made here that was made under entomologist.

5. Operators—Control Operators—Inspector Operators

This is the basic field man. In some districts largely as an inspector, in others as a spray man. He is the principal field man in each case. While distinctions of title and job may be important locally, in the salary survey the lumping into one category appears justified.

6. Labor.

This title is used for a temporary worker who works for about three months or less. He is usually paid by the hour or day. Many districts employ certain personnel for six to eight months, paying them by the month, and it has seemed preferable to include these with the control operators.

7. Pilot.

The biggest weakness in the reporting of this category is the inability to determine even approximately the annual salary. While the indications of the flight pay range is important, the actual annual total salary cannot be interpreted in most cases.

One person in correspondence questioned the sequence of the positions in the submitted schedule. The positions, is economy of production, plus the desire to have any given position listed entirely on the same page.

III. REVIEW OF WORKING CONDITIONS AND MISCELLANEOUS ITEMS.

1. Annual Audit.

More explanation on this item would appear desirable. In some cases there may be quarterly or monthly audits, in others just an annual audit. Is the cost in some cases determined by the size of the district's budget, or by the hours or work involved in making the audit?

2. Insurance Coverage.

Airplane coverage should be kept separate from the district's general liability and auto coverage.

Differences in premiums may represent differences in total program, in amount of coverage, in types of risk, in payroll, in experience record, in assistance by the local insurance agent, etc. Interpretations of these factors would be interesting.

3. Group Medical Insurance Coverage.

This item is receiving increasing attention by mosquito abatement districts. District participation through financial assistance also is increasing.

4. Vacation.

Almost all county and state employees receive 15 working days vacation per year. About half or slightly more of the mosquito abatement districts follow this plan. Much private industry and a few mosquito districts still retain the two week vacation allowance which for many years was a rather standard consideration.

5. Sick Leave.

The weakness in the submitted schedule is in the failure of most districts to show the number of days which may be accumulated. Most of the districts permit one day per month of sick leave. Most counties and the state permit these days to accumulate to a specified maximum. It would seem logical that most mosquito districts permit some such accumulation, however only a few of them report it. An increasing item of information would be the amount of sick leave actually used by district personnel, and any evidence of abuse.

6. Holidays.

Public agencies have been severely criticized by private industry for excessive use of this item. Just why no work should be done on a general election day, when actual voting takes not more than five or ten minutes, is difficult for some taxpaying citizens to understand. Several of the other state declared holidays have little significance to most people today. In Visalia a survey of a large number of private businesses indicated that by far the greatest number took eight holidays, namely Jan. 1, Feb. 22, May 30, July 4, Labor Day, Nov 11, Thanksgiving, and Dec. 25. The state, most if not all counties, and most mosquito districts take eleven days plus election days. A few districts, however, take only eight days.

7. Working Hours.

The forty hour week is almost universal in government work. A few mosquito districts increase their work hours in the summer. Saturday work has been virtually eliminated.

8. Retirement.

Social Security is accepted by most districts. Few districts have had much experience in this field. We have not given much thought to retirement age, compulsory or otherwise.

Mr. McFarland: Thank you, Don. Now before I ask questions from the audience, Les, do you have anything you would want to add?

Mr. Brumbaugh: Well no, Gardner, except that I did think that we should mention something about unions. What brought this on was that approximately a year ago in Puerto Rico, the American Federation of Labor and the Congress of Industrial Organizers met there and appropriated approximately $400,000 to be used in San Joaquin County to organize labor. Why they picked Stockton, I do not know. That was to organize foreign labor. They had been branching off into government groups for some time; and I thought perhaps I would give you some information as to what was happening so that maybe you might use it as a guide when it knocks at your door.

Mr. McFarland: Dave, do you have anything you would like to add?

Mr. Kleinman: Don Murray had brought up the point on assistant managers. Regarding this I would like to point out this job wasn't meant to necessarily stand alone. We tried to develop a group of class specifications or job descriptions for a hypothetical district. And we tried to abstract those elements of the job that seem to fit the class of assistant manager. Now the job could be done by the entomologist, or the source reduction superintendent, or the general foreman as Don pointed out. A lot depends upon the size of the organization, the way its program is operating and the people it has been able to recruit. One of the problems we had in this survey was to determine what is the hypothetical district going to look like. And we tried to make a composite of everything we saw with the

result that maybe it is a little bit more than anything we saw.

I remember a similar problem in a different area. A friend of mine was looking for a summer house in Vermont and somebody showed him one. Being a city fellow they figured he would be impressed by the very fancy bathroom, stainless steel and all that. But they didn't have any water. Well, he figured, "This is ridiculous you know. By golly, let's get the water in first, and then put in the bathroom." So he bought a house that had some water, no other facilities. As a matter of fact, the water was piped in from the stream out on a little hill above the house. They had put a funnel in the stream and ran a pipe down to the house. Well, along comes somebody else that buys the first house, installs the same system—he has cold water, he doesn't have hot water. At any rate he has water running in his bathroom. And for another $100 he put in a septic tank and got the bathrom operating.

Well, I thought of this survey in a similar fashion. We are trying to set up a structure that you can use and that would be a guide. We are not trying to set up something that describes anything for everything that is operating today. And I feel Don's comments were particularly pertinent. Because if this survey does nothing else but raise questions it will have served a worthwhile purpose.

When I first started to talk, I mentioned that I don't consider myself an expert. People working in a position classification don't come up with plans that can be used for all time. They should be used as a starting point and change as they are shown to be inadequate, and they will become more complex or simple, depending on operational developments.

Mr. McFarland: If there are no other questions, I wish to thank each member of the panel for their excellent and most interesting papers and discussions.

Mr. Graham: The program now calls for a recess until 3:00 P.M. But before you leave I would like to turn the time back to Gordon because I understand that there are some people here whom he would like to introduce this morning.

Pres. Smith: It seems that we have some distinguished guests present. Being an ex-Army man I don't know whether I should do anything about it or get Don Murray up here. The last I heard—Mr. Holway's name, he was called Commander. I understand he has had difficulty raising his right arm now with the rank of Captain. Will you stand up Captain Holway. And Mr. Austin Morrill, of the 12th Naval District. I understand that you brought a stranger from far away places, back from somewhere in the southeast with you. Ensign John Mulrennen, Jr. And we have another visitor, if he is present, from farther away even than Florida—Dr. March from Tahiti. Welcome to California.

RECESS

Mr. Graham: Gordon has asked me to make a few more introductions. Actually I should like to make one more introduction, and we will let the man take over and introduce the people who are here with him. I would like all of you to meet Dr. Al Buzicky. Al, would you introduce the Board members you brought with you.

Dr. Buzicky, Minneapolis, Minnesota: We have some of our Board Members here that arrived last night, Mr. Ira Peterson and Mr. John Hagen, who is our Treasurer. We certainly wish to thank you for being able to participate in your knowledge here in California. We appreciate it very much. Thank you.

Mr. Graham: I meant to say here too, that Al is from the Metropolitan District in Minneapolis, Minnesota.

The next panel on the program is a Symposium. "The Place of Granular Insecticides in California Vector Control." The Moderator is Ted Raley, and I will turn the time over to Ted and let him introduce his panel and take it from there. Ted.

SYMPOSIUM: THE PLACE OF GRANULAR INSECTICIDES IN CALIFORNIA VECTOR CONTROL

TED G. RALEY, *Moderator*

Manager, Consolidated Mosquito Abatement District, Selma

Granules have been an item for control that has created quite an interest. We hope, today, through this group presentation to bring you as well up to date as possible on the district use of granules and the technical phases in the formulation of the various types of granules. I have a very illustrious group. I will introduce them in the beginning. If you feel that I have slighted them as we go along, each will appear before you to tell his part of this discussion with no further introduction. At the end of the collective presentation we do hope that there will be questions. I have thought of questions after each paper, but in that we have organized it to present parts from each one, we feel it will be best to reserve questions until after all of the speakers have presented their material, and then we will raise those questions that have come to mind, and to the best of our ability try to or at least clarify the points that you haven't gotten too well in the beginning .

The panel: Dr. Guy McLeod, Vice-president of Sunland Industries, Fresno, California. Dr. Mulla is not able to be here today because of illness. Larry Marsten, Entomologist for the Coachella District will digest and present parts of Dr. Mulla's paper. Gus Augustson, Manager-Entomologist for the Madera County MAD, at Madera. Arthur F. Geib, Manager, Kern MAD, Bakersfield, Larry Lewallen, Senior Vector Control Specialist, Bureau of Vector Control, Fresno.

The order of presenting the papers will not be quite the same as given in your program. Mr. Marsten will appear first and present Dr. Mulla's material.

CRITERIA FOR SELECTING GRANULAR INSECTICIDES FOR VECTOR CONTROL

MIR S. MULLA

University of California Citrus Experiment Station, Riverside

Introduction

Granular formulations of insecticides have an important place in the control programs of a variety of vector insects which have terrestrial and aquatic habitats. Currently, there is a strong tendency toward greater utilization of granular insecticides for insect vector control in California. The total amount of pellet or granular insecticides (mostly 5% malathion) used by 17 mosquito abatement districts during the year 1956 for vector control in the state was less than 43,000 pounds (Anonymous 1957). Two years later (i.e. 1958) the amount of granular insecticides used and reported by 21 agencies in the state was more than a hundred thousand pounds, the great bulk of which was 5% malathion granules (Anonymous 1959).

Some of the possible apparent advantages of granular insecticides in mosquito control have been enumerated by Mulla and Axelrod (1959). In addition to these advantages, granular formulations in contrast to sprays are believed to be safer to use when pollinators and natural enemies of crop pests are present in fields to be treated for mosquito control. Granular materials with desirable physical properties would hardly leave any toxic residues on plant foliage. They would mostly penetrate the plant canopy and reach the water beneath the plant cover and deliver the toxic dose into the water for larval kill.

The selection of granular materials as opposed to emulsifiable concentrate formulations for controlling pestiferous and vector insect species should be based upon the economics, potential hazards to applicators and beneficial insects, efficiency, residue considerations and ease of application. In addition to these factors the ecology and biology of the insect would also determine the type of formulation. For example, emulsifiable concentrate formulations would yield little or poor control of certain bottom feeding insects such as *Mansonia* spp. and certain midges and gnats. Insecticidal granules with greater density than water applied to deep bodies of water would settle down to the bottom and release the toxic agent in a relatively narrow layer of the treated water. Insecticides applied in this way would give efficient control with reduced dosages than would be normally required. Toxicants applied as sprays to the surface would reach the bottom portion by diffusion or water disturbance. In the case of the granular materials the toxicant gradients would exist from the bottom to the top, while the reverse would be true, at least for a while, for the emulsifiable concentrate formulations. The former type of gradient is necessary for an effective control of bottom feeding insects. Only certain kinds of granular insecticides, however, are proven to yield this type of gradient in water (Mulla & Axelrod 1959). Specific problems and situations would merit special approaches.

It is possible to make a great array of granular formulations of a single toxicant. The efficiency and performance of granular formulations is determined by the type and size of granules used as the base and the solvent used for impregnation. Also, concentration of the toxicant, concentration of the solvent and, above all, the toxicant itself will influence the rate and magnitude of release of the toxicant from the granules. Some of these factors influencing the efficiency and performance of impregnated type of granules in mosquito control are discussed here. It is expected that the information presented here would be applicable to aquatic and terrestrial midges and gnats as well.

Solvents for Impregnation

Petroleum solvents are mostly employed in impregnating toxicants onto the granules. These solvents are economical and safer to use in contrast to chemically pure solvents. The list of petroleum solvents available to pesticide industry is inexhaustive and the selection of an appropriate solvent for a granular insecticide is based on an understanding of the physico-chemical properties of the solvent.

Approximately 50 representative petroleum solvents were evaluated for their role in regulating the rate and magnitude of release of parathion from attapulgite granules. Solvents with high flash points, high initial and maximum boiling points and wide range of distillations resulted in formulations releasing the toxicant very slowly. Solvents having intermediate values for these physical properties produced formulations that yielded faster release of the toxicant as compared to the low volatile solvents. Highly volatile solvents with low flash points, low initial and maximum boiling points and narrow ranges of distillation gave formulations that released the toxicant much faster.

A few representative solvents tested in each category of the three types of solvents are:

Highly Volatile Fl. P. 30-80° F.	*Less Volatile Fl. P. 80-150° F.*	*Low Volatile Fl. P. 150-220° F.*
AR-35	Espesol 1	AR-50
Cyclo-Sol 27	Espesol 5	AR-55
RX-4	Cyclo-Sol 35	AR-60
Socal 51L	Cyclo-Sol 53W	Cyclo-Sol 68W
Chevron Light solvent	140-H Solvent	AN-5K
	Socal 306L	AN-1
Solvent A-80	Socal 3	AN-3
Socal 230L		

The solvents in the above groups are classified roughly. The effect of one solvent in any one group may be greater or smaller on the release of the toxicant than that of another solvent in the same group. Some of the solvents in the volatile group have very low flash points, thus constituting greater fire hazards. Solvents of this type require special care in handling and storing.

Solvent Concentration

Investigations on the effect of solvent concentration in the formulation on the rate and magnitude of release of parathion from attapulgite granules have indicated a direct relationship between concentration of a solvent and the rate and magnitude of release of parathion. Only two solvents, one a volatile and the other a low volatile solvent were evaluated. Both these solvents showed a direct concentration-release relationship. To

understand the underlying principles, further studies on this subject using other solvents would be desirable.

In the final analysis the concentration of a solvent used for impregnation is limited by the type of carrier. Attapulgite and vermiculite granules for example are capable of absorbing 30% to 40% or higher concentrations of solvents whereas the limit for most of the bentonite type granular materials is 10% dry weight basis. The cost factor also enters into the picture and this discourages the use of higher concentrations of solvents. For economic and practical reasons formulations prepared with 5% to 10% of a solvent are suitable for most mosquito control operations. The higher concentration levels of suitable solvents on appropriate granular materials can be advantageously employed under specific type of conditions, where greater efficiency outweighs the cost factors.

Carriers

Granular materials as carriers play an important role in determining the rate and extent of release of toxicants into water. Also, the pattern of distribution and release of the toxicant in a column of water is determined in part by the type of carrier. The attapulgite and bentonite type granules have been shown to yield relatively uniform release of parathion throughout a water column. Soluble granules such as ammonium nitrate, urea and others, on the other hand, yielded relatively stratified distribution of parathion and malathion in a water column having a depth of 8.25 inches (Mulla & Axelrod 1959). Selection of an appropriate type of granular material can be made after a thorough consideration of the ecological behavior of the aquatic insect pest against which the control measures are directed.

The efficiency and role of granular materials in granular insecticides have not been fully elucidated. Limited data on this subject point out that toxicants and solvents used for impregnation further complicate the picture.

Granule Size

Larger sized granules have fewer particles per unit weight of material than smaller sized granules. Therefore, for any given weight of material, fewer particles will be supplied per unit area if coarser particle granules are used. The particle counts per pound of several standard size A-LVM attapulgite granules are indicated below:

Mesh	*No. Particles/Pound**
30/60	13,600,000
24/48	8,672,000
15/30	1,300,000
8/15	166,000

*Taken from Attaclay Digest, Minerals and Chemicals Corporation of America, N. J.

An inverse relationship between particle size and rate and extent of release has been observed. Finer particle materials such as the 30/60 mesh resulted in faster release of parathion from the granules. On the other hand, release of parathion from coarser mesh granules such as 20/40 and 15/30 was relatively slow. The finer particle materials (30/60 mesh) however, have a considerable amount of fines and are undesirable to use in situations where toxicity to applicators, beneficial life, drift and toxic residues on food and forage crops are some of the problems to contend with. This leaves the coarser type materials in the range of 15/30 or 20/40 mesh granules to be more desirable for controlling mosquitoes and certain other aquatic pestiferous insects.

Toxicant Concentration

Toxicant concentration in a granular formulation is important not only from the standpoint of performance, but also for economic reasons. The cost per unit toxicant is invariably lower where concentrate formulations are used. By lowering the concentration of a toxicant in granular formulations, the cost per unit of toxicant is increased. However, increasing the toxicant concentration in a formulation results in slow and poor proportionate release of the toxicant into water. Five percent and 10% parathion granules were shown to release the toxicant much slower than the 1% and 2% formulations. On 30/60 mesh attapulgite granules, the extent and rate of proportionate release of 0.5% and 1% parathion were similar. However, the 0.5% formulation proved to be more efficient using 20/40 mesh or 15/30 mesh granules than the 1% formulation prepared with these granules.

For mosquito control, 1% and 2% parathion formulations are more practical. Formulations with concentrations lower than 1% are more expensive and formulations with higher concentrations than the 2% level are apt to result in poor distribution of the particles and incomplete coverage of the treated area and finally poor release of the toxicant. For malathion the most economical and practical concentration would be about 5%.

The problem of formulation concentration is considered to be more critical for materials that have little or no solubility in water. Chlorinated hydrocarbon insecticides and certain organophosphorus insecticides would fall into this category.

Ecology and Biology of the Insect Pest

Ecological and biological information concerning an aquatic insect pest or vector would ultimately determine the type of granular formulation to be employed in its control. For controlling bottom feeding mosquito and midge larvae, granular formulations resulting in stratified release and distribution of the toxicant would be more effective than those which release the toxicant throughout the water depth. Soluble granules have been shown to be a partial solution to this end (Mulla & Axelrod 1959). The placement of toxicant through the use of granular insecticides at the desired loci in a body of water is an interesting subject and requires a detailed study. Edaphic factors prevailing in the field would also have to be considered in an overall study of this problem.

Biology of the pest to be controlled will also have a bearing on the selection of a granular formulation. Species with susceptible stages developing in aquatic habitats for longer periods would be successfully controlled with a slow releasing granular formulation. On the other hand, fast releasing formulations would be required for an effective control of species which com-

plete their aquatic stage development in a relatively short time.

Many of our pest mosquitoes such as *Psorophora* spp. and *Aedes* spp. lay their eggs on moist grounds. The eggs hatch after flooding or irrigation. Pre-larviciding treatments are usually recommended for controlling these flood water mosquitoes. The treatments are made prior to either flooding or hatching of the eggs. The grounds infested with the eggs may be treated a few days or even weeks prior to flooding. It is conceivable that granular formulations would fit into this scheme very nicely. Appropriate granular formulations would retain most of the toxicant inside the particle thus lessening the deterioration of the toxicant due to physical components of the environment. Immediately after flooding, release of the toxicant will ensue at rates regulated by the properties of the various ingredients incorporated into the formulation. Since early instar larvae are much more susceptible to insecticides than the later stage larvae, slow releasing formulations would be successfully used under these ecological conditions.

Future Outlook

The next few years would probably witness a greater increase in the utilization of granular insecticides for controlling insects of public health importance in California. This assumption is based on two important developments which would lead to greater utilization of granular materials. In the first place, during the past year investigations at the Citrus Experiment Station and by private industry have led to the development of improved and highly efficient granulated insecticides for mosquito control. Further research work along this line would undoubtedly result in the production of a variety of granular insecticides which would have broader usage and application for the control of a variety of insect vectors.

The second factor that would lead to greater utilization of granular insecticides is the inevitable appearance of resistance in some mosquito species, gnats, and midges to standard materials such as DDT and malathion. This phenomenon is causing a shift from the use of relatively safe materials to more toxic and hazardous insecticides. Materials with higher mammalian toxicity could possibly be rendered less hazardous to applicators and beneficial life. Reduced toxic residues would incur on food and forage crops by employing clean insecticidal granules for vector control in agricultural areas than liquid and dust formulations.

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INSECTICIDE GRANULES COMPARED WITH EMULSION CONCENTRATE SPRAYS AS MOSQUITO LARVICIDES

LALLAN RAI[1] and LAWRENCE L. LEWALLEN[2]

ABSTRACT

There were no apparent differences in the effectiveness of sprays and granules at similar dosages except in the case of parathion where granules may have been slightly more effective.

Although the performances of the two types of applications were similar the granular materials were easier to handle and could be applied more rapidly. Highly toxic materials can be handled more safely as granules than as sprays. Granules may also be useful for pre-irrigation treatments.

The materials listed below were tested for control of fourth instar larvae of *Aedes nigromaculis* (Ludlow) in irrigated pastures containing dense vegetation. Plots 1/32 acre in area were used.

Insecticide	*Granular Formulation*	*Spray Formulation*
Di-syston	2.5% on attapulgite-LVM-A, 20/40 mesh	25% emulsion concentrate
Malathion	10.0% attaclay-AAlum, 24/48 mesh	57% " "
Parathion	5.0% on attaclay-AAlum, 24/48 mesh	25% " "
Thimet	5.0% on attaclay-AAlum, 24/48 mesh	47.5% " "
Trithion	5.0% on attapulgite-RVM-A, 30/60 mesh	37% " "

Mr. Augustson: As most of you may know I probably used more pellets than a lot of you have, and I am really sold on them; but there is still a lot of kinks to be worked out. There is the economy of them. We have found out after last year that even though we get better results with pellets the cost is a little bit out of line.

We started using pellets several years ago, and last year started a few operators using hand seeders. They are just ordinary alfalfa hand seeders, and the one we use is known as the cyclone seeder. It is a canvas bag, I will show you a picture of it later, which he carries in front and packs a crank that distributes the pellets in

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front of him. These worked out very well, of course, like most of you know. The senior operators are very skeptical about using anything new. At first they were kind of reluctant to use them, but after we started using them we couldn't get them back from them. They were very much sold on them, and for very many reasons. For one thing, these seeders are light, they are much easier to carry than a back pump. You can get through a fence easier with them, and you can cover more ground in less time with them. And as it has been pointed out already, the pellets usually leave a residue that gives a very good kill, and the operators found out that they didn't have to go back and make repeat sprayings.

We surveyed our use of malathion pellets; and we came up with some very interesting figures. For instance, it took a man in one place five gallons of liquid to do a half acre, we usually put down ten gallons of liquid per acre. In order to do this half acre it would take him one quarter to a half hour. By using pellets he can distribute about ten to twelve pounds of pellets, and cover in the same amount of time a full acre and a half. In other words, he just about more than doubled his output.

We found that as you started using more of these hand seeders the operators were able to cover ground more rapidly; and where you are limited to operating personnel, one operator in a zone, he could cover his zone more adequately in the later months of the season than he could with a back pump. Now in comparison, most interesting is your pellets last longer due to the fact that the pellets leave a residue. You could put them down for one application and would obtain a kill in the next hatch, particularly for *Aedes nigromaculis,* and in some instances we found that we got a kill in the second group and also into the third. We also reduced our emergency work crews with the use of pellets in a lot of areas, particularly around populated areas of Chowchilla and Madera. When the operators came in at night, if he hadn't finished his particular work, we would have to send out emergency crews to clean up for the next two or three hours. Then we have found by using these pellets the operator no longer had this problem, and was able to do the job in his daily routine work period. We have also compared one ranch where there was a twenty acre crop, almost in the city of Madera, that during 1958 by use of hand pumps and a liquid spray, with hand pump one operator took 120 man hours to hand treat this one twenty acre permanent pasture. In 1959, by using this pellet, broadcast by a little seeder, it took him only 49 hours, so you see we have a terrific reduction of man hours. The unfortunate thing about it is that when we got into the cost accounting of this, we found out the reduction of man hours didn't compensate for the extra costs in the pellets, although it was very close. In the use of pellets the best thing to have, we found out, is a 50-pound carton instead of the conventional paper sack. This carton is easy to handle, easy to put into a jeep, and it is easy to load out of. We found that by using a measuring can, an ordinary one pound coffee can, holds exactly 2½ pounds of pellets, or a two pound coffee can, exactly five pounds. We were able to get a very accurate count on the amount a man would use daily.

We have, of course, very many other problems in the use of these hand seeders that weren't produced for this type of work; they were produced for just occasional seeding, lawn seeding, alfalfa seeding, and small plots. We ran into the usual trouble, the pot-metal gears wear out very rapidly, they weren't protected in the gear box, and we ran into an awful lot of field problems which we hope to straighten out this winter. In my opinion, I think that the pellets have a place, but it is going to take a long time before the cost is going to meet the actual work that is required to put them out. Can I have a couple of those pictures now?

(Showed pictures)

Mr. Augustson: We have a lot to learn about the actual field application of pellets. There are things that we have to answer; but I think as you listen to some of these other speakers, that you will realize that the pellets are very interesting. We are particularly interested in the holdover effect. Where we put down liquid it lasts for just that one spraying. Maybe it will be there for a day or two and then it would be gone. We were amazed that, a lot of times, how long the toxic effect of the residue of these pellets would remain in the water. And when you have a permanent pasture water is standing all day or all the rest of the week and into the next week. This is a very important factor, particularly if you have *Culex tarsalis.* One interesting fact we found is that on broadcasting these pellets even in water as high as 18 inches deep, we get a very effective kill, whereas sometimes the liquid application is very spotty. I was hoping we would have a quesion period, but I guess I had better wait until the end for that. Thank you.

(Mr. Geib's presentation was not submitted for publication.)

Dr. G. F. MacLeod: Mr. Chairman, I am always amused at panels—panels are just a succession of speakers. I think it is to lure you into coming and seeing how much one end can endure while the other end tries to absorb.

You are all aware of the demand for granular insecticides. I think the future is even brighter than pictured by the research workers, and those men who have had some experience with granular materials, particularly for mosquito control where water is the common denominator. Let me give you the problems that we see from the industry point of view, which I am supposed to present to you.

Our problem is only one, and it has been mentioned about three or four times. It is my firm conviction that no single granular material can be made which will do all jobs equally well. I don't believe that is at all possible. Therefore, it becomes necessary for you, who are the practical user, to tell us what sort of specifications you want built into a granule. This has been our problem for a matter of some nine or ten years during which we have been working with granules. A great many times we are confused as to what a man wants. We find on questioning him that he, too, is equally confused; so we make up a confused granule, and as Art Geib so aptly put it, the results are erratic.

First of all, mesh size—what is the size of a granule? Of course, we could ask what is a granule, because we now have concepts in regard to that which I will men-

tion to you briefly. After much running around with sizes all the way from 5 mesh up to 100 mesh, we find that acceptance is greatest somewhere in the range of 10 mesh to 24 mesh. But we would like to know about this because that determines what kind of equipment you must have with which to start, a particular granule. Each formulation, of course, has to be a custom job for a while until we get more information, because, frankly, nobody knows yet how to make all of the granules that are needed.

Now the next thing is, what should the core, or base, be? What shall you start with? Well, you can start with a variety of things. You heard the word attapulgite, which is typical of a lot of clays. A clay is a highly absorbing and adsorbing kind of material. The problem with clays is that they absorb and adsorb a certain amount of toxicant with which they are impregnated, and you will never get it back. It may be decomposed right within that particular piece of clay. Clays are platelike, they have a tendency to stick. They are used as stickers in dusts. Therefore one must be careful of the residue problem when they are used in certain places. The release of toxicant is not only lesser, that is, you may put on 2%, but get off only 1/10 of 1% perhaps; in the case of many toxicants. Of course, the solubility of the toxicant also has a bearing.

We began not so long ago with the thought that a core should be a non-absorbent thing on which one could put a material of some kind by wrapping it around it in some way or other, but not having it adsorbed, so that it might be released fast and completely. Hence, our interest in going to a silica type of granule. We have used not only diatomaceous earths and sand; we have even used lighter materials. There is a relationship of the weight of the toxicant to the weight of the core that determines how concentrated a product can be made. Will you tell us first the mesh? Then will you give us the story of the particular job to be done so we may select the proper core?

As for the toxicant itself, there is a primary question, of course, of compatability. Many clays, we have found, will inactivate many of our common-day toxicants. This is true of practically everything that you use in mosquito control. The concentration of a toxicant, when it comes from the basic producer and when diluted sufficiently so that it may be sprayed or impregnated, is another variable.

Then there is the problem of what machinery to use. The usual tumbling mill produces a grinding effect. You start out with one size particle and you wind up with a few of that size and much dust. That is definitely objectionable because part of the safety factor of granular insecticides has been lost by so doing. So tumbling can't be used in the usual sense. A ribbon blender, commonly used for making dusts, often grinds up granules.

Then, in addition, you come to the packaging. Gus mentioned why the packaging is important. Again because of dusting or attrition, rubbing, handling, dust is produced. Put in a bag or something of that kind, loaded on a truck, unloaded, stacked, reloaded,—by that time half the particles have become dust again.

There is no point in spraying silica cores with an impregnating fluid of any kind, because the coating will come right off again. So, to coat any core, we impregnate a toxicant into a powder with which it is compatable. Then by coating the granule with the proper materials, a dust-free, clean particle of uniform size is produced.

If the material used is a glue of the right kind you can time the release. I say this with tongue in cheek, because the timing of the release is limited to a narrow range.

As for the cost; you can see from what I say, that the handling of these things is much greater than you would think. What have we actually done in the way of making granules, and giving them mostly—or selling them experimentally, has been limited to the mosquito abatement people and others in similar sorts of situations. We have, for example, made 5% triple D. We have made many of the parathion granules, as you have heard, one and two percent primarily. These are easily made, and can be made to release toxicant within any reasonable time and any reasonable size that you want. Malathion usually is made at 4% or 5% strength. DDT we can actually go up to a 50% granule by weight. My plea to you is—tell us what you would like to have us make, and we might be able to come up with it.

Let me give you some order of magnitude in prices, because I imagine many of you have never tried these things. Those are order of magnitude prices; please do not use them as firm commitments to sell to you at this price. They will give you something on which to base general calculations. 2% Parathion sells for $13.50 per hundredweight. These are all coated granules. A 5% Malathion sells at $17.00 per hundredweight. Dieldrin 2½% at $14.60. The 5% Dieldrin at $19.80. And the triple D, or DDD, 5% at $12.85.

I believe there will be an increasing use of these very interesting compounds. I think that for the mosquito abatement districts, the problem is primarily one of what job you want these granules to do—getting your own specifications. I think the day is here when you can just about have what you want. It has been nice to be with you.

Ted Raley: You have heard some of the parts of this very interesting phase of mosquito control. We don't pretend to know all parts of it. But I am sure this panel can answer any question that you might have within that range that they have had experience with. Do you have any questions?

Mr. Kramer: I have two questions. The first is, if the material is released over a long period of time, that is the toxicants, say 7 to 10 days, is the concentration of the total amount applied, which you apply at so much per acre, if so do you get a kill within the first couple of days with reduced dosages? And the second question is, would it be possible to layer these granules so that the outer layer would be dissolved more quickly and the inner layer more slowly?

Mr. Raley: May I ask Dr. MacLeod to answer your second question and I think he will touch on the first one too. Doctor, particularly the second one on whether it can be coated for delayed release.

Dr. MacLeod: Yes, we can coat granules so that the outer layer would release rather rapidly and that there would be an inner resistance layer. Now what you are asking would be double the price I gave. It can be done. But the cost is in handling, as you all know; you heard it this afternoon in your personnel problems, labor is the cost. Labor costs more than anything else. If you have to handle them twice, and that is what you

have to do there, you would have to make the granule which would be slow or resistant to dissolution in water and dry, and then you would have to recycle it, put another coating on which would be fast in its take-up of water and release. Such a double handling would increase the cost, and your toxicant would probably be increased a little bit there too. It could be done. I doubt very seriously if it is within the limits of practical efficiency.

Mr. Raley: Did that cover both parts good enough for you? On the first question whether the heavy application would release uniformly over a given period of time. Was that about what you had in mind? Art, have you had any indication of whether this 3% will release on a uniform pattern or is there a slug dose and then a gradual diminishing?

Mr. Geib: I believe most of the information is available on that is the work that Dr. Mulla has done in the laboratory. I am sure that information is going to be published in a short time, and that is probably the best place to get it. However, one of the things that does happen depends, to a great degree, on a lot of factors, one of them being the type of toxicant that you are using. For example, if you use malathion your hydrolysis will take place very rapidly, particularly under high temperatures. Whereas, if you use parathion hydrolysis will be more stable, you will have perhaps a better residual action. There again it depends upon so many other factors. I think most of these answers will have to come from Dr. Mulla's work.

Question: Would it be possible to formulate one granular for early release and another for a much later release, and mix two granulars? In other words—five pounds for early release and five pounds with later release to make ten pounds of mixed granules for the dual purpose?

Answer: It would be very, very nice to do that and to charge you for that mixing, but you would be a lot smarter if you bought the two types of granules, a clay granule and a coated granule and mixed them ad lib, depending upon what you wanted to do with them. Same as any other tool. They could be very easily mixed with no reason in the world why simple mixing wouldn't handle the mixing of a clay-impregnated granule and a sand granule in any proportions you want. The clay for the long, slow release; the sand coated granule for the quick release, and add just your own recipe for kill. I think that would be the smarter thing to do. That would perhaps be cheaper than combining two on one.

Mr. Buzicky: We have used granules in our District very extensively during this past year. We have some experiences similar to what Auguston related with hand seeders. I think the quality of the hand-seeders are poorer than what we had a year ago. Before this new type of metal, we had little gear trouble. Our experience has been that seeders, are so cheap that it doesn't pay to spend much time to repair these little machines. We have a problem in that after mid-season we have very dense and verdant vegetation and our men sink in the muck so that they can't use hand-seeders or project these granules up above the emergent vegetation. I was wondering if any of you folks had any experience with other types of granule applicators, either hand or feed applicators, that might solve that problem. We did a little work with Hudson Equipment Company in modifying their back-pack machine, modifying their hopper so that their granular discharge is on the outlet of the air blast. They did that and provided us with an experimental machine that worked fairly well, but is there a pressure model that any of you know that will give better results than these hand-seeders?

Mr. Kirkham: Turlock District used the K-D Whirlwind quite successfully for the last few years. Mechanical trouble has not been great and acre coverage has been increased three times over the hand cyclone. The trouble with that is the rice crop, but they try to stay on the levee banks and not get out into the water and they have very good results that way.

Eastside MAD: I think I can answer part of that equipment problem. We went directly to the Cyclone people who make a seeder that they call a heavy duty machine. It is made with bronze gears and is heavier throughout—it is the same thing only heavier. It wasn't too much more expensive; I don't know precisely, off-hand, but it worked out very well for us. The gears are not enclosed in a box, but we have had no trouble with the bronze gears. Eventually, there may be wear, but one of our boys hand-faced them with a torch and it has worked out very well.

Mr. Buzicky: How do you keep the granules out of the boots of the men?

Mr. Raley: In our district the step that we have made to date is the use of an apron. Whether that is going to be the best, or whether some type of a sleeve that attaches to the pant-leg and fits down over the boot is best, we don't know; but have found the rubberized apron works very well to not only protect his pockets, waistline and many places where the granules can collect, but also prevent them from falling into the boot. It has its objections, however. We think that there is going to be some better way to manage that boot problem.

Eastside MAD: I might say that we built a small guard around the machine to keep the material going forward rather than on the men.

Mr. Raley: We have tried the guard, but found it decreased the swath width. Are there other questions?

Mr. Augustson: Art spoke mainly on pre-treatment. You know the secret of using these granulars or pellets is to reduce your number of treatments. Art, did you use your five pounds per acre as a contact method or just pre-treatment?

Mr. Geib: We used it both ways, as contact and pre-treatment. I probably didn't call attention enough to the fact that we attempted to use this Anderson broadcaster to compare your actual cost by ground with airplanes. We found that the application by airplane was a great deal simpler and approximately half the cost of what it would be for applying by ground equipment. You cover so much more territory and perhaps get a better, more uniform application. The broadcaster gave us about fifty foot swath width with 14-28 mesh, whereas the airplane gave 60, and we could have gotten by with 66 feet, using the same mesh, 14 to 28. We had equally good results as pre-treatment applications and as direct larvicide use at five pounds per acre.

Mr. Raley: If there are no other questions then. In summarizing I think we can safely say that this is a very interesting method that does have very provocative end results. We have felt that the initial cost is going to be the biggest hurdle in the extent to which

we can use these materials. Of course, as you have areas that can not be controlled with your liquid sprays because of the physical cover, cost is perhaps no factor. So at least we have—we feel now, something that will fit for that particular job. How far granules can be expanded in use for districts only time will tell. The labor saving is, I think, one of the most important sides that we must begin to evaluate. It is quite common, at least here in California, of those I have talked with, and it has been brought out here today, that with the granule of the sand-coated type that was mentioned, an operator can cover about three times more area in an hour that he can with the conventional liquid hand sprayer, so that is in itself quite an important consideration. There, of course, is the safety factor in handling some of the insecticides that we are using at this present time.

I bring you to a conclusion, and also to remind you that with these granules, we will not have a cranberry incident. I would like to thank all members of the panel, and particularly Mr. Marsten. Mr. Marsten did not know that he was to read Dr. Mulla's paper until 2:00 o'clock this afternon. I think he did an excellent job. Dr. Mulla's paper has some very fine information in it, and I know all of you will want to read it as the Proceedings are available. I thank you again, and it has been a pleasure for the group.

(A Hospitality Hour and Banquet were held at the Marysville Hotel on Monday evening, and after the banquet Dr. Audy gave an interesting and informative presentation on Research and Progress in Science as follows:)

RESEARCH AND PROGRESS IN SCIENCE

J. Ralph Audy

Director, The Hooper Foundation, University of California School of Medicine, San Francisco

A few days ago I was warned about this talk—by whom I shan't tell you, but his name begins with P and he is sitting at the corner of the table over there. He told me that this would be a very mixed audience, and hinted that I shouldn't go on bumbling about research like an egghead. But I must admit that this subject (which was given to me) is hard to treat with great levity after a dinner and the fluid hospitality which has marked this evening.

A speaker on research in general is obliged to say something about the *nature* of research, about its *use*, and about its *abuse*. Although the title suggested for this talk implies that I should concentrate on the *use* of research in the progress of science, I shall dismiss this with only a few words. Almost every time you use or enjoy something, from an egg-beater to good music on the radio, from aspirin to penicillin, from a wristwatch to a bicycle, from a paint-pot to a tin of beans, you are enjoying the results of research of some sort. In fact, without research there would be no science, because that very word means the progress of understanding by making hypotheses and testing them by experiment: in other words, carrying out research. Without constant research we get nowhere. So I shall say no more—though I shall have much more to say about the abuse of research.

As for the *nature* of research, I think it would help clear thinking a lot if we distinguished between *research* and *investigation*. If I were to measure this table with a ruler, nobody would be so foolish as to think that I had done some research. It is just the simplest form of investigation. Yet now imagine I go into a village with an assistant, and spend six months and many dollars investigating the people there: taking blood and finding out how many people have what kinds of anemia and blood parasites, taking stools and detecting parasites and their eggs, measuring weights and heights and ages, and sizes of spleens, testing urines and making physical examinations—even X-rays. At the end of this I have made a kind of medical survey, and I may publish a long and useful paper about it. Is *this* an example of research? As it stands, I would say *no*, this is an investigation. A measurement is a measurement, no matter how elegant or complicated it is, and no matter how much effort and technical skill and marvelous instrumentation may have gone into it. Measuring the heights or hemoglobin levels of a hundred school-children, or finding out what percentage harbours intestinal parasites, is no different in principle from measuring this table with a ruler. Furthermore the value of a measurement is in no way related to its complexity nor the skill nor money it costs to make—the depth of the watertable in the soil is as simple a thing as the length of this table; nevertheless, in many practical instances it is much more important than the elaborate mechanical analysis of the soil which would be done as a routine in a laboratory.

To take another example, we may collect mosquitoes, identify them, inoculate samples, recover and in due course identify a virus. Is *this* research? No, *by itself* it is an investigation, a measurement which has required elaborate techniques, much experience, and meticulous care.

It is a plain fact that a great deal of research consists in practice of exactly the sort of thing I have been describing: making glorified measurements or elaborate observations. Where then does the research come in, apart from the investigation? To answer this, and to illustrate some practical points, I should like to take an example from the thousands of known varieties of rice. A great deal of work has gone into hybridizing strains of rice and characterizing different varities, each growing best or giving the best yield in some particular conditions—for example, there are the varieties of "wet-rice" grown in flooded fields, and varieties of "dry-rice" or "hill-rice" grown on hillsides. Let us take a particular variety and see how it is used in the field. Instead of being grown in the standard conditions of the agricultural experimental station, you will find it grown in a variety of soils and water-conditions, with some differences each year, and the grain after harvesting will be treated in a variety of different ways both in pretreatment and storage, and finally in the cooking. The field experiments used to characterize the variety cannot take account of all these variables.

A long series of experiments were done by the departments of Biochemistry and Nutrition of the Institute for Medical Research in Kuala Lumpur, Malaya,

after the war, on this subject. It was a tedious investigation, costing much time and effort and resulting in many measurements. An analysis of these showed that the variety of rice used had much less effect on the final nutritive value than the soil, growing conditions, storage, and cooking had in actual working conditions. This at once puts the whole matter of the use of selected varieties, and of further experimental hybridization, in a new perspective.

What was gained from these experiments? At the end, we could say only that *this* sort of rice did better than *that* sort of rice in *this* sort of condition, and so on. It was an investigation. Where did the research enter into the experiments? Research entered in several ways. First, we must mention the *background* of previous research (and investigation, which goes with it): the recognition of differences in genetic strains, the very idea of hybridization, the significance of "nutritive value," the development of many techniques such as biological assay of vitamins and detecting the location of thiamine by ultraviolet fluorescence of sections of rice grains, and many others. Every advance in science rests on previous research, every view of new vistas is gained by standing on the shoulders of those who have worked before us—and never let us forget that.

Next, research (as apart from investigation) entered into these experiments in *seeing the problem* clearly. That requires thought and it requires theory or hypothesis. One way of seeing this particular problem would be as follows: We know that genetic strain, soil, water, temperature, sunlight, method of getting the grain from the paddy*, all affect the yield of rice per acre, while all these and in addition the methods of pretreatment, storage, and cooking, affect the nutritive value of the grain per pound. What is of greatest final value to us, yield or nutritive value? Is it possible to work out a compromise-index between the two, of practical value? And having reached this decision, of a measure of final value per acre as an article of diet, we want to know (a) which of the above factors produces the most marked changes in value of the product, (b) which of the above factors are most easily and cheaply controlled by man in field conditions, and finally (c) in field conditions, which of these factors are worth investigating more thoroughly as the most promising means of improving nutrition among those who eat the rice? Seeing the problem and breaking it up into its component parts, and stating it clearly, are all part of the research process. Sometimes this can be extremely difficult.

Next, *seeing the implications* is part of the research work. I have given one example already: that of wondering if genetic variety of rice often outweighs variety of conditions which a given strain encounters in practice. An example of another kind concerns the way in which I have blithely used the term "nutritive value." What does that mean? Does it refer to calories, to provision of carbohydrates and proteins and fats, to vitamins, or to minerals; and if to all these, with what degree of importance for the various items? Obviously we cannot answer this, firstly without considering what the people eat in addition to rice, and secondly without a lot of research—in this case, the research has already been done, but you can see that the study of the implications of a problem may set one off on years of research, not on the main problem but on a subsidiary one. Sometimes, we may as a result of such work have to go back and restate the original problem in new terms, in the light of new information.

Designing the experiments is a part of research rather than investigation. The design of an experiment may be extremely difficult, and call upon a penetrating insight into all aspects of the subject, and often the collaboration of a mathematician or statistician, to make sure that we have a tab on all the variables involved, and that we get data which can honestly be analyzed to produce usable results.

In addition to designing the experiment, *designing a technique* may be part of the research. Once a technique has been worked out, it becomes a tool, and its use may or may not have anything to do with research. But its original conception and its elaboration and interpretation may involve much research. To conceive a calculating machine is research, but to use one is routine. The same applies to a typewriter, a still, or a Kipps' apparatus.

We may now summarize all this by defining our terms, thus: *Investigation* is the application of techniques to get raw data, in the shape of measurements or observations (e.g., measuring the number of people suffering from a recognized clinical illness who also develop neutralizing antibodies in their blood to a certain virus; on using a cine camera to record the behavior of an octopus presented with food with and without electric shocks).

Research is investigation with a well-informed and completely thought-through purpose, in which a hypothesis, or hypotheses, are clearly stated or obviously implied, and in which the investigators are designed so as to give meaningful answers.

There is no doubt that some scientific workers believe that what they call "philosophy" is reprehensible in science: the only thing that matters is facts, so that anyone spending a lot of time theorizing is wasting his time and someone's money. This is of course not true. It is very easy to waste time and enormous sums of money by gathering undigested and undigestible facts. The danger is that their weight and complexity may give the impression that they are valuable; but we have already noted that the value of measurements (and that is what these facts turn out to be) is unrelated to their complexity, novelty, inaccessibility, or cost in time or cash. Facts are useful if they are collected with purpose and digested with wisdom, and that is simply where the research comes in.

This brings us directly to the subject of the *abuse* of research. Let me say outright that true research is always valuable—we may agree that this particular piece of research is much less worth the time and effort than an alternative piece, but nevertheless all research produces something of lasting value. Therefore, when I talk of the abuse of research I mean two things: first, the failure to make use of good and completed research, in which case the fault lies more with all of us at large than with the researcher; or second, work which goes under the guise of research but is nothing of the sort, in which case the fault lies with

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* *Padi* or paddy is the name for rice harvested, and not for a field. It is correct but unnecessary to speak of paddy-fields, and better to speak of ricefields, but incorrect to speak of rice-paddies, a very common error.

the researcher. I wish to say a few words only about the latter. To advance we must have research, and to do research we must have money, and to get money we must first justify ourselves to the benefactor and then satisfy our consciences that we have spent the money honestly. If we waste money provided for research then we are not only being dishonest but we are killing the goose that lays the golden egg. Why should the researcher deserve support if he abuses it?

One way in which research can be abused is that there may in fact have been no research problem. This results in an investigation and the production perhaps of masses of data, but with no new conclusion, no new ideas. The problem has not been thought-through and no clear-cut hypotheses have been framed. Also, I regret to say, there may have been no research worker! Let us be honest about this: many can investigate, some can investigate skilfully, some can do research, and a few can do good research consistently. The research worker is not necessarily outstanding, though he must be unusually good in his own field; for he may be eccentric, or utterly impractical, or a hopeless administrator. Therefore, I am emphatically not saying that the research scientist is a superior sort of being, but simply stating that various people have various special capabilities, and being able to do research is only one of these capabilities. If a man cannot do it, that is not a stigma, but for heaven's sake let us not deceive ourselves into assuming that a scientist is automatically a research worker. It is unfair to the man and to his employers to make him responsible for research when he is not by nature a researcher.

There is one human failing which may obscure a problem, namely, the closure of the mind by preconceived notions, fixed ideas. Fifty years ago, the devastation of epidemic typhus (transmitted by human lice) had a strong emotional hold on the thoughts of doctors. As a result, doctors in the tropics were extremely perplexed when they encountered obvious clinical cases of typhus with no sign whatever of epidemic spread. They thought that since typhus is transmitted by lice it simply must be epidemic—what they didn't know (though some were beginning to suspect) was that they were seeing cases of a related form of typhus transmitted sporadically by rat-fleas. In 1913, Dr. McKechnie, in North India, wrote a very significant passage in an unpublished report: "After seeing her (one of these patients), I simply had to revise my notion, and then I found that the only thing against my thinking of typhus for other cases which had occurred was my obsession as to the epidemiology. If some of the other cases were typhus then it must be my *obsession* that was wrong." He was right: his obsession was wrong. Preconceived ideas, and law laid down by the literature, had blocked his mind (fortunately only temporarily). The researcher must be able to free his mind. However revolting the idea may be, the scientist must accept that anti-gravity might exist just as he now accepts the existence of anti-protons.

Another form of abuse is the pursuit of investigation or research by getting hold of the equivalent of a Sears Roebuck catalog and ordering all the equipment which the sponsor can afford. There is a great deal of skill and experience in knowing when it is worth spending a lot on certain kinds of apparatus, and when it is worth doing without and spending the money on something else. In every case, wastage is unjustifiable. A colleague of mine once told me about a hospital which was built and well-endowed. The authorities planning it decided that it was not possible to have a good hospital without an electron microscope—and this was in the earlier days of electron microscopy, when models were constantly being improved. They provided the room but not the technicians to use it. As a result, the microscope remained unpacked in its room for over a year, until a technician was finally budgeted for. When the technician unpacked the microscope he was shocked. It was a hopelessly out-of-date model. This was of course true: it was at least last year's model, like a lady's hat. The technician was the expert, and as the result of his advice a new electron microscope was ordered. We all know of advances made possible with the electron microscope, but that is when it is used as a tool in research. What I have described is an example of utter irresponsibility, by people who are planning for "some sort of research" without having any idea of what research is. It would do us all good to look at the television transmitter and receiver which were built by John Logie Baird almost forty years ago. I believe this was the first functioning TV outfit, and it is preserved in the Science Museum in London. The bits of string and sealing-wax and other improvisations do not conflict with the ventriloquist's doll-head he used for a model. He improvised partly because he was very poor. Must another waste because he is richer?

I haven't mentioned *communication*—writing up research. This should be considered part of the research. If it is neglected or done badly, then that is a form of abuse—a common form. Unpublished research is work which has been done solely for the benefit of the researcher and must be discounted completely as a contribution to science. Unpublished investigations are a different matter—they should nearly always remain unpublished. Since communication is part of the research, good research can be depreciated by bad writing—yet how many people take the same trouble over their papers as they take on their work?

In summary, the research worker does not start with the idea of "doing some research" on such-and-such a subject in the belief that energetic investigation is bound to produce useful results. He makes himself thoroughly well-informed on all aspects of the subject; thinks through his purpose in complete detail; clearly frames his hypothesis or hypotheses; then tests his assumptions by carefully designed and properly controlled experiments; and finally spends an equivalent amount of thought and care in writing up his results so that they are available to others. However well-endowed he may be with funds, he will avoid all waste of material and effort as much as he avoids slipshod workmanship.

THIRD SESSION

TUESDAY, JANUARY 26, 1960, 9:00 A.M.

ANNUAL BUSINESS MEETING

President Gordon F. Smith: The meeting will please come to order. This is the annual business meeting. We have a limited amount of time; as of now an hour and a half. We will have to keep things going as rapidly as possible—if you have remarks from the floor, I would appreciate it if they were as brief and concise as possible.

Will the Secretary please call the roll?

Secretary Murray: I would like to make one comment as to the eligibility for voting. Anybody can participate and carry on discussion in the meeting, but, according to the by-laws, the corporate members only may vote. To be a corporate member the agency must have made its contractual payment; however, there are several situations which have never been completely analyzed by our Association so we had better talk about them right now. Any agency who made the contractual payments during the past year and a half is eligible to vote at this time. Contractual payments for the current year are due January 1, 1960; however they are not delinquent, according to action by the Board of Directors, until June the thirtieth.

There are several Districts that are new; they have been formed only during the past year, and a couple of them have not made contractual payments. However, we could not say that they are delinquent, again, until June 30. Perhaps a couple of them may be represented here. If contractual payments were not made during the past year and a half, and the Agency is not new, its name will not be read. If there are any questions after this is over, please ask them.

Just give one answer for a District. Your District should have made up its own mind as to who is to speak publicly and take part in the voting. I have not chosen to request in writing, although several districts did send such in, the names of the delegated representatives. I am not going to check on names; but if there is more than one reply, we will stop and check as to who should have given the answer. Just indicate whether or not you are represented in attendance.

(Initial roll-call was taken and the attendance of a quorum was esablished: 27 districts present out of 48.)

Pres. Smith: It says here on the program that I am supposed to have a message. I don't know what a message is sometimes, so I don't have any. I would like to make a couple of remarks before we open the meeting. As to the last year, from the Board of Directors' point of view, I think we have had a rather successful year. We did complete, or at least get well under way, three things that I would like to mention specifically.

One of these which has been causing some disturbance has been the lack of a budgeting procedure. We set up a special study on this in the past year, recommendations were made and accepted by the Board of Directors establishing a definite, and we hope continuing, procedure for the development of a budget to control the Association's funds. We hope that this procedure is satisfactory in general and can be followed through in the Association so that it can be handled in an orderly manner.

Secondly, something which I can't take any particular pride in on my own behalf, since I was not the initiator thereof—but Bob Peters and the people who worked with him may take a bow—and that is the classification study which was presented at yesterday's session by Dave Kleinman. I had the opportunity to go over it prior to the meeting and I recognize that it is not something which will fit every district, or possibly any district, but I think it is an excellent study and took a great deal of time. The State Public Health Department is to be thanked for it. I know it took Dave Kleinman a lot of time to do it. I think that taking the work that is in that classification study and fitting it to your own situation, everybody can benefit.

The other work, which is not as yet complete, is something which I have requested and desired for a long time, and that is the study which is under way by the Research Committee. It has been my feeling for a long time that although this Association has repeatedly stood up and been counted, they have used the word without a definition. Research is a nice big word; it covers a lot of territory. But we have never yet defined in practical terms, as far as description or budget, just what research we wanted—what fields we wanted to cover, what areas to study, and how we wanted it done. There has been a great deal of work expended by the Research Committee this past year in preparing a preliminary study that has been sent out to the Districts. I should like to emphasize that I don't feel, and I don't believe that the Research Committee feels, that their work is done. It has developed questions, which is desirable. You were requested, and I think Don Grant will say this again, to study what has been sent out, to search your own minds and work with the Committee to develop a good, sound and adequate research program.

I would like to thank the past year's Board of Directors, which serve until the end of this meeting, for the work which they have done. I think we have a very good Board, a cooperative Board, who have taken their duty seriously. I hope, and I believe the rest of the Board members do, as everyone does, that we at least leave the Association in no worse condition than it was before, and that we have added something to it during my tenure of office. And that completes my message.

We will now have the Committee reports. First, the Ways and Means Committee, Gardner McFarland, Chairman.

ANNUAL REPORT OF THE WAYS AND MEANS COMMITTEE

Our committee discharged its responsibilities to the best of its abilities and the Chairman at this time

wishes to thank each and every one on the committee for their interest and work.

Several amendments to the By-laws were submitted to the Ways and Means Committee to be prepared in proper form so that they could be voted on at this Conference. Included are the amendments regarding the President-Elect and the enlargement of the Board of Directors by four additional Trustee Members.

The Sub-Committee has been spending a considerable amount of time studying the subject, "The Future of the CMCA" on all its ramifications. This Sub-committee was directed by the Board of Directors to make the study comprehensive and long range. This committee will continue its study and will report separately as a sub-committee at this meeting.

The final draft of the study regarding the classification of the mosquito abatement district personnel was submitted to the Division of Personnel Classification of the State Health Department, who in turn have reported on a previous paper more comprehensively.

The Chairman wishes to thank the committee again and all those of the Association and others of other organizations for their great help.

Respectfully submitted,

Gardner McFarland, Chairman
Joe Willis
Howard Greenfield
John Brawley
Robert Peters
Lauren Messier

Pres. Smith: Discussion? At this time we are not voting on the amendments but on the motion to accept the report and put the by-laws amendments up to vote at this time. Question? (Motion passed.)

We shall then take up the bylaws amendments, first, the amendment providing for a President-elect. Will anyone move the acceptance or rather passage of this amendment? (Moved by Chet Robinson and seconded by Bob Peters.)

Any discussion? (Oral vote carried in providing for the establishment of the Office of President-elect within the Association and on the Board of Directors.) So ordered.

The amendment changing the by-laws to provide a Trustee member of the Board, from each of the five regions of the State, rather than the single Trustee member as we have had in the past. Does anyone wish to move the adoption of this amendment? (Moved by Oscar Lopp, no second yet.)

Mr. McFarland: I would like to ask if there is anyone that is not familiar with this particular amendment? It wasn't controversial, particularly, but there was a difference of opinion.

Mr. Robinson: It was my understanding that this had been referred to the Committee for further investigation and not to be brought to a vote at this time.

Pres. Smith: Is that right? I will ask Mr. Secretary.

Sec. Murray: I don't think so. I believe that it was to be brought, if necessary, to roll-call vote. There were differences of opinion as has been expressed. The provisions were such that it could be brought up for passage or rejection at this time. If it is rejected, there is no reason why it cannot be brought up another time.

Mr. Raley: I will second the motion.

Mr. Robinson: No method has been set for election of these Trustees. This hasn't been provided.

Sec. Murray: This is the exact wording distributed by mail to all corporate members:

"Two by-laws amendments are to be presented at the Annual Meeting of the CMCA at Marysville in January. Each Member should study the proposed changes and be prepared to vote for or against them at the business meeting of the Conference. A vote of two-thirds of the members present and voting at the Annual Meeting will affect the amendments. All provisions of the by-laws relative to these amendments have been and are being met."

Pres. Smith: On your question, Chet—it was provided; I am sorry to differ with you . . . .

Provisions for electing Regional Representatives, Paragraph 3: "Regional Representatives to the Board of Directors will be elected, two from each geographical region . . ." which I think we can only interpret as that each region shall do its own electing of the additional member if this amendment is passed.

Mr. Brawley: Mr. President, this proposal seems to me to be superfluous in the first place, in that each of your Regional Representatives represents the corporate members in the area; therefore, if you appoint a trustee representative from the same area to represent the same people, you have a duplication of representatives. There is no reason at the present time why a trustee could not be the one and only Regional Representative. I think it is superfluous.

Pres. Smith: I take that your point is that it is not necessary that a manager be elected as a regional representative; it could just as well be a trustee, as the by-laws state.

Do we have further discussion? This was supposed to have been discussed when the information was sent out to the districts in the past. Does the person who made the motion wish a roll-call or voice vote? It should be roll-call for two-thirds of the quorum, although we didn't do so on the other amendment, but it was apparently unanimous. We will have a roll-call vote on this amendment then.

(Roll-call vote as recorded:)

Sec. Murray: There were six "yesses," twenty-seven "noes."

Pres. Smith: I believe the amendment is defeated. We have a Sub-committee report?

Mr. Greenfield: First, I would like to state that the members on this committee are Lauren Messier, from the southern area, Joe Willis, from the Northern area, and myself.

REPORT OF THE WAYS AND MEANS SUBCOMMITTEE

HOWARD R. GREENFIELD, *Chairman*

Our objective, as was stated, was to find out "what way now within this Association." We have held one committee meeting to determine our procedure for following in the coming year. It is proposed that each of the regions will schedule a meeting for the coming year with information being sent to them for discussion purposes. This information will be of the nature of, first of all, what may be wrong with the Association, is it providing adequate representation for everyone?

Are there any changes indicated; and if so, what are they? This is the general theme of our committee for the coming year. So I cannot at this time give you anything on what we have determined or found. This coming year, in my opinion, holds a great deal for us if we can develop the information and put it into a proper proposal, maybe then we will have something to work with in the future. That, Gardner, is about the the extent of our subcommittee report. Thank you.

Pres. Smith: Thank you, Howard. We will call on Bob Peters' Subcommittee Report on Personnel Classification.

Mr. Peters: I would like to just hand this report in since it would duplicate that which has already been said to a great extent. I might say that additional copies of this position classification are available through the State Health Department or Secretary of our Association. I herewith submit this report acknowledging the very helpful assistance by other members of this Committee, and in particular, Dave Kleinman who was aided by Tom Mulhern of the Bureau of Vector Control. (CMCA Ways & Means Sub-Committee on Position Classification in printed form was distributed to the membership.)

CMCA WAYS AND MEANS SUB-COMMITTEE ON POSITION CLASSIFICATION

The Ways and Means Sub-Committee on Position Classification is happy to announce the completion of a report on POSITION CLASSIFICATION, which was initiated and planned in 1958 and consequently composed in 1959 after a considerable amount of effort by a limited few, to whom we are indeed extremely grateful. Five Agencies in this State with a wide range of diversified operations cooperated in this study which included individual job descriptions by each employee, in combination with an all-inclusive compilation of available information from the total field of mosquito abatement, the laws, reports and scientific material covering our activities.

It should be pointed out that this report is merely a guide or reference for each Agency to use for its individual purposes in relation to any classification plans. This report is an objective study and does not imply total application by all or any one agency. It is a very welcome resource on this subject, which has been sorely needed in our growing field.

We are particularly indebted to David S. Kleinman, State Bureau of Personnel and Training, who was aptly assisted by Thomas D. Mulhern, State Bureau of Vector Control, along with the other members of the State Health Department and the C.M.C.A., who gave us generously of their time in making this extremely valuable report a reality.

Robert H. Peters,
Ways and Means, Sub-Committee Chairman

Pres. Smith: Thank you, Bob, and thanks a lot for the considerable amount of fine work you did with this committee.

Harold Gray: May I make one remark in regard to that classification study? I was not present yesterday when you presented and discussed this report, and so I did not see, until this morning when I looked at the printed document, what I consider to be a very serious oversight. When it comes to the qualifications of engineers employed by mosquito abatement districts, there is no provision in there that an absolute requirement is that such a person should be a registered professional engineer under the laws of the State of California. I suggest that that matter be put in as a necessary basic requirement. Somehow or other it escaped attention.

Pres. Smith: Don Murray says he will go along with that if we will define entomologists . . . I mean that entomologists should be adequately trained entomologists, or registered in some manner.

Mr. Gray: I assumed that qualifications for entomologists were set up fairly well in there, Don. I read that he had to be a graduate in entomology, or there is an option there that he had to be a biologist or zoologist with particular training in entomology. I think you will find that that is satisfactory.

Pres. Smith: I think Harold has brought out an excellent point on that study which I think everyone should keep in mind and perhaps correct in their copies of the classification study. Thank you, Harold. Now, the Legislative Committee, Les Brumbaugh, Chairman.

1959 LEGISLATIVE COMMITTEE REPORT

JANUARY 25, 1960

Gentlemen:

The C.M.C.A. Legislative Committee, in addition to holding two meetings, met several times during the year at the State Capitol, trying to promote favorable legislation for all C.M.C.A. agencies. This year's committee was fortunate in having excellent assistance and cooperation from many managers and legislators, who gave their time, energy, and knowledge on mosquito abatement legislative matters.

At the first of the year, it was announced that Governor Brown, in submitting the State budget, had practically eliminated all but $11,000.00 of the state aid to mosquito abatement districts. At the request of the C.M.C.A., the Legislative Committee instructed Assemblyman Bill Biddick to introduce an amendment to Governor Brown's state budget, requesting the restoration of state aid to its original amount, $400,000.00. This amendment was passed by both Assembly and Senate committees and by both houses of the State legislature. However, when Governor Brown reviewed the legislature's approved budget, he eliminated approximately $200,000.00 of the operational support to local agencies.

The five C.M.C.A. legislature bills, which were proposed and approved in 1958 by the Board of Directors of the C.M.C.A., were introduced to the California Legislature by Assemblyman Porter, 69th District, Los Angeles County, California. These bills were actually amendments to existing provisions of the Health and Safety Code. The general purpose of this legislative action was to provide technical improvements, clarification, and protection to the mosquito control program. The Assembly bills 870, 871, 872, 873, and 874 passed both houses of the State Legislature, were signed by

Governor Brown and became laws on approximately October 1, 1959.

Again this Committee wishes to express its thanks and appreciation to C.M.C.A. managers and legislators who assisted in saving 50% of State Subvention and promoting favorable legislation for mosquito control agencies.

Sincerely yours,
L. R. Brumbaugh, Chairman
T. M. Sperbeck
E. C. Robinson
W. D. Murray
Wm. Bollerud
Gardner McFarland

Mr. Brumbaugh: I move the acceptance of this report. (Seconded by Don Grant and motion carried.)

Pres. Smith: The Education and Publicity Committee Report. Les, come back up here and give us this report.

EDUCATION AND PUBLICITY COMMITTEE

The Education and Publicity Committee's goals for 1959 were:

(1) To prepare an irrigated pasture bulletin.
(2) To sponsor a seminar on management for mosquito control administrators.

The committee started to gather information for this pasture bulletin, but was informed that the University of California Agricultural Experiment Station was planning to publish a circular of a similar nature. After reviewing the University's proposed circular, it was decided to postpone the C.M.C.A. pasture bulletin. The University of California Agricultural Extension Service Circular No. 476, entitled, "Managing Irrigated Pastures," was published and ready for distribution in July of 1959. This is an excellent circular, and we would like to recommend this University Publication for use in any education or publicity program of a mosquito abatement agency.

The second goal of this committee was to complete arrangements for a seminar on administration for mosquito control administrators. This meeting was held in October, 1959, and was conducted by the University of California Extension Service, Department of Public Health, and the California Mosquito Control Association. It was attended by approximately thirty people and was considered a marked success.

In reviewing the past year's activities, we would like to make the following recommendations:

1. The 1960 Committee consider the preparation of a bulletin entitled "Mosquito Control in Rice Fields," as the number one project for the year 1960.
2. Start making arrangements for another seminar on administration for mosquito control to be held in the year of 1961.

Respectfully submitted,
L. R. Brumbaugh, Chairman
Jack Kimball
Donald Grant
R. F. Frolli

Mr. Brumbaugh: I would like to move that this report be accepted. (Seconded by Roy Holmes and duly carried.)

Pres. Smith: I would like to express my own appreciation for the work that the Committee did on the Asilomar Conference. I personally felt that it was highly worth while, and I believe that everyone else felt the same. Now, Operational Equipment and Procedures, Ted Raley, Chairman.

Mr. Raley: We have had no occasion to meet as a Committee, but in visiting with the many districts throughout the State, the committee found that the districts are progressing excellently in the development of equipment and operational procedures.

Pres. Smith: Thank you, Ted. I don't believe we need a vote on that. The Source Reduction Committee, George Whitten.

REPORT OF SOURCE REDUCTION COMMITTEE ACTION FOR 1959

The C.M.C.A. Source Reduction Committee held four meetings during the year.

The first meeting was held at the Delta M.A.D. office on April 22. The returns from the source reduction questionnaire were discussed. The results were published and mailed to all members of the C.M.C.A. The committee program for the year was planned.

The second meeting was held at the East Side M.A.D., June 10. Material to be presented at this annual conference was discussed and subjects were assigned to committee members. The publication of a source reduction handbook were discussed. The committee decided to compile information which would be of use to source reduction personnel and publish this for distribution.

The committee decided to send out a questionnaire on dairy drain waste disposal. Mosquito breeding in dairy drains is a very acute problem in some districts so the committee felt that the extent of the problem needed to be outlined. A general discussion of the source reduction committee's scope and functions developed.

The third meeting was held on Aug. 12, at the Consolidated M.A.D. office. The source reduction handbook was the main topic of discussion. The committee re-evaluated this project and decided to bring the material out in the form of papers to be submitted by the members and published by the committee.

In this way the individual members would receive credit for their work and ideas and at the same time the committee would not be forced to approve the material presented with which some members might not be entirely in agreement.

A progress report on the dairy drain questionnaire was presented by David Reed.

The last meeting of the committee was held at the San Joaquin M.A.D. on Oct. 14. Material for presentation at this meeting was clarified and last minute changes made on titles. Papers for publication were turned in and discussed. A preliminary report on the dairy drain questionnaire returns was presented.

The committee has papers by Stephen M. Silveira, Ray McCart, Thomas Mulhern, George Whitten and the dairy drain questionnaire by David Reed to publish and distribute to the membership. This, I hope, will be done within the next month.

The committee recommends that the 1960 com-

mittee continues this policy of publishing papers on source reduction for distribution to the general membership.

Respectfully submitted,
George R. Whitten, Chairman
Source Reduction Committee

(Acceptance of the report moved by Dick Sperbeck and seconded by Bob Peters. The motion was duly carried.)

Pres. Smith: The Subcommittee Report on Dairy Wastes, Dave Reed.

Mr. Reed: I wasn't prepared to give a report at the Conference, I thought the Dairy Wastes were to be included in the Source Reduction Committee Report. But anyhow, a questionnaire was sent out to all of the MADs concerning their part as far as dairy waste disposal. The results of that survey has already been sent back to all agencies, which concludes the report as far as I am concerned. Do you wish to add anything, George?

Pres. Smith: Thank you, Dave. The Forms, Records and Statistics Committee. Unfortunately Jack Kimball is unable to be with us today, but he has already sent out a rather voluminous report to all of the Districts. We shall include it in the minutes rather than reading it today.

1959 COMMITTEE REPORT

FORMS, RECORDS AND STATISTICS

Gentlemen:

During the year 1959 the Forms, Records and Statistics Committee has completed the following four projects:

(1) *"Mosquitoes About The Home"*—The first printing of 25,000 leaflets was completed and distributed on June 5, 1959, to the fourteen Agencies requesting them. The leaflets were sold at $35.00 per thousand plus special imprinting and shipping costs.

(2) *"Mosquitoes About The Home"*—The second printing of 25,000 leaflets was completed in August and 12,000 copies were shipped on August 24, 1959, to nine Agencies at the same cost as the first printing.

At the present time, November 5, 1959, there are 13,000 leaflets packed in cartons of 500 ready for shipment when authorized and directed by the Secretary.

(3) *"Personnel and Working Conditions Schedule—1959"*—On September 18, 1959, Don Murray, a one-man sub-committee, distributed a seven page compilation of administrative information as submitted by 45 Agencies. As in the past five years this invaluable compilation presents an up-to-date summary of the following subjects:

(a) 1959-60 Budget Estimate
(b) Number of Employees—Max. and Min.
(c) Work Days Vacation Per Year
(d) Work Days Sick Leave Per Year
(e) Number of Holidays Per Year
(f) Working Hours Per Week
(g) Expenditure for Annual Audit
(h) Expenditure for Automobile and General Liability Insurance
(i) Group Hospital Insurance Plans
(j) Retirement Plans
(k) 1959 Salary Schedules for 19 job classifications

(4) *1959 Year Book:* On September 21, 1959, the printing of 700 copies of the Year Book was completed by John G. Shanafelt, Jr., Entomologist for the Orange County Mosquito Abatement District. Some 500 copies were distributed to agencies and individuals. The total cost to the Association was $230.96, or a cost per copy of 33 cents.

The following recommendations are presented for consideration by the Board of Directors:

Recommendation No. 1—

That the Board of Directors promote the sale of the remaining 13,000 leaflets "Mosquitoes About The Home."

Recommendation No. 2—

That the Board of Directors recognize the personal contribution by Don Murray as Manager of the Delta Mosquito Abatement District in the gathering, compiling, printing and distribution at no cost to the Association, the 1959 Schedule of Personnel and Working Conditions for 45 mosquito control agencies in California.

Recommendation No. 3—

That the Board of Directors at their December 4, 1959 meeting decide whether or not they wish this Committee to publish a 1960 Year Book, and if so, take the following action:

(1) Maintain the existing Committee as is.
(2) Provide $300.00 in the Budget for the Year Book.
(3) Advise this Committee on any desired changes in content.
(4) Authorize the Committee to submit to all agencies the questionnaire for 1959 operating statistics on or before December 31st, and urge these Agencies to respond quickly in order to permit this Committee to compile, print and distribute the 1960 Year Book by March 30th, prior to intensive mosquito control activities.

Attached are three separate financial reports to the Association Secretary accounting for a total expenditure by this Committee of $1857.29 for the printing of 50,000 leaflets and for the publication of the 1959 Year Book.

Respectfully submitted,
1959 Committee on Forms, Records and Statistics
Jack H. Kimball, Chairman
W. Donald Murray
Howard R. Greenfield
C. Donald Grant

Pres. Smith: The Publications Committee, C. Donald Grant.

REPORT OF THE PUBLICATIONS COMMITTEE

The Publications Committee was pretty short on membership this year until the appointment of Don Murray in such capacity. With the primary charge of

publishing the proceedings of the Annual Conference, the Committee functioned without conflict and one of our earliest publication dates was attained—June 22. A very helpful procedure in attaining this end was the coordination of recording, transcribing and editing through one center. This entails considerable concentrated work but resulted in a complete transcription, edited and ready for mailing within two weeks after the conference, and at the cost of less than one half of professional charges wherein the transcript must be again completely reworked. Similar proceedings are planned this year.

Some additions have been made to our mailing list for libraries and reviewers to enhance awareness and availability of information presented at our Annual Conferences. Gaining proper mailing addresses of all individuals or firms and their sub-offices which are entitled to copies of the Proceedings has been somewhat of a problem in the past and every effort will be made to overcome this difficulty in the future.

Minor reviews were made of other distributed publications and the Bureau of Vector Control and Gardner McFarland are to be commended on the preparation and publication of the current conference program.

Your suggestions concerning the Proceedings and its distribution will be welcomed for consideration.

Respectfully submitted,
W. Donald Murray
C. Donald Grant, Chm.

Mr. Grant: Now I would like to give thanks to some of our district people who are recording—taping, and will be working on transcriptions for the Proceedings. They are Vi Burkey, Secretary, and Tom Lauret, Entomologist. They have been very conscientious and do a good job.

I move the acceptance of this report. (Seconded by Sandy Steiner of Orange County, and the motion duly carried.)

REPORT OF THE ENTOMOLOGY COMMITTEE OF THE CMCA

The Entomology Committee held its Annual Seminar at the University of California at Riverside on March 27, 1959. Dr. Robert Metcalf presided over the Seminar and directed the topic of "Insect Resistance to Insecticides." The genetics, biochemistry, along with the resistance picture in agriculture in California, as well as the world-wide implication of resistance, were also discussed.

The afternoon session was devoted to "The Biology of Hippelates Eye Gnats in California." The biology, distribution, and other pertinent aspects, were covered in the Seminar.

After the formal meeting a guided tour of the entomology and toxicology departments was given, and various aspects of these interesting projects were explained by researchers in their respective departments.

At the request of the Ways and Means Committee of the CMCA, the Entomology Committee drew up a statement of qualifications for an entomologist, and a statement of range of duties for an entomologist. Considerable thought was given to these "statements" by the committee. It was the desire of the committee to ensure a professional attitude be maintained by the entomologists in a mosquito control agency, and to aid in outlining some of the basic duties expected of an entomologist within an agency. Because of the considerable variations in operations of mosquito control agencies in California, sufficient latitude had to be given to the duties of an entomologist so that the maximum effectiveness of technical information and abilities could be utilized by the agencies. After review by entomologists and managers, the "Duties" was delivered to the Ways and Means Committee.

A continued study of the seasonal population of mosquito species in dairy drains was attemped. After review of the initial committee work, it was realized that further work was needed in refining sampling methods and recording to best further the work on this project. The project was thus discontinued until further study could be made.

Arrangements have been made for the 1960 Entomology Committee Seminar, and it will be held April 15-16, 1960 in Forestry Hall, University of California, Berkeley. The subject matter will be limnology and various aspects of biological control of mosquitoes and other arthropods.

Respectfully submitted,
Thomas H. Lauret, Chairman
Entomology Committee

Mr. Grant: I move for acceptance of the report. (Seconded by Dave Reed and duly carried.)

REPORT OF THE INSECTICIDE COMMITTEE

During the past year, this committee met and discussed its historv and goals. The outstanding accomplishment of this committee has been the preparation and publishing in 1956 of, "*A Guide and Recommendation for the Use of Insecticides in California Mosquito Control.*" This publication has been outstanding and has found considerable use.

It is the opinion of the committee and has been suggested by others that this publication should be reviewed and revised with the addition of a section on weedicides pertinent to mosquito control.

Due to many changes concerning this work since 1956, it will require considerable effort to bring this publication up to date. At present, members of the committee along with Larry Lewallen of the Bureau of Vector Control have been assigned various phases to review. This work will be continued through the coming year with the plans being to complete the project.

The committee has applied for California Mosquito Control Association funds for this project and they are included in the proposed Budget.

There will be questionnaires, surveys, etc. sent to all Districts and we hope they will give the committee full support and cooperation.

Respectfully yours,

INSECTICIDE COMMITTEE
L. L. HALL—Chairman
W. D. MURRAY
D. E. REED

Mr. Hall: I move the acceptance of this report. (Seconded by Roy Holmes and duly carried.)

Pres. Smith: The Duck Club Committee, Art Geib.

Mr. Geib: For those of you who may not be familiar, we had a very poor duck season in California this past year. No ducks; no report.

Pres. Smith: Do you want a motion on that, Art? The next Committee is one which was appointed specially this year to try and straighten out some of our problems. The recommendations of this Committee and actions by the Board have already been sent out with the Board minutes. I refer to the Budget Committee. John Brawley, do you have anything to say?

REPORT OF THE BUDGET COMMITTEE

Mr. Brawley, Chm: Mr. President, I have a few things here, but as you say, it has been mailed out to the membership. They have received the budget. The main comment that I have to make is that we functioned primarily as a policy committee and passed the buck to President, Secretary and Treasurer to actually make up the budget. I move that this report be accepted. (Seconded by Les Brumbaugh and duly carried.)

CALIFORNIA MOSQUITO CONTROL ASSOCIATION

ESTIMATED INCOME

January 1, 1960 to December 31, 1960

Source Income	*Estimated Amount*
Contract Agreements	$ 3,000.00
Associate Member Dues	.00
Sustaining Member Dues	200.00
Sale of Publications	.00
28th Conference Exhibit Rentals	500.00
28th Conference Registration Fees	500.00
28th Conference Dinner Tickets	600.00
Miscellaneous Income	50.00
ESTIMATED TOTAL INCOME	$ 4,850.00

ANALYSIS OF FUNDS

Source	*Estimated Amount*
C.M.C.A. Building & Loan Dep. 1-1-60	$ 2,500.00
C.M.C.A. Bank Balance 1-1-60	1,900.00
TOTAL FUNDS AVAILABLE 1-1-60	$ 4,400.00
ANTICIPATED INCOME YEAR 1960	4,850.00
TOTAL AVAILABLE FUNDS YEAR 1960	$ 9,250.00

1960 CALIFORNIA MOSQUITO CONTROL ASSOCIATION BUDGET

1.0	*Administration*	
1.1	Advertising and Exhibits. Includes a one-half page advertisement in each issue of *Mosquito News*	$ 150.00
1.2	Communications. Postage, telephone	300.00
1.3	Office of Secretary. For CMCA secretary and his clerical asst., or to the district of the secretary, for services rendered, as per minutes of Dec. 4, 1959, item 4	600.00
1.4	Office Supplies. Stationery, etc.	200.00
1.5	Publications - Proceedings	1,600.00
1.6	Publications - Others	1,500.00
	$300 for 1960 Yearbook – minutes of Dec. 4, 1959, item 13	
	300 for a new insecticide and weedicide manual–committee request	
	500 for a publication explaining the research needs and the desired research program of the CMCA–committee request, also minutes of Dec. 4, 1959, item 4	
	100 for a source reduction booklet–committee request	
	The budget funds for all miscellaneous publications will require specific approval at the time needed.	
1.7	Public Accountant. As required in Bylaws, Article IV, Section 6, P. 7	100
1.8	Fidelity Bond. Minutes of Sept. 25, 1959, item 4, Section IV, P. 18	65
1.9	Travel Expense. To assist president and/or secretary, or designated alternate, to attend AMCA Annual Conference.	500
1.10	For contingencies	150
	SUB-TOTAL	5,165
2.0	*Conference Expenses*	
2.1	Dinner, Hospitality, Rooms, etc.	1,800
2.2	Proceedings, Recording	200
2.3	Proceedings, Steno Service	200
	SUB-TOTAL	2,200
3.0	Capital Outlay	---
4.0	Unappropriated Reserve Emergency Fund	650
5.0	General Reserve Operational Fund	1,235
	GRAND TOTAL	9,250

REPORT OF THE RESEARCH COMMITTEE

This Committee, in its second year, was charged with the review and evaluation of our research needs and problems for recommendations to the Board of Directors of this Association. Consideration was given to many different aspects and a comprehensive file of material prepared in this analysis. A questionnaire was also sent out to all corporate members with about sixty percent total returns and a paucity of recommendations. However, based on previous polls and the recommendation of a special committee for ways and means, an initial procedural outline for seeking an increased program in the total field of vector control was submitted and unanimously endorsed by the Board of Directors with directions to follow through in development of such procedural recommendations. Such a research proposal was developed along with numerous consultations with pertinent parties and reasearch authorities to establish feasibility and procedural acceptability. The resulting initial proposal was submitted to the CMCA Board of Directors in December of 1959 and by their endorsement and direction was mailed out to all of the Corporate membership for review by their trustee members.

The proposal draft and attendant background information constitute an integral part of this report, but time and procedure do not call for further review at this time. Appreciation is herewith expressed to other Committee members for the time and contributions they have made to this study.

Respectfully submitted,

Oscar V. Lopp,
David E. Reed,
Jack H. Kimball,
W. Donald Murray,
Gordon F. Smith,
Thomas M. Sperbeck,
C. Donald Grant, Chm.

RECOMMENDATIONS FOR PROCEDURE AND INTENT IN PROVIDING FOR AN ADEQUATE PROGRAM OF RESEARCH.

PROPOSED BY THE CMCA RESEARCH COMMITTEE

SEPTEMBER, 1959

1. That such a proposal for an adequate program of mosquito and other vector control research be readied for submission to the 1961 State Legislative session.
2. That a comprehensive review of the needs, justification, background and proposed program be initially prepared for distribution to CMCA agencies and interested parties for consideration and criticisms in order that a final form of program could be readied by the time of the CMCA Annual Conference in January, 1960.
3. That the justification for such a research program, entailing adequate personnel and properly equipped facilities should not be limited to mosquito control interests but rather de developed to handle related studies pertinent to vector control for which many agencies have a pressing need.
4. That the establishment of facilities for such research center should most feasibly be located at the University of California at Davis which already affords study centers for associated fields such as agriculture and parasitology as well as being the planned site of the seven million dollar U. S. Soils and Water Laboratory.
5. That such a center should serve also as a coordinating body for our various research projects, and that supplementary studies of specific function should be supported by grants at other facilities and coordinately, via specialized personnel, through local agencies.
6. That application be made for the use of federal funds (NIH and others as may be determined) in providing for the costs of constructing such research facilities on a matching and supplementary basis with State funds requested through the State Legislature.
7. That the funds for operation of such a research program be established on a continuing basis within the budget of the State Department of Public Health (BVC); and that proper negotiations be made in correlating responsibilities for such establishment between this Department and the University of California at Davis.
8. That pursuant to endorsement by the CMCA of a widely accepted plan of research, that a brief but first-class brochure providing exposition of such proposed program and its justification be prepared and printed for use in soliciting endorsement by other interested parties, agencies and the State Legislature; and that the request is herewith tendered that the amount of $500.00 be placed in the CMCA Budget for FY 1960 to meet printing and distribution costs of such brochure.

(Moved by Mr. Grant and seconded by Bob Peters that the Committee report be accepted. The motion was duly carried without discussion.)

Pres. Smith: That concludes the list of Committees, but we still have the Treasurer's report. Les Brumbaugh.

Mr. Brumbaugh: Mr. President, ladies and gentlemen, I was worried, I thought the President was going to forget us.

At the request of the Board of Directors, an audit report was made of the books and I believe this is the first time that we have been able to present an audit report at the Annual Meeting. The audit is on a yearly basis and I have here an eight-page report that I am not going to read. I think you are particularly interested in how much money we have and how much did we spend . . .

Board of Directors

California Mosquito Control Assn., Inc.

P.O. Box 629

Turlock, California

Gentlemen:

Pursuant to the verbal instructions received from your Treasurer, we have examined the records and supporting documents of the California Mosquito Control Association for the year ended December 31, 1959. Our report includes the following schedules:

Schedule 1—Balance Sheet

Schedule 2—Summary of Cash Available and Disbursed

Schedule 3—Schedule of Receipts from Dues, Exhibits and Publications

Schedule 4—Statement of Expenditures Compared with Appropriations Per Budget

Our examination was made in accordance with generally accepted auditing standards and included such tests of the accounting records as we considered necessary in the circumstances.

During our examination, the following subjects appeared worthy of special mention:

SUPPLY OF PUBLICATIONS

No provision was made in this report for the value of publications that may have been on hand at December 31, 1959, as this information was not available.

METHOD OF HANDLING CONVENTION DINNER AND REGISTRATION FEES

The records did not disclose details of the bank deposits resulting from the convention dinner and registration fees. Apparently the procedure used in recording the cash received from this function was inadequate.

We would suggest that, in the future, a detailed record be maintained of registrants and payments received.

MINUTES OF BOARD OF DIRECTORS MEETINGS

Items recorded in the minutes of the regular meetings during the year were reviewed and compared with the Association's other records; however, the minutes of the special meeting of July 12, 1959, was not available for our review.

We are commenting elsewhere in this report upon the budgeting procedures which were adopted in 1959. In connection with the improved procedures, formal actions should be systematically recorded in the minutes such as budget approvals, inter expense classification transfers, supplemental budget authorizations, etc.

MEMBERS DUES AND PARTICIPATION IN ASSOCIATION ACTIVITIES

Information furnished to us indicates that during 1959 contract dues were assessed on a calendar year basis whereas previously, the dues were assessed on a fiscal year basis. Due to the resulting six month period of "forgiveness" inherent in the change, schedule 3 is included in this report and is intended to furnish the officers of the Association with a summary of the present status of members' dues.

The schedule is also intended to show the extent that members participate in, and avail themselves of the services offered by the Association.

The date to which members contract dues have been paid as shown on schedule 3, was compiled from information furnished to us by personnel of the Association and was not independently verified. The data has also been incorporated in this report so that examinations made in future years can confirm membership dues by reference to the membership roster.

ACCOUNTS PAYABLE

We have been advised that the Association had no liabilities as of December 31, 1959. From the information furnished to us, we found nothing to indicate otherwise; however, we did not independently search for creditors or outstanding balances.

BUDGETARY SYSTEM AND BUDGET LEDGER

An earnest effort appears to have been made during 1959 to organize a systematic budgeting procedure. The budget ledger which was established during the year is a very helpful and necessary item if the proper records are to be maintained.

While the benefits of the above actions are already apparent, they will be even more beneficial to the Association in the years ahead in two principal respects, namely: (1) planning of financial requirements and comparisons of resulting procedures, and (2) dissemination of financial information to directors and officers by requiring appropriate resolutions for approvals and transfers.

OPINION

In our opinion the accompanying Balance Sheet and related statements of Cash Available and Disbursed presents fairly the financial position of the California Mosquito Control Association, Inc., as of December 31, 1959 and the financial transactions which were carried on by the Association during the year 1959 in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Respectfully submitted,
LYMAN & KEISTER,
Howard C. Lewis,
Certified Public Accountant

Stockton, California

January 11, 1960

California Mosquito Control Assn., Inc.

BALANCE SHEET

As of December 31, 1959

Assets		*Liabilities and Unappropriated Reserve*	
Cash in Commercial Checking Account—Security State Bank	1,986.06	Liabilities	0
Cash in Savings Account—Stanislaus—Merced Savings and Loan Association	2,674.25	Unappropriated Reserve	
		Balance at January 1, 1959 (Computed)	6,994.88
		Add: 1959 Receipts	4,814.16
		Total	11,809.04
		Less: 1959 Disbursements	7,148.73
			4,660.31
Total Assets	4,660.31	*Total Liabilities and Unappropriated Reserve*	4,660.31

SCHEDULE 1

California Mosquito Control Assn., Inc.

SUMMARY OF CASH AVAILABLE AND DISBURSED

For the Year Ended December 31, 1959

CASH AVAILABLE—January 1, 1959				
Bank Balance—Commercial Checking Account—Security State Bank			4,418.13	
Savings Account—Stanislaus—Merced Savings and Loan Association			2,576.75	
Total				6,994.88
SOURCE OF FUNDS RECEIVED				
Dues, Exhibits and Publications—See Schedule 3				
Member's Contract Dues		805.00		
Rent of Exhibit Space		700.00		
Sustaining Members' Dues		70.00		
Associate Members' Dues		9.00		
Publications Sold:				
Field Guide to Common Mosquito	148.28			
Mosquitoes About the Home	1,372.64			
C.M.C.A. Proceedings	8.50	1,529.42	3,113.42	
Other Receipts				
Conference Registration Fee and Dinner			1,380.00	
Refunds:				
Gordon Smith—Unused Portion of Advance for A.M.C.A. Meeting		35.20		
Jack Kimball--Refund on C.M.C.A. Yearbook		69.04		
Asilomar Hotel—Unused Portion of Advance for Manager's Institute		19.00	123.24	
Interest on Savings Account			97.50	
Deposit of Cash previously withdrawn from bank for use as Cash Fund at Conference Registration Desk			100.00	4,814.16
TOTAL				11,809.04
DISBURSEMENTS—Per Schedule 4				7,148.73
CASH AVAILABLE—December 31, 1959				4,660.31

SCHEDULE 2

California Mosquito Control Assn., Inc.

STATEMENT OF EXPENDITURES COMPARED WITH APPROPRIATIONS PER BUDGET

For the Year Ended December 31, 1959

Budget Classification	*Appropriations Per Budget*	*Actual Expenditures*	*Unexpended Budget Balance 12-31-59*
SALARIES			
Office of Secretary	$ 300.00	-------	$ 300.00
Office of Treasurer	100.00	-------	100.00
Sub-Total	$ 400.00	-------	$ 400.00
OPERATIONS			
Proceedings—Printing	$1,600.00	$1,542.32	$ 57.68
Proceedings—Recording	200.00	100.00	100.00
Proceedings—Stenographic Services	200.00	126.42	73.58
Yearbook	300.00	300.00	-------
Pamphlet: Mosquitoes About The Home	800.00	1,626.33	(826.33)
Pamphlet: Guide To Mosquitoes	600.00	545.89	54.11
Sub-Total	$3,700.00	$4,240.96	$(540.96)
CONFERENCE EXPENSE			
Rentals, Dinner, etc.	$1,800.00	$1,644.22*	155.78
ADMINISTRATION			
Postage and Express	100.00	51.74	48.26
Telephone and Telegraph	100.00	55.96	44.04
Office Supplies	150.00	214.98	(64.98)
Travel Expense	250.00	250.00	-------
Public Accountant	50.00	25.00	25.00
Surety Bond	50.00	12.50	37.50
Advertising and Exhibits	216.00	216.00	-------
Contributions	50.00	50.00	-------
Condolence	25.00	-------	25.00
Miscellaneous	25.00	387.37	(362.37)
Sub-Total	$1,016.00	$1,263.55	$(247.55)
TOTALS	$6,916.00	$7,148.73	$(232.73)

* Includes $100.00 withdrawn from bank for use as Cash Fund at Conference Registration Desk. The $100.00 was deposited to bank account at end of conference.

SCHEDULE 4

California Mosquito Control Assn., Inc.
SCHEDULE OF RECEIPTS FROM DUES, EXHIBITS AND PUBLICATIONS
For the Year Ended December 31, 1959

Members	*Contract Dues*		*Rent of Exhibit Space*	*Sustaining Members' Dues*	*Associate Members' Dues*	*Field Guide to Common Mosquitoes*	*Publications*	
	*Dues Paid To**	*Amount Collected in 1959*					*Mosquitoes About The Home*	*C.M.C.A. Proceedings*
Alameda	12-31-59							
Antelope	12-31-59						$ 43.18	
Ballona Creek	12-31-59						42.18	
Butte	12-31-59						37.76	
Carpenteria								
Coachella Valley	12-31-59							
Coalinga Huron	12-31-59	$ 40.00						
Colusa								
Compton Creek	12-31-59	25.00						
Consolidated	12-31-59	100.00				$ 25.00		
Contra Costa	12-31-59							
Corcoran	12-31-59							
Corning	12-31-59							
Delano	12-31-59							
Delta	12-31-59	100.00						
Diablo Valley	12-31-59							
Durham	12-31-59						42.90	
East Side	12-31-59							
Eureka	12-31-59							
Fresno	12-31-59	100.00						
Fresno Westside								
Inyo								
Isla Vista								
Kern	12-31-59	100.00				1.00		
Kings	12-31-59						84.89	
Lake							37.76	
Los Angeles								
Los Molinos	12-31-59							
Madera	12-31-59	90.00						
Marin	12-31-59							
Matadero	12-31-59							
Merced	12-31-59							
Napa	12-31-59						37.14	
No. Salinas Valley	12-31-59						42.70	
No. San Joaquin	12-31-59	60.00						

Orange	12-31-59						80.00	
Oroville								
Pine Grove	12-31-59						37.14	
Red Bluff								
Sacramento-Yolo	12-31-59	100.00						
San Diego						50.00	204.50	
San Joaquin	12-31-59					15.00	85.93	
San Mateo	12-31-59							
Santa Clara	12-31-60	90.00						
Shasta	12-31-59							
Solano	12-31-59					10.00		
Sonoma	12-31-59						84.28	
Southeast	12-31-59						80.00	
Sutter Yuba	12-31-59						43.90	
Tulare	12-31-59						74.74	
Turlock	12-31-59						166.62	
West Side	12-31-59							
Exhibitors and Sustaining Members								
Besler Corporation			$ 50.00					
Delmer Engineers			50.00					
Food Machinery & Chemical Co.			50.00					
Ford Motor Company			50.00					
Fresno Agric. Chemical Co.			50.00					
International Harvester Co.			50.00					
Kent Chemical Company				$ 20.00				
Livestock Sprayer Mfg. Co.			50.00					
Moyer Chemical Co.			50.00					
National Dynamics Corporation			50.00					
Pacific Associates, Inc.			50.00					
Pacific Pump & Supply Company			50.00					
F. M. Speekman Company				25.00				
Spraying Systems Company			50.00					
Sunland Industries				25.00				
Willys Sales Corporation			50.00					
Wood Treating Chemical Company			50.00					
Associate Members								
Ray R. Neal					$ 3.00			
Wesley Nowell					3.00			
Louis J. Ogden					3.00			
Publications Sold to Non-members						47.28	147.02	8.50
TOTALS		$ 805.00	$ 700.00	$ 70.00	$ 9.00	$ 148.28	$1,372.64	$ 8.50

* Dates to which contract dues have been paid were furnished by the Secretary and were accepted without independent confirmation.

SCHEDULE 3

Mr. Brumbaugh: I would like to move that the full Auditor's report be reproduced in the Proceedings so that everyone will have an opportunity to review it. (Seconded by Oscar Lopp and duly carried.)

Pres. Smith: Now it is customary to entertain a motion at this time approving the action of the Board of Directors during the preceding year . . . Please.

Chet Robinson: I will so move. (Seconded by Don Grant and duly carried.)

Pres. Smith: We have three other items of business which I have on the agenda. One is of long waiting and got tied up in red tape last year. The necessary action in reference to the by-laws have been taken—and I speak in reference to the election of our secondary honorary member of this Association, Dr. Stanley B. Freeborn.

Mr. Robinson: Mr. President, in that Dr. Freeborn was a former trustee of the Alameda County Mosquito Abatement District, I move that Dr. Freeborn be elected to the roll of honorary member. (Seconded by Bob Peters and unanimously carried.)

Pres. Smith: In anticipation of this event, we have already had prepared a sheepskin to Dr. Stanley Freeborn notifying him of the honor that we are conferring upon him.

Honorary Member Gray: Mr. President, Honored President, Respected President—All good things come in threes, they say, and I herewith presenta petition signed by nine corporate members of this Association requesting that Dr. Hackett be elected an honorary member in this Association and that it go through the usual processes, which of course means that it cannot come up until next year.

Pres. Smith: Thank you, Harold. This is indeed an impressive list of signatures on the nominating petition. According to the by-laws on this mater we cannot act now, but will take notice now an d pass it on to next year's Secretary for action, since he is the one that has to get out the notices. It doesn't have to go through the Board of Directors.

Harold, you can get back up again as Chairman of the Resolutions Committee.

Mr. Gray: As usual, the Resolutions Committee doesn't commitee very much, but of necessity, it resolutes.

RESOLUTION # I

We, the members of the California Mosquito Control Association, hereby express our thanks to the City of Marysville and its various officials for the excellent accommodations and courtesies which we have received at our twenty-eighth Annual Conference.

I move the adoption of the Resolution. (Seconded by Gardner McFarland and duly carried.)

RESOLUTION # II

We, the Members of the California Mosquito Control Association, hereby express our thanks to the Sutter-Yuba Mosquito Abatement District for their services as host of this Association.

I move the adoption of this resolution. (Seconded by Les Brumbaugh and duly carried.)

RESOLUTION # III

The California Mosquito Control Association wishes to express its appreciation to the support given it during the past year by our various contributing members and also to express our appreciation of their courtesies at the hospitality hour on Monday evening, and also to express our appreciation to our commercial exhibitors.

I move the adoption of the resolution. (Seconded by Chet Robinson and duly carried.)

RESOLUTION # IV

The members of the California Mosquito Control Association hereby express our thanks and appreciation to the Officers and Committeemen of the Association for their fine work done during the year 1959.

I move the adoption of this resolution. (Seconded by Oscar Lopp and duly carried.)

RESOLUTION # V

Be it resolved by the Officers and members of the California Mosquito Control Association meeting at Marysville, California, this twenty-sixth day of January, 1960, that we send our greetings to Chancellor Emeritus Stanley B. Freeborn of the University of California at Davis, and express our great regret that he is unable to be with us on this occasion. We thank him for his many valued contributions to our knowledge of mosquitoes and their control and extend to him our hopes for his health and his happiness.

I move the adoption of the resolution. (Seconded by John Brawley and duly carried.)

RESOLUTION # VI

Whereas at this twenty-eighth Annual Conference of the California Mosquito Control Association there has been scheduled no panel or symposium on the problems of the trustees of mosquito abatement districts, and whereas such panels or symposia are of great value to the trustees,

Now, therefore be it resolved that we recommend that at all subsequent Annual Conferences of the Association the program commitee be directed to schedule a special program for district trustees. (Adoption of the resolution moved by Sandy Steiner and seconded by Roy Holmes. Motion carried.)

Mr. Gray: As there are no other resolutions which have been brought to my attention, this then concludes the report of the Resolutions Committee.

Pres. Smith: Thank you, Harold. Is there any other old business to be taken up at this meeting? Any new business?

Mr. Raley: I would like to ask a question. In the presenting of John's report, I did not quite get whether this was the Budget Committee, *per se.*

Pres. Smih: It was the special Budget Committee which set up the procedure whereby the President, Secretary, Treasurer and Vice President would present the new budget to the Association and to the Board of Directors.

Mr. Raley: Has that been presented?

Pres. Smith: It has been. If you wish to speak on it, now is the proper time.

Mr. Raley: I think we have spoken on it by letter. I think everyone present who is a corporate member has had a copy of that letter.

Pres. Smith: Would you like to call for any action?

Mr. Raley: Perhaps discussion.

Pres. Smith: We will then open the matter of the budget as it has been sent for discussion.

Mr. Brumbaugh: Mr. President, I would like to discuss some parts of the budget because I was a party in its preparation. One point that I would like to bring out is that in preparing a budget, you need to have some past history—what your expenditures and income have been so that you know whether you are over-expending in preparing such budget. It is just a guide so that you can know where you are particularly heading next year. Taking any specific item within the budget, you have to set up an approximate or estimated figure and hope that you can keep within that amount. There were questions on some of these features; for instance, it was not known exactly what was being spent for postage, telephones, publications, etc.; but we tried, after going through all of our back records, to put it all together and came up with these tentative figures. We do not want to make a lot of transfers within the budget where we are over-expending. If we are under-expending, that is fine. In setting the format for future Secretary and Treasurer in future years, we will have an actual procedure and records so that you will know exactly where the Association stands. That was the reason for submitting the budget and putting down those different amounts.

We set one amount as one hundred for the audit report. We have an eight-page report, and I defy anyone to get a report of that nature for less than one hundred dollars .They completely went through all the cancelled checks went through all the books, all the bills, and all those payable, and made several important suggestions to the Secretary and Treasurer. Also you have a complete listing in that report as to who has paid and when, as well as where, the money was dispersed. I think that is very, very important.

Anyone who is handling money should be reputed as honest, and I think you will all agree with that. We have set in the budget a sixty five dollar security bond. The Association is handling approximately $10,000 worth of money. We are all honest, still sometimes you might get somebody who is taking a little of the funds and using it for his own pleasure. For a little over twenty dollars a year you are trying to protect the Association's funds. So, whoever is the Secretary-Treasurer should have a security bond; particularly when you have about $10,000 which such a person is handling. Sixty-five dollars is for a three year policy, and I think it is very good business practice to have that type of security bond.

One of the big things of the Association is communications, and that happens to be postage, telephone, telegrams, etc. We have no back records as to how much we spent on that. We do believe that many of the Districts used their own expenditures when it came to communications. I do not feel that the District of the Secretary and Treasurer should have to pay all that type of cost. When you send out Proceedings and you have eight, ten, twelve cents a copy going out, when you have the different bulletins, Year Book, and you have the Field Guide—and I know there are other publications that are going to come out—these constitute the organ or life-blood of our Association, our communications.

I could keep going on down the budget, item for item, but I would like to say that I feel the total is a step in the right direction .Whether the actual amounts are right, only time will tell.

Mr. Brawley: I would like to make one brief comment on the matter of the audit. We did discuss the possibility of having an Audit Committee and in eliminating that item, but we find that our by-laws specifically require that you have this audit. You can, of course, get out from under that by revising the by-laws, but until we do we must include an audit cost in the budget report.

Mr. Grant: I think part of this goes back a little bit further than any of the individual items here. In the report of the Budget Committee abou two years ago, there was considerable concern about the matter, and the particular propsal, I believe, was defeated because of the fact that the Budget Committee recommendations served to hamper individual actions by Committees as well as to dictate policy and restrict freedom of action in the prerogatives of the Board of Directors. A Budget Committee empowered wih too much influence upon the action of the Board through its budgetary action pretty much acts as a Department of Finance, with which we have troubles even here in the State of California. This tends to be somewhat of a lever, but we recognize the need of budgeting and proper planning.

But because the budget, once established, leads to considerable feeling when new expenditures are brought in through emergency action by the Board and so forth, it is very necessary to properly plan and budget for these items which may be anticipated as coming up, even though the eventuality and use of that money may never occur. This has certainly been the case with several of these items, and one of them, I believe, is the five hundred dollars, which was recommended to be appropriated for publication of the Research Committee brochure or proposal when and if any such proposal was adopted by a majority of the members within this Association.

In the recommendations originally compiled it was stated that if this Association felt that any such proposal should be sought, there would be the necessity of some means of providing education or the information contained in such proposal to our trustees, to other parties, to members of the Legislature on an informational basis. To do so would, of course, entail some expenditure of funds. This was anticipated—to do it in a proper manner, in a concise form of adequate nature —at a cost of two to three hundred dollars. When asked, as Chairman of the Publications Committee, I indicated that amount. It was mentioned that wider circulation might be desired in this regard and that a larger number of copies might be provided, and it was suggested that $500, as a maximum, be budgeted in the event that any monies are to be expended for the publication of such a brochure. In more recent developments of this, I feel that there may probably be no expenditure, even if such proposal is met. Other means of financing such a brochure are available if it does come up; however, the policy of budgeting such amount for the possible anticipated expenditure must still be defended.

Mr. Raley: Could I ask for a motion or a roll-call vote on the inclusion of that five hundred dollars for the brochure in the budget? I will have to defer to the chair for the proper procedure for this. I would like an expression of approval on that particular item.

Pres. Smith: I will repeat your motion as I understand it—that you are voting that the $500 that was included

in the budget for publication of the Research Committee report be deleted, and you are requesting a roll-call vote. Seconded by Ed Davis.

Mr. McFarland: Do you have specific reference to a brochure which is designed for distribution to the Legislature and so forth? You are not thinking of a mimeographed report such as went out—not referring to the normal operations and expenditures of the Committee?

Mr. Raley: Just the five hundred dollars, it wasn't too well spelled out in the budget, but if you read back in the minutes, you will find that $500 was . . .

Mr. McFarland: In other words the Committee would not be able to operate normally, the way it has in the past?

Mr. Raley: Our committees have operated very efficiently without that sum of money.

Mr. Brawley: Mr. President, as Chairman of the Budget Committee, I would like to be sure that we understand the issue, and that is that the motion is to reverse the actions of the Budget Committee and of the Board of Directors as it has been taken in the past. Is that correct?

Pres. Smith: The action of the motion is to remove a line item, or portion thereof, of the budget as accepted by the Board of Directors and remove five hundred dollars from the item under 10: Publications; Others, $500, which was set aside in the eventuality that we should want to finance a special publication. In our thinking it was a printed report or whatever you might want to call it, to be sent out for informational purposes to various directors, legislators and others to whom we might wish.

Mr. Brawley: If I may again, so that there is no confusion. A "No" vote would leave the matter as it stands. A "Yes' vote would change it. Is that right?

Pres. Smith: A "Yes" vote would remove the $500 from the budget.

Mr. McFarland: I rise to to a point of order on this matter, in part to explain it. John, this doesn't reverse any action of the Board of Directors. This budget is a recommended budget, recommended to the next Board of Directors with the idea that it will save time and we will not have to wait until March to have a budget. So this is not really reversing any official action since none could be taken to date .This is merely instruction to the new Board of Directors as to whether we include or delete this amount in the budget which they will adopt later.

Mr. Lopp: Mr. President, would you kindly state again what a "yes" and "no" vote means on this motion, because it seems a little bit confusing as I heard it.

Pres. Smith: The motion was to remove $500 from the item Publications: Other, in the budget which is being passed on to the next year's Board of Directors. That $500 in the consideration of the Board of Directors was for the purpose of publishing a brochure by the Research Committee, an educational brochure, stating the final work of the Committee on needs and so forth in research. A "Yes" vote will reverse a portion of the action by the Board of Directors in accepting this budget. A "Yes' vote will remove the money; a "No" vote will leave it in the budget.

Carl Muller, Turlock MAD: I am rather new at this sort of thing here, but one thing since I have been on the Board that has been rather prevalent, or rather obvious, and that is that we are doing many things to the best that we know how, and we know that we know preciously little about how on some of our basic operations. I am sure that this matter of research is a very important thing. It seems rather ridiculous to me that you would set a Committee to perform a research service or survey and to recommend certain findings and then emasculate the budget to the point where you can't do anything about it. You've got a lot of good ideas and that's as far as you can get. It would seem to me a method of frustrating or nullifying, or vetoing any findings that the committee may wish to publish. If the amount of monies we are thinking of in terms of subsidies to individual mosquito abatement agencies as opposed to research, and this is one way of accomplishing that objective, then you should discuss that phase of it directly and not try to frustrate any action of the whole corporate body in developing a research program and, certainly, making those findings known. (Applause)

Pres. Smith: Any further discussion?

Bob Peters: Mr. Chairman, I would like to say that a vote "'Yes" will hamstring all future opportunity of this Committee to meet the will of this Association.

Harold Gray: Did you ever hear about swallowing camels and choking on gnats?

Pres. Smith: In answer to the question, will the Secretary please call the roll for voting.

Pres. Smith: In answer to the question, will the Secretary please call the roll for voting.

Alameda County	No
Antelope Valley	No
Ballona Creek	No
Borrego Valley	-----
Butte Couny	No
Coachella Valley	-----
Coalinga-Huron	No
Colusa	No
Compton Creek	No
Consolidated	Yes
Contra Costa	No
Corcoran	No
Corning	-----
Delano	-----
Delta	No
Diablo Valley	-----
Durham	No
Eastside	No
Fresno	Yes
Fresno Westside	No
Inyo	-----
Isla Vista	-----
Kern	Yes
Kings	No
Lake County	No
Los Molinos	-----
Madera	-----
Marin County	No
Matadero	No
Merced County	No
Napa County	No
Northern Salinas Valley	No
Northern San Joaquin	No
Orange County	No
Pine Grove	No
Sacramento-Yolo	-----
San Joaquin	No
San Jose City Health Dept.	No

San Mateo County	No
Santa Clara County H. D.	No
Shasta	-----
Solano County	No
Sonoma County	-----
Southeast	No
Sutter-Yuba	No
Tulare	Abstain
Turlock	No
Westside	-----

We have three "yeses," "31 "noes" and one "abstain."

Pres. Smith: The motion is defeated. Do we have any other business to discuss?

There is one thing I would like to have Norm Hauret do sometime and that is to get up here and tell us how to pronounce Ballona (Bai-Lyona) Creek.

If there is no further business from the floor, I will get the greatest pleasure in calling upon the Chairman of the Nominating Committee to come forward and give his report.

Bob Peters: I might say that I am chairman of this committee by dubious means. It just so happens that our President was inclined toward a second term, since he appointed this Committee wihout a chairman; but the Committee resolved this problem by ballot. Even though I did not vote for myself, some others did and therefore I must make this report.

REPORT OF THE NOMINATING COMMITTEE

It is with pleasure that I announce that we have candidates for each of the Offices as follows:

For President	Gardner McFarland
For President Elect	Lester Brumbaugh
For Vice-President	John Brawley
For Secretary-Treasurer	W. Donald Murray
For Trustee Representative	E. E. Frisby (Orange Co.

This concludes the report of the Nominating Committee.

Respectfully submitted,
Robert H .Peters, Chm.

Provided there are no other nominations submitted or from the floor, I move that we cast a white ballot in favor of the nominees.

Pres. Smith: Have we received any other nominanations, Mr. Secretary? (No.) Are there any from the floor? We have a motion to cast a white ballot for the foregoing nominations; is there a second to the motion? (Don Grant) All in favor? ("Aye") Opposed? (None.) The nominees are elected.

There is one thing I would like to do before I finally step down from this position of high eminence, and that is to bring to your especial attention the amount of work that your new Secretary has done. I can't express my appreciation too strongly or thank him too much for the wonderful job he has done. He has put in a great deal of time, I am sure, on the Association business. I think, Gardner, that with Don in there, you are going to have an easy time next year.

I would like to ask the new officers to step forward, please, but before I do so, I would like to ask if the different areas have elected their representatives. Southern California?

Norm Hauret: Yes. Our new representative is Jack Kimball, of Orange County.

Pres. Smith: The Southern San Joaquin Valley?

Mr. Brawley: We have elected David Reed, of Tulare MAD.

Pres. Smith: The Northern San Joaquin Area?

Bob Peters: We have elected Steve Silveira, of Turlock MAD.

Pres. Smith: Sacramento Valley area?

Dick Sperbeck: We were to have gotten together last night, but somehow we didn't quite make it. We will do it as soon as possible.

Pres. Smith: The Bay Area?

Mr. Greenfield: The Bay Area elected Bill Rusconi, of Napa County.

Pres. Smith: Will the new officers, then, lacking one, please step forward. Congratulations.

I don't think we need to introduce any of these fellows since I am sure you already know them. It's all yours, Gardner.

New Pres. McFarland: It is with a good deal of pleasure and some misgivings that I accept this honor. I thought there was going to be more bloodshed this morning than there was . . . that's why I had a speech, but I must have lost it last night. I think it is a healthy thing for our group to have such controversies.

PRESIDENTIAL ACCEPTANCE SPEECH

It is with mixed feelings of humility and emotion that I accept the great honor you have tendered me.

For the past several years, I have worked on various committee assignments with quite a number of you gentlemen, and as Vice-President this past year. Of all my years in various capacities and different activities, I have never worked with a group as capable, competent, and public-service minded as this group. Of course, there have been differences of opinions in the past and even today. This is to be expected, since our members give of themselves so unselfishly to public service. As a result, the methods of accomplishing worthwhile service to the people of this great State create minor differences that become magnified with consequent disturbed feelings. I firmly believe that if we all back up just a tiny bit and give just a little bit, everyone will be able to work together for the good of this great State, as regards to mosquito control within the California Mosquito Control Association.

At this time, I wish to ask for a unanimous vote of thanks for the wonderful job done by our outgoing President, Gordon Smith, and his Officers. Gordon has been patient and hardworking, and together with his Officers, has advanced the cause of public service in the field of mosquito control during his year. I, also, wish to thank our speakers who are helping to make this Program so successful and thanks to the exhibitors whose products are so necessary for the operation of our districts.

The hospitality from this fine City of Marysville and the Sutter-Yuba District, its wonderful Manager, Dick Sperbeck, and outstanding Trustees, with our Trustee Member, Marion Bew, are greatly appreciated by all of us.

As many of you know, the committee chairmen and the members of their committees have been unofficially selected. A brief meeting of the new Board of Directors will be called immediately following the end of the meeting to officially confirm these committee makeups. I ask that the commitee chairmen contact their mem-

bers so that they can carry on the good work without loss of time, and so that informative progress reports can be submitted o the Board of Directors at the March 25 meeting.

Of interest at this time is the shape of things to come in early 1961. The National meeting of the American Mosquito Control Association and our Association will be held at Disneyland, Monday, January 30 through Thursday, February 2, 1961. Please mark this important date on your calendar.

Again, I wish to thank everyone for the parts they have played in our wonderful Association; and I know that with your co-operation and interest we will go forward to greater things in 1960.

Pres. McFarland: We are right on time. Gordon has done a wonderful job of keeping us on schedule, and at this time I will declare a fifteen minute recess.

RECESS.

CONFERENCE PROGRAM COMMITTEE

It is with a great deal of pleasure that as Program Chairman, I thank the members of the Program Committee who helped me so much in his wonderful Program, held here in Marysville. These people are: Edward D. Davis, C. Donald Grant, W. Donald Murray, Richard F. Peters, and Thomas M. Sperbeck. Certainly without this Committee, our Program would not have been possible.

I particularly want to thank Dick Peters for his great help all through the past months in preparation of the Program and finally in the printing of the Program.

As far as arrangements, we must give great thanks to our wonderful host Thomas M. Sperbeck, Mr. Marion Bew, Trustee Representative of the Association and Trustee of the Sutter-Yuba Mosquito Abatement District, and all those that helped them.

Respectfully submitted,
Gardner McFarland, Chm.

CIVIL DEFENSE

TUESDAY, 10:45

Pres. McFarland: In that we're a little late, we start off the same way that Gordon did yesterday. If there are any issues that need further discussion this afternoon, we will be able to continue after lunch. At this time I would like to introduce the panel Chairman for the subject of Civil Defense, Mr. Dick Peters.

Mr. Peters: Mr. President, this subject, "Relationship of Mosquito Abatement Agencies to Civil Defense," is one on which you have received a bit of material in the past, but I would say in truth, we have not yet faced up to our responsibilities in this field. For the information of those who are unaware, you, as units of the CMCA, are depended upon in the statewide Civil Defense Program—both for the control of vector animals under disaster conditions and for decontamination of medical and health facilities. In this you are identified within the official structure of the State Civil Defense Program. The objective of this presentation is to goad, stimulate, encourage, or otherwise to get you doing something about fulfilling your civil defense responsibility.

My role on this panel is that of moderator. I will now bring on the first of two panel members identified with the medical and health relationships of the California Disaster Office, William J. McLarty. He is the field representative of this Division, and will speak on the Sanitation Aspects of Civil Defense.

Mr. McLarty: Thank you very much, Dick. It is a real pleasure to be here today and to be able to say a few words about civil defense to you, because as an official organization (as Dick said) and as members of individual mosquito abatement districts you do have a responsible role in making civil defense effective.

Just what do the people of California expect from you as members of mosquito abatement agencies? What kind of role do you play as people who have a unique specialty—how may it be best used in the civil defense program? I think I should begin this by perhaps telling you a few things about the organization at the State level of Civil Defense, and particularly about recent happenings in the State Civil Defense Program.

About two years ago, the Federal Government made some surveys in the States for the purpose of reviewing the overall civil defense planning of the States. After two years of reviewing civil defense plans in California and reassaying the entire program of civil defense, a group of about thirty people that spent about two hundred and fifty thousand dollars of Federal funds in the State, came up with some revisions in civil defense planning for the State. There weren't many large changes, but there were some important changes in our state plans. One of these is that the old critical target areas that we think of have been abandoned. We used to talk about the critical targets in California as ground zeroes—specific points—one at Treasure Island in the San Francisco Bay Area, one at Lindberg Field in San Diego, and the other at City Hall in Los Angeles. These points were circumscribed then by twenty mile radii circles, which were presumed areas of destruction. Under the new assessment of the threat to California, the military sources of retaliation have been included as targets. The new Operational plan delineates areas of greater danger—instead of critical target areas, they are now called danger areas. This map is of such small scale that I doubt if you can see it back there, but it delineates seven individual areas in the State which are now known as danger areas. Instead of something like three thousand square miles being involved in target areas, there is now something like nine thousand square miles. This is quite a bit of property as you can see, but it still represents only something like five to six percent of the total area in the State. What it does of course, is to circumscribe areas within the State which are bases for military retaliation, for warning systems, and critical industrial and population centers. So that if you took individual targets and made little rings around them, say for five megaton weapons, and connected the circles, then you would have areas that are defined like this. The boundaries are extended to places on the ground, geographical landmarks of some kind, so that the areas can be actually defined on the ground. They follow a major street, or a river course, or a mountain crest, a county boundary or something of the like, so that the areas of danger can be located on the ground and you can know whether you are in a danger area or out of the area.

As I say, these areas represent 9,000 square miles, or only about five or six percent of the total land of the State, but they do represent the major population centers of the State, so that most of the

people in the State are in these danger areas now. For our medical and health purposes, so are the majority of hospital beds. I don't know whether you can see the figures here or not, but the total general hospital beds in the State are 61,633. Of these, 45,753 are in the danger areas. In other words about 74% of all the hospital beds are in the danger areas. 26% of the hospital beds are in the remaining area of the State. This in itself is serious enough to have caused the Federal Government to be greatly concerned. Several years back, they developed a packaged hospital meant to replace the hospital beds that could be lost in the event of a large scale disaster of some type. These packaged hospitals run about thirty thousand dollars each; they are based on the mobile army surgical hospital which was used in Korea; they are entire packaged hospitals with three complete surgeries, X-ray machine, and all of the equipment that goes to make up a two hundred bed hospital. We now have in the State of California, one hundred and fifteen of these hospitals which are generally located outside of the critical target areas or danger areas. They are stored in the basements of schools and fair-grounds and other similar buildings which can be used to actually set up the hospitals in an emergency. These facilities can be converted into hospitals under disaster circumstances.

The two hundred bed civil defense hospitals represent about three and a half million dollars of Federal monies which have gone into the State of California for this purpose. It shows the critical concern the Federal Government feels toward the loss of existing hospital beds in this State. The C.D. hospitals could not begin to replace all of the beds that might be lost if we do have an attack. Furthermore, there is always the possibility of contamination from radiological fallout (which you people have heard about) affecting large areas of the State, much greater areas than the 9,000 square miles which are shown in the target or danger areas themselves now. We will have to be concerned with reclaiming existing hospitals in the fall-out areas, we have to be concerned with reclaiming the packaged hospitals, too, that might be in fall-out areas. This important decontamination responsibility is worthy of the new delegation of authority to mosquito abatement districts and the CMCA. We have to have some group that is capable of going into these hospital areas, of actually reclaiming these hospitals by removing the contamination, whether it be in the form of radiological fall-out on the hospital, whether it might have been in the form of biological agents used, or some kind of chemical agents that might have been used. This decontamination function, in effect, is just the same as creating a hospital from the ground up, because hospitals are unusable unless we can decontaminate them in time for them to be effective.

Under the map here, I have an outline of the decontamination organization within the State. At the very top of the decontamination organization, and the State Civil Defense Organization, is the Governor of the State. He has supreme authority in extreme emergency to administer the entire program. Under him we have the California Disaster Office, and as one of the divisions under the California Disaster Office, we have the Medical and Health Division, under which both Dr. Coggins and myself serve.

The Medical and Health Division has a dual responsibility, because we are also a division within the State Department of Public Health. We make use of one of their buildings to house our division down in Berkeley. We have the right to call on personnel and equipment that the Department has for medical and health assistance in disaster. The Bureau of Vector Control of the State Department of Public Health, under Dick Peters' direction, directs and coordinates the entire decontamination and vector control program during a state of extreme emergency.

Coming down to the next level, this is a regional level. I don't know whether you noticed it on the map I just showed, but the State is divided into three geographical regions. There is about a two-county-wide strip along the coast extending from the Oregon border to the southern Monterey County boundary; there is a strip that goes down the central valley, to the Northern Kern County boundary; and then the rest of the southern part of the State is the third region. This latter region includes Inyo and Mono Counies. In each region we have a regional coordinator, (a California Disaster Office employee) and a full-time paid staff. This staff represents the major functions in the Civil Defense set-up: medical and health, law enforcement, communications, all of the functions you can think of as being necessary to relieve the effects of diaster. On his staff is a Medical and Health Chief, who is very often a voluntary medical person on the regional level. On the staff of the Medical and Health Chief is the Regional Vector Control and Decontamination Officer; this is a full time paid employee on Dick Peters' Bureau of Vector Control staff.

On the local level, we have a local Civil Defense Director who directs the local civil defense effort. It could be a City or County Director. Under him are the same counterparts, representing the same types of activities, such as the local Medical and Health chief. On his staff is the local Decontamination and Vector Control Specialist. This might be the manager of a local mosquito abatement district, or it might be a vector control specialist on the local health department staff. He works on the local level in directing and coordinating the entire vector control and decontamination program on that level. Below him we have the local pest control operators and mosquito abatement district personnel. These people actually perform the decontamination and vector control operations. They perform these operations at hospitals and critical medical and health facilities, perhaps a laboratory that has to be reclaimed, but only at medical and health facilities.

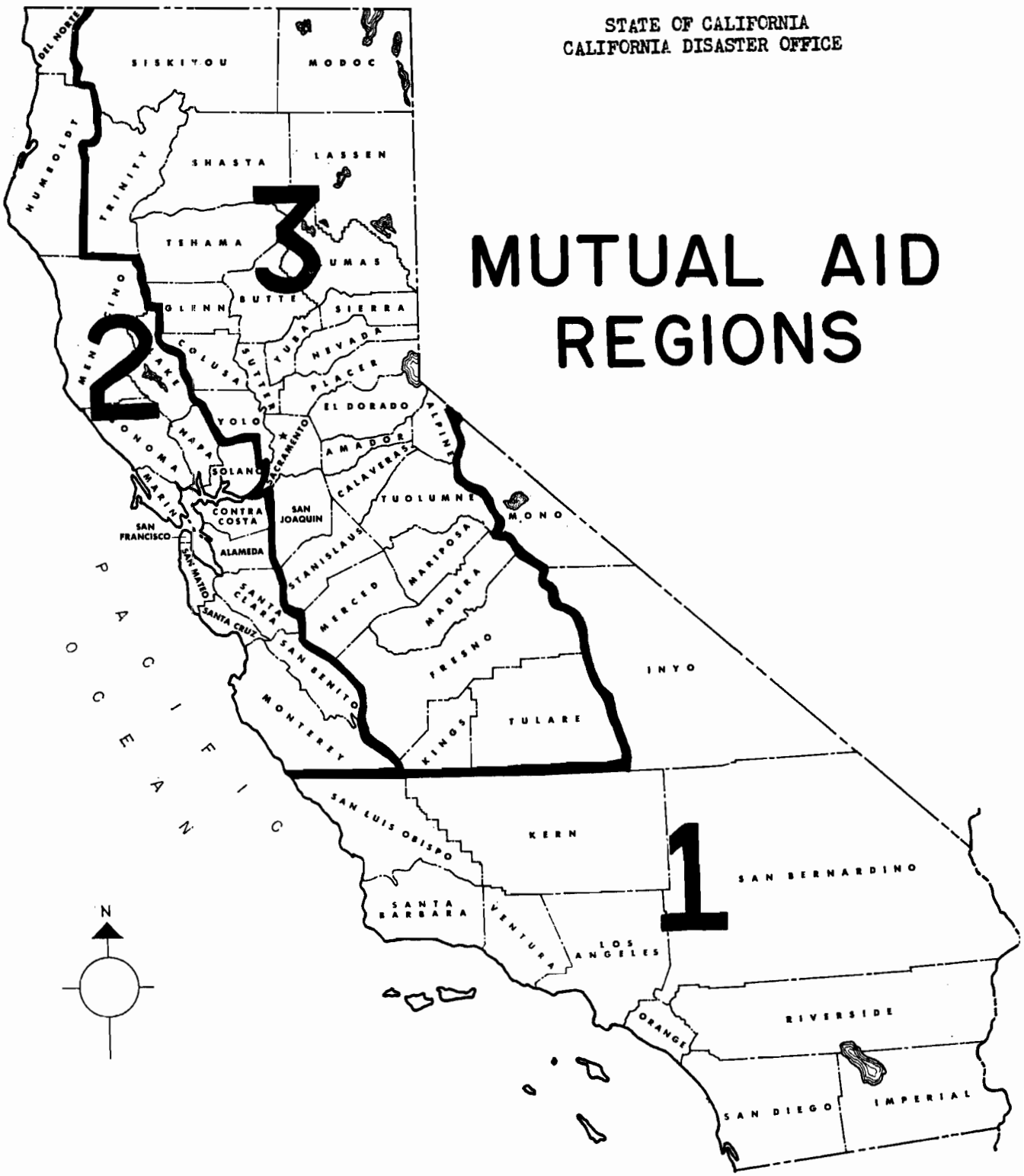
Is this simple enough? Am I making it too complicated? Now that is the organization. I might say right now that the most important people on this program are right here, they are the ones that have the working assignment. You can forget about all the superstructure because it won't be used unless decontamination and vector control problems extend beyond local (city, county,) or regional boundaries. They perform a purely coordinating function at that upper level.

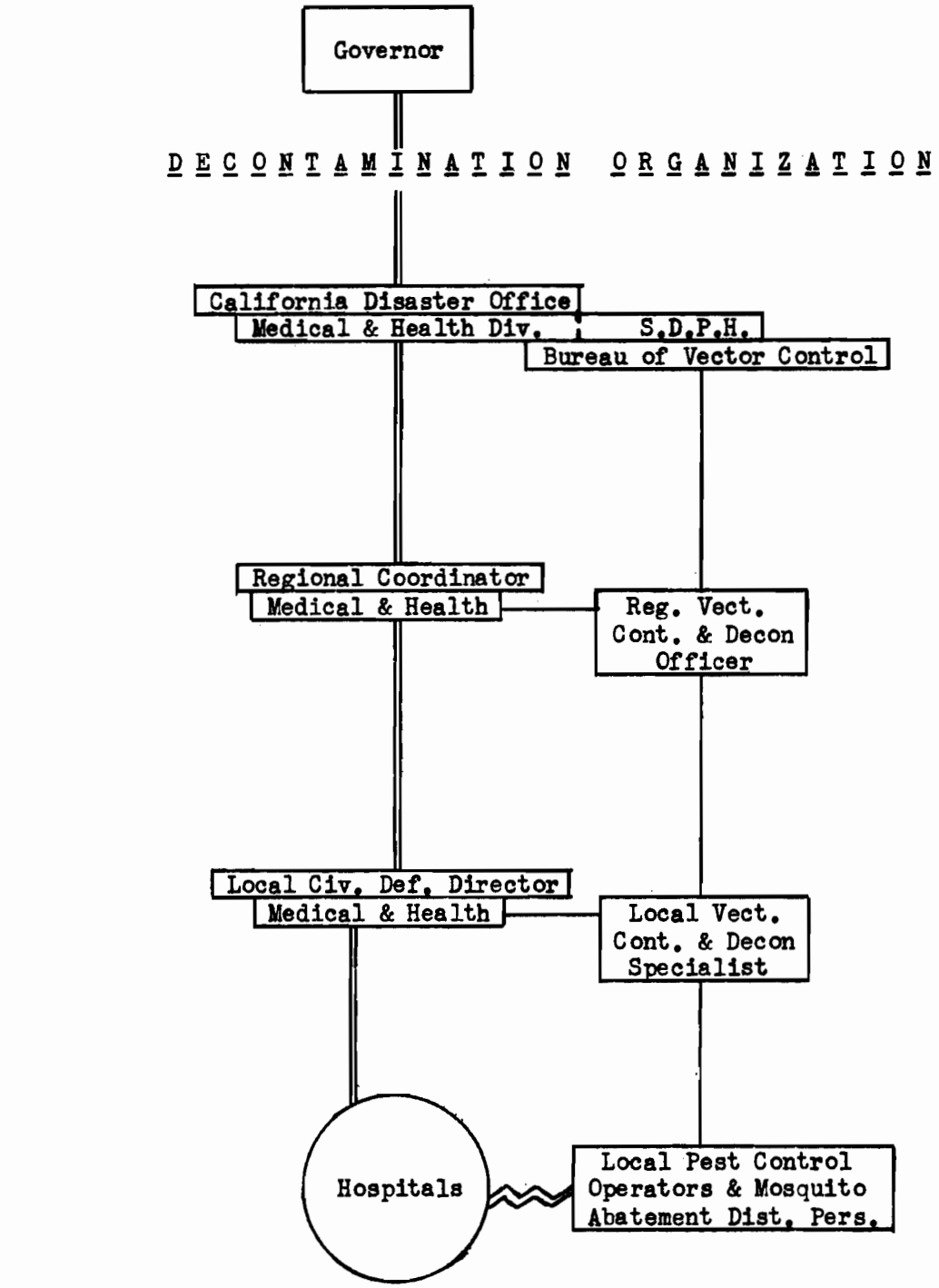
I would like to say, of course, that any paper organization has no ability in itself but only as it is represented by flesh and blood people, somebody who has the ability to perform these functions, somebody who knows what his responsibilities are, such as you in this particular case who have a background of knowledge in chemicals, whose training, ability and material re-

sources, whose equipment can be adapted to this function. It is for this reason that mosquito abatement men were chosen along with private pest control people to be assigned this particular function.

What particular benefits does this program have for mosquito abatement districts? First, you have access to Federal surplus property, not directly through your own mosquito abatement district, but through the agency of the local civil defense director who can acquire surplus civil defense property and assign it to you as custodians of the material.

Following the Christmas '55 floods, you probably remember that a number of mosquito abatement districts derived Federal funds through public law # 875; something like a quarter of a million dollars in all, given to mosquito abatement districts for reclaiming





Medical and Health Division
Decontamination Organization

areas that they were interested in, for replacement of equipment, and so forth.

Early enrollment in the organization of your local civil defense agency will permit you to have civil defense identification passes, it will permit you to have the benefits of State Workmen's Compensation should you be injured during a period of disaster or during a period of training for disaster emergency. Of course, last but not least, enrollment in your local civil defense organization is a great public service.

I hope that soon Dick and his staff will be in a position to do some training. The Federal Civil Defense people are very much interested in the biological and chemical aspects of the program at the moment. They are providing kits of protective masks and chemical detection kits, which will go out to groups who are trained to utilize these devices. I think that Dick shortly will be in a position, perhaps, to provide some of these briefing courses, his men possibly going around to mosquito abatement districts or whatever joint arrangement you may agree on. We hope that a large scale disaster never strikes us, but if it should, let us see that we are prepared.

Mr. Peters: Thank you, Bill. The next speaker represents mosquito control—Arthur L. Cavanaugh, Manager of the Coachella Valley Mosquito Abatement District, who also speaks as one familiar with Civil Defense on a close working relationship.

Mr. Cavanaugh: Coachella Valley Mosquito Abatement District has been integrated into the Riverside County Civil Defense plan for approximately three years. This plan covers the care of refugees from the densely populated Los Angeles basin in case of nuclear attack, and our District has been assigned the mission of assisting in this care.

There has been a great deal of planning by County Coordinator O. S. Dresher and Regional Coordinator John Davis in the mapping of a great number of flowing wells of potable water and the method of supplying water to refugees, and the selection of reception areas to care for approximately 40/60,000 refugees until they can be sent farther inland.

Our District headquarters is adjacent to the local high school, which has been designated as an emergency hospital with which our District can coordinate in the processing of patients, and with our mobile radio system we can cover the entire Valley with directions for refugees—coordinating with the Sheriff's office and the local Police Department.

We have applied to the State Civil Defense and hope soon to be activated as a radiological monitoring unit to check fallout in this area. With these and many other activities, we feel that we are one of the finest Civil Defense units in the state and are going to continue to improve. We are ready, willing and able to help our state and the nation in a time of disaster.

Now, what has Civil Defense done for us? A very great deal in helping to equip us for Civil Defense: with matching funds for mobile radio equipment, with trucks, jeeps and other equipment; with planning and training; with Civil Defense conferences and film which they have made available.

A word about Mosquito Abatement Districts in California and Civil Defense: it is my feeling that all Districts should be encouraged to join and be integrated with Civil Defense through their local county coordinator, with the regional office developing a master plan utilizing all the resources—not only the equipment, but the highly trained personnel (which I believe would surprise many Civil Defense officials). In the fact that the Districts are distributed throughout the state, many in rural areas ,all districts in case of disaster will normally be used, but by integrating and training, their value to Civil Defense will be greatly increased.

The Districts are more familiar with their areas than any other organization due to their work in the control of mosquitoes, gnats and flies, using insecticides ranging from D.D.T. to parathion. This brings a Civil Defense mission for the Districts in Health and Sanitation in the reception and attack areas, in he control of insect vectors and the possibility of control in bacteriological warfare with its many ramifications in which the use of spray equipment and lab facilities is essential.

It is my hope the Association officers will make the inclusion of all Mosquito Abatement Districts in Civil Defense this year one of their objectives.

Mr. Peters: Thank you, Art, for your succint and highly appropriate viewpoints on this subject. I am now faced with the fact that we have but fifteen minutes to complete this panel presentation and the next speaker is one who spellbound the Pest Control Association last December with an hour-and-a-half presentation on his aspect of Civil Defense. So, Dr. Coggins, much as I hate to have to ask you to contract your remarks to fifteen minutes, I shall have to do so in the interests of the exhibitors and others who have patronized this Association. Dr. Coggins is Assistant Chief of the Division of Medical and Health Services in the California Disaster Office. He is eminently prepared to address you in this capacity, having risen to the rank of Admiral while in the United States Navy, and having been across the world a number of times and acquired a global concept on this subject. Dr. Coggins.

Dr. Coggins: Thank you, Dick. Ladies and gentlemen, I shall confine myself to the short time described. I will not try to touch on the technicalities of your part in Civil Defense, but I would like to make a few general remarks.

The public is generally regarded as apathetic towards the subject of Civil Defense, but it has been my experience everywhere, in the State of California, that this apathy is derived entirely from lack of information concerning our present situation. Civil Defense no longer means a hard hat and a sand bucket, the dull meetings and the fruitless watching that it did in the past. Such a concept as that very naturally leads to apathy. But the facts are that today the military forces no longer have the job of protecting the lives of American citizens. This change has come about so gradually, perhaps, that you haven't been aware of it. The facts are that their mission is two-fold. First to make the enemy afraid to attack us, and second, if he does anyway, to retaliate overwhelmingly. Now those are the only two missions that the military forces in the United States have got. The actual protection of the people is now a job for the people themselves.

The last Congress has delegated this task to each American citizen by passing public law #85-606. It has been made official. If the enemy attacks his country, (and remember, the Army, Navy and Air Force frankly admit that they cannot prevent such an attack),

then it is up to each citizen to protect himself and his family. This he can do if he becomes an active participant in Civil Defense. In his community he cannot even save his own life except by such participation in the event of war. It is not the job of the government to protect him. It is the job of the government to show him how he can save himself and his family, through the leadership and guidance of Civil Defense officials at all levels. This new state of affairs not only comes as a surprise to many citizens, but apparently to a good many members of Congress who last year appropriated only twenty-seven cents for Civil Defense—that is to actually protect the life of each man, woman and child in America. At the same time, however, for each American citizen they spent two hundred and seventy-five dollars on the military forces to ensure that the death of each one of us would be avenged. In time it is going to become evident to our legislators at all levels, that in so far as the survival of this country is concerned, Civil Defense is quite as important as the Army, Navy, and Air Force put together! And then we may expect that these expenditures will come into a little bit more realistic balance.

Meanwhile we must get to work. The Civil Defense task which has been given to mosquito abatement districts and to pest control operators is to insure that every hospital in California, every aid station, all medical facilities, will be decontaminated from fallout, whether it be radioactive, biological or chemical, as quickly as possible after an attack occurs. Without your assistance, it will be impossible to use our hospitals for many days after they are very badly needed. I can think of no more important task in the entire field of Civil Defense than that which has been alloted to your organization, to your operators. A crew of your operators, for example, may be able to bring back a five hundred bed hospital into operation two weeks before it might otherwise be possible. In that period, in that one hospital, under wartime priority of treatment, two thousand lives can be saved. Can you imagine a more worthwhile job?

Your operators need for this job both organization and training. Decontamination will have to be done. The job will not be easy; it might even be dangerous. All the more reason for training. You have now a great deal of the know-how on procedures related to chemistry and decontamination. You have the equipment and you are familiar with its operation, and you will be successful, if you all try.

Don't fall for the three schools of thoughtlessness. These are: First, that "It can't happen here"; Second, "If it does, there isn't anything that we can do about it"; and third, "If war comes, the government will provide." Each of these ideas is as phony as a three dollar bill. It is very interesting to read history and to note that prior to every one of our wars, people were saying that it can't happen here. The enemy may attack. If you read newspapers, you will know hat the international situation, throughout the cold war for the last five or ten years, has been pretty grim. If it does happen, there is a great deal that we can do about it, and the people that believe in the third school, i.e., that if war should come, they would get a little package from Uncle Sam marked "Civil Defense—Little Gem Model: Open on this end," are doomed to disappointment.

First, I beg of you to act as good citizens. This means that you can be active in Civil Defense; that you can urge others to do likewise; that you can inform yourself and your family on the subject of Civil Defense; that you can build and equip your own fallout shelter. You can also insist that your local laws be so modified so as to permit shelters to be built. After that, comes your duty as mosquito control operators and decontaminators. Form your local teams; coordinate with your local Civil Defense director; get the necessary training. (Dick Peters and a group of his did so just a month ago at Treasure Island) and then start teaching your own classes. Tell yourselves that, whatever comes, you will be ready to do your part to insure the survival of your own family, your own community, and your own country. Thank you.

Mr. Peters: Thank you again, Dr. Coggins, for your excellent presentation. I think it is evident to all that civil defense has not offered us a complete coherent and understandable pattern of how to proceed in the past. Our speakers have pretty well made it evident why. To a very great extent civil defense depends upon initiative of people and their acceptance of responsibility. I feel that we, having been committed to this responsibility, can certainly accept it and ready ourselves to do our part. By such acceptance, I feel the entire civil defense structure can be strengthened and made more meaningful. So, my plea to you in my official capacity, and, likewise, as a fellow worker, is to start out by inquiring locally as to your civil defense organization and to get registered there. Get yourselves officially linked to the civil defense program. There are several good examples among the mosquito abatement districts in regard to civil defense. Art Cavanaugh has already been cited as one. Some of you who have not recently visited the Consolidated Mosquito Abatement District should do so to see the degree to which they have extended themselves as a partner in the civil defense program. The San Joaquin Mosquito Abatement District has not only accepted its decontamination responsibility, but almost to a man they have also equipped themselves as detection technicians, above and beyond their vector control and decontamination responsibilities. Some of you have made the move. I would feel much more comfortable in my official relationship if this move got contagious and we all were a party to it to the fullest extent.

We also have the responsibility for emergency vector control and decontamination training, and are hoping to offer such training through the agency of the Bureau in the forseeable future. We will draw upon such people as Mr. McLarty and Dr. Coggins, as they can be made available. But to illustrate how limited the Civil Defense program is financially, they both had great difficulty in securing funds in order to come to this meeting.

It has just recently been made known to us that such vital items as gas masks of use in this modern age of chemical, radioactive and biological hazard, are just now becoming available. One of the conditions entitling an agency to receive masks, even for such as you who are linked to this program, is that you become trained in fulfilling your responsibility.

I will turn this meeting over to President McFarland. I wish I had an opportunity to ask for questions on this subject, but we just can't do it in the time available.

Pres. McFarland: I think, Dick, that you are session chairman this afternoon, if Art, Dr. Coggins and Mr. McLarty could come back after lunch, would take a

few minutes if there are some questions which people would want to ask.

The buses are ready to depart from the door to your right as you leave for the equipment demonstration. Be back here at one-thirty for the afternoon session.

(Adjourn for equipment demonstration)

ALTERNATE SESSION

TUESDAY MORNING, JANUARY 26, 1960

An "Operator's Session" under the chairmanship of E. L. Geveshausen, Foreman of the Southeast Mosquito Abatement District was held concurrently with the CMCA Business Meeting. The proceedings of this operational session were not recorded, but the following papers were submitted for publication.

IN-SERVICE TRAINING FOR OPERATORS

ROBERT E. TURNER

Superintendent of Operations,

Delta Mosquito Abatement District

Although mosquito control programs differ considerably among the many districts in the state, the ingredients for an effective in-service training course can follow the same basic pattern. The important factor in the beginning is to give careful attention to the subjects you expect to include in your program, the persons who will cover these subjects, and finally, and most important, plan close adherence to your schedule. It would seem desirable to assign your administrative personnel to cover their respective areas of responsibility; the manager to explain the general make-up and policies of the district, the entomologist to discuss the mosquito, its biology, ecology and field identification, the superintendent or foreman explains the details of district work, employee responsibility, discipline, etc., and perhaps the mechanic may give some vehicle and equipment maintenance requirements. Remember, a well-planned in-service training program that is an integral part of your total program can pay you dividends later in the form of increased efficiency, happier, more productive employees, and a better control program generally.

Two patterns of training sessions are in general practice. In one, several days are set aside in the spring and the entire program is covered without interruption. In the other, and equally as effective, one subject is taken up at a time, perhaps for only part of a day, and then the men go back to routine work for the rest of the week, returning to the training program at weekly intervals. Either method seems to work satisfactorily, so the choice is yours.

Subjects to be included must be tailored to your program, but, with an eye toward the future development of leadership potential which may lie dormant in some of your men, it seems desirable to begin with a discussion of just what comprises a mosquito abatement district. This may seem like unnecessary repetition to some of your older men, but we find that the old timers need constant reminders of most of the basic rules you will be explaining. In fact, the person giving the class will profit from the review and discussion.

So let's begin by describing a typical district, how it is formed, where the money comes from, the administration (using an organizational chart), official district policies insofar as applicable, and the operators responsibility in the field of public relations. This could constitute your first class and you should pause here for a discussion period.

In the second phase of training we should plan to get into the control program proper. Here is where we must employ the greatest care to explain in detail each segment of the subject under discussion, for this is the area in which you can realize the greatest benefit in the future. The operator must, at this time, be given all the operational knowledge necessary for him to develop his zone program. This should include map making and map reading, record keeping, insecticide handling and application techniques, vehicle respect, equipment maintenance, plus enough basic ecological knowledge and behavioral characteristics of the important species of mosquitoes in your district to enable him to make field identification of these species based on his personal observation or on description by residents of the area. The identification and analysis of his problem, by the operator may leave a great deal to be desired technically, but you will find that as he gains in experience and confidence, your man will be surprisingly accurate in his field problem diagnosis. Now let's pause for an extended discussion period, and let the discussion leader ask questions of the men in order to promote more participation by the group. Only in this manner will you realize fully the value of the time you spend in this phase of training.

The final general division of your training program should consist of a detailed explanation of employee benefits. These generally include paid vacation, compensatory time off for overtime, holidays, and in some districts, retirement plans, insurance policy participation by the district for the employee, workmen's compensation and sick leave with pay. Salary schedules should be carefully explained as well as when and how the men are paid. This is also a good time to get in a plug for the future of mosquito control work locally and in the state.

Bear in mind that sessions in the class room are only a part of the operators total training. If you spend the time with him in the field that you should, he will continue to assimilate that knowledge you have imparted to him formally, and as he further learns while he does his job, you will see the final result of the time you have spent in instruction. We have found one more

to be desirable—keep your men informed of the
nt condition, mosquito wise, in your district. This
g of the "big picture" is valuable in that it gives
men a broad enough appreciation of district suc-
o make them feel more a part of the team—hence
r esprit de-corps.

UIPMENT NEEDS FROM OPERATORS' STANDPOINT

ALBERT H. THOMPSON, *Foreman,*
range County Mosquito Abatement District

e this is only the second time there has been an
ors' session held in conjunction with the
.A. conference, I feel honored to have been asked
part of this panel.
first operators' meeting which was held with
M.C.A. conference at Fresno two years ago, I
very interesting and educational. Although I
een associated with mosquito control for eleven
this meeting introduced many new ideas to me.
that this get-together of the men who actually
control work, keep the vehicles and equipment
dition and fabricate new types of equipment,
be a part of the C.M.C.A. conference in the
I want to compliment Al Geveshausen for the
d job he did in getting together this panel. These
e all experts in their field.
n asked to present a paper on "Operational
ment," I decided the most effective method to
ze its operation would be by way of color slides
f the vehicles and equipment of our District.
d have liked to have presented pictures of other
ts' equipment, but time did not permit.

DIX-WESTINGHOUSE COMPRESSOR AND "PUSH BUTTON" SPRAYING WITHIN COMMUNITIES

-ton Chevrolet trucks are used by our Inspector-
ors. The equipment is basically the same as used
ep and does about the same type of work. They
uipped with a compressed air spray unit. The
supplied by a Bendix-Westinghouse air com-
r mounted on the engine and operated by a pulley
his compressor was introduced to me by Jack
of the Consolidated Mosquito Abatement Dis-
These compressors operate continuously but are
atically regulated and can be set for the amount
ssure needed. The air is pumped into a reservoir
t 100 pounds and from this tank to the insecticide
60 pounds. An air pressure regulating valve con-
e pressure between the reservoir and the insecti-
nk. These compressors have been trouble free
e past three seasons.
se trucks are also equipped with two 15-gallon
for water and oil, and with a hand spray wand
ed by a Kingston valve with fifty feet of hose.
y nozzle is mounted on each side of the truck at
ar for spraying gutters, roadside ditches, etc.
spray nozzles are controlled by the operator in-
e cab with two electric 12-volt Solenoid valves.
witches that operate these valves are located on
the dash within the operator's reach. (That is what we call push button spraying).

HIGH PRESSURE RANCH HAND SPRAYER FOR FLOOD CHANNEL CONTROL

Specialized equipment, mounted on a Dodge four-wheel drive truck, is operated by two men for spraying flood control channels where pressure and volume is essential. Most of the channels that we spray are 60 to 70 feet wide, 25 to 35 feet deep and 10 to 15 feet wide at the bottom. These channels are sprayed from the top of the bank with one man driving and one man spraying. Ten gallons a minute at a pressure of 500 pounds is produced by a Ranch Hand spray pump, driven by a 5 H.P. gasoline engine. Art Geib of the Kern Mosquito Abatement District recommended this four cylinder radial pump several years ago. A heavy duty adjustable trigger action Gun-Jet spray gun, with a fire hose type nozzle is used to produce a jet stream that is able to overcome and to reach the bottom of the channel.

JEEP-MOUNTED HOMELIGHT MIST BLOWER EMERGENCY CONTROL

A Homelight mist blower, mounted on a Jeep is used for emergency treatment of large areas such as dairy farms, pastures, alfalfa fields, flood control channels, etc. The Homelight blower has an air velocity of 150 miles per hour. The rate of spray is adjustable from 0.1 gallon per minute to 1.0 gallon per minute. The horizontal coverage is up to a 300 foot swath. The spray blast is directed by rotating the blower housing.

Additional equipment on this Jeep includes a power take off driven gear pump and spray unit for additional spray coverage. To get the "GO" we need in mud, slush and sand, we have added dual rear wheels using adaptor spools made for this purpose.

WEASEL-MOUNTED HOMELIGHT MIST BLOWER FOR FLOODED AREAS

A second Homelight mist blower is mounted on an Army Surplus Cargo Carrier called a Weasel. This equipment is used for emergency spraying of salt marshes, large dairy pastures, gun club duck ponds and other places that standard equipment cannot reach. With its wide tracks and high sides it can operate in mud, water and rough terrain. It carries a 90-gallon insecticide tank divided into three compartments.

HARDY PUMP AND HOSE REEL FOR ALL PURPOSE SPRAYING

A Dodge four-wheel drive truck has been equipped with a No. 99 Hardie pump, a 75-gallon insecticide tank and 200 feet of hose. This is an all-purpose piece of equipment operated by two men. It is used primarily for spraying catch basins, gutters, drainage ditches, the smaller flood channels, etc. The advantage of this equipment over the Jeep and Chevrolets, is that it has higher pressure, more volume and longer spray hose. This enables the operator to reach and spray out-of-the-way areas where more pressure and volume is needed.

JEEPS WITH AIR COMPRESSOR SPRAY UNIT FOR SUMMER SPRAY ROUTES

The Jeeps are used primarily for spraying gutters, catch basins, roadside ditches and small drainage

ditches. It is a one man operation and he can spray from either side of the jeep.

These Jeeps are equipped with compressed air spray units, air being supplied by a one-cylinder air compressor operated by pulley belts off the power take-off.

In addition to the above equipment the Jeep has the following:

(1) 50-gal. galvanized pressure tank
(2) 18-gal. oil or water tank
(3) 2-gal. spray can
(4) Squeeze bottle
(5) Measuring cup
(6) Strainer and funnel
(7) Spare parts for spray can and valves
(8) Tools (crescent wrench, pliers and screwdriver)
(9) Dipper
(10) Boots
(11) Route map and map of Orange County

NOTES ON SPRAY CANS, VALVES, NOZZL AND SQUEEZE BOTTLES

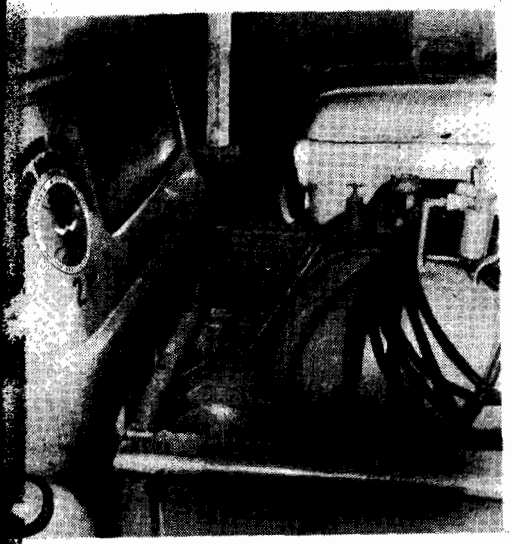
We now use Ker-O-Kil spray cans (galvanized reason I emphasize galvanized is that prior t change we had to contend with rust and consid time was lost cleaning valves and nozzles. At th ent we have no problem. The one on the left is eq with a Kingston valve and a spray system nozzle. The one on the right has a Lofstrand val a spray system adjustable nozzle. Both unit proven very satisfactory. The one quart plastic is what we call a squeeze bottle. It is equipped nozzle screwed in the top of the cap. This is u larviciding small spots.

DIPPERS WITH GOLF CLUB HANDL

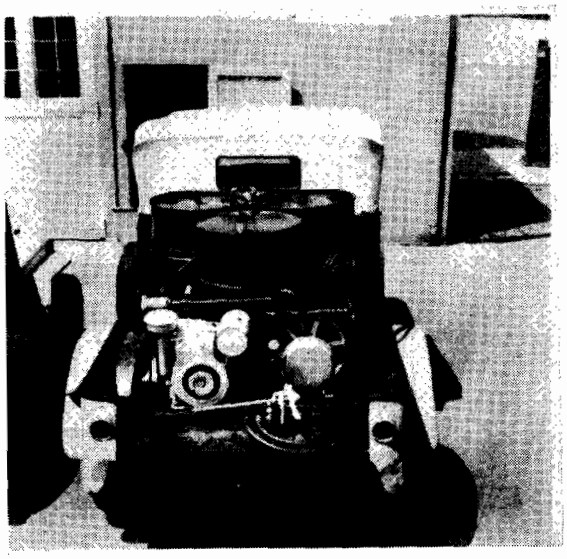
Why would I show a dipper? Everyone kno a well known piece of equipment used in m control work. This dipper is unique by the repla of the wooden handle with a golf club handle w brazed on. These are broken golf clubs and ar able at any golf course.

EQUIPMENT NEEDS FROM OPERATORS' STANDPOINT

Photographs

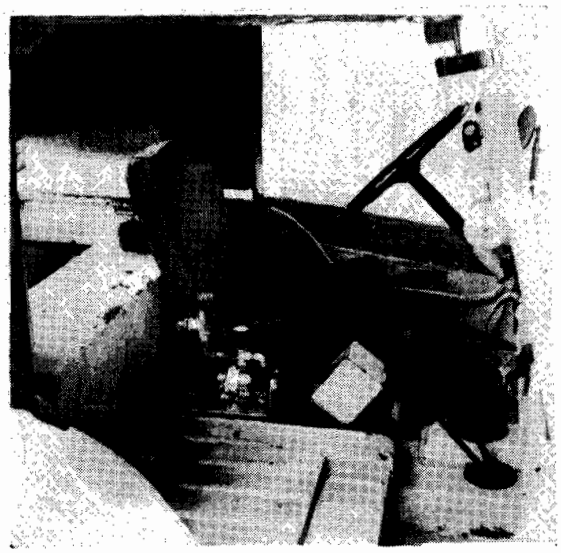


noid valves above air reservoir
. Insecticide tank to right.



High pressure Ranch Hand Sprayer for Flood Control Channels.

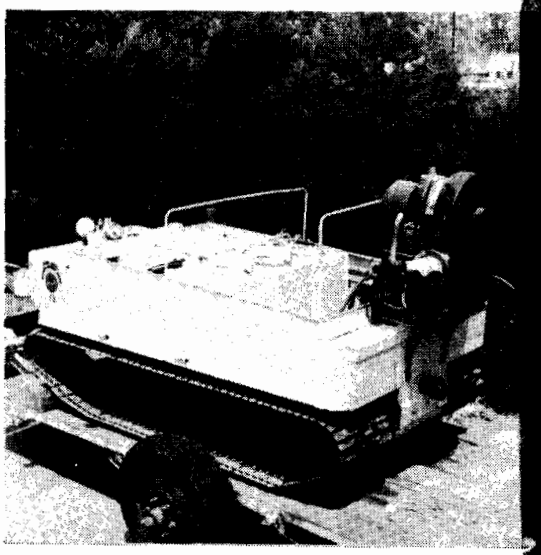
mounted Homelite Mist-Blower for
rgency control.



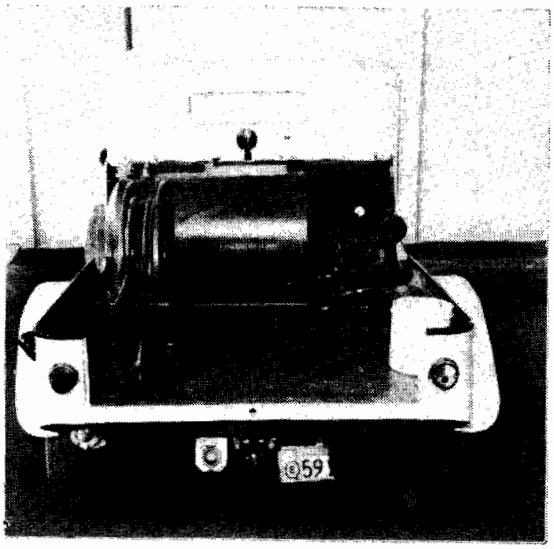
Power take-off gear pump and spray unit mounted in Jeep.

EQUIPMENT NEEDS FROM OPERATORS' STANDPOINT
Photographs

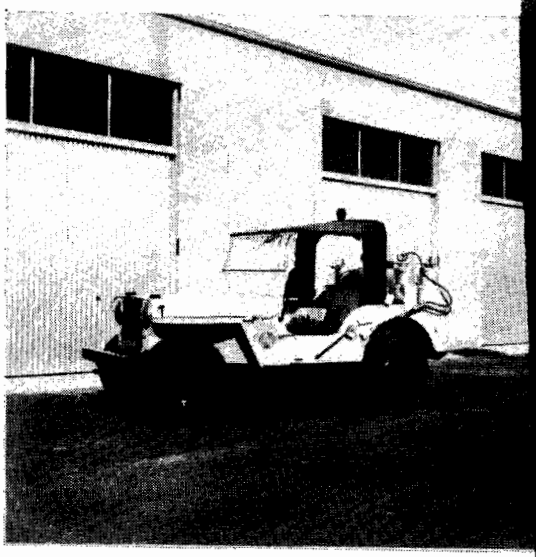
Adapter Spool for mounting dual wheel.



Weasel mounted Homelite Mist-Blower f
flooded areas.



Hardie pump and hose reel for
all purpose spraying.

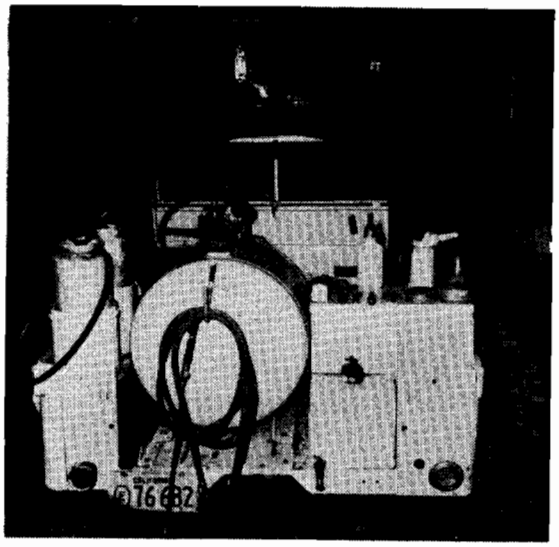


Jeep with air compressor spray unit f
summer spray routes.

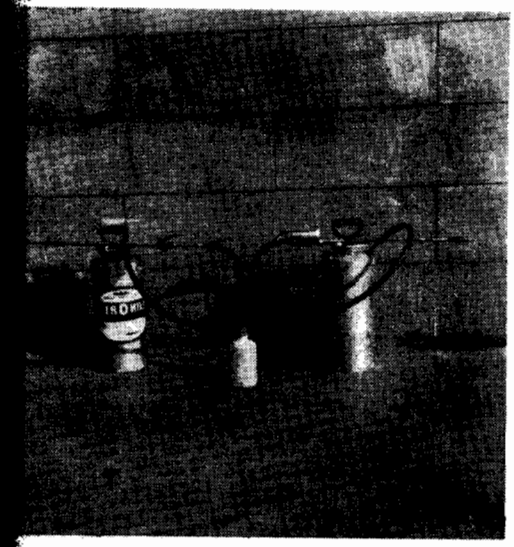
EQUIPMENT NEEDS FROM OPERATORS' STANDPOINT

Photographs

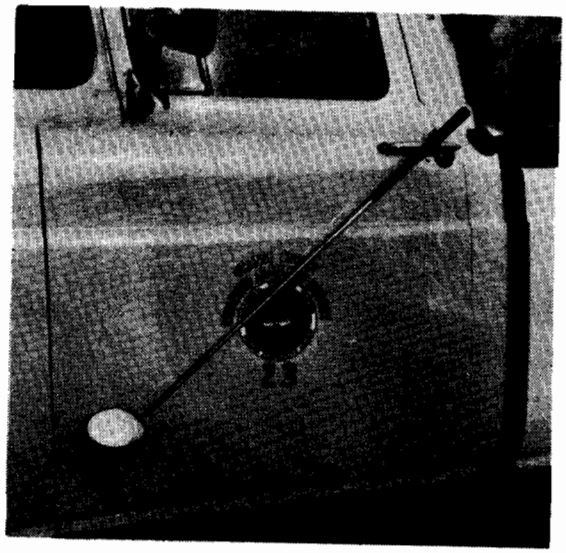
linder air compressor operated
ly belts off the Jeep power
off.



Equipment carried on all District Vehicles.



ized spray cans, Kingston Valve,
rand Valve and "Squeeze Bottle".



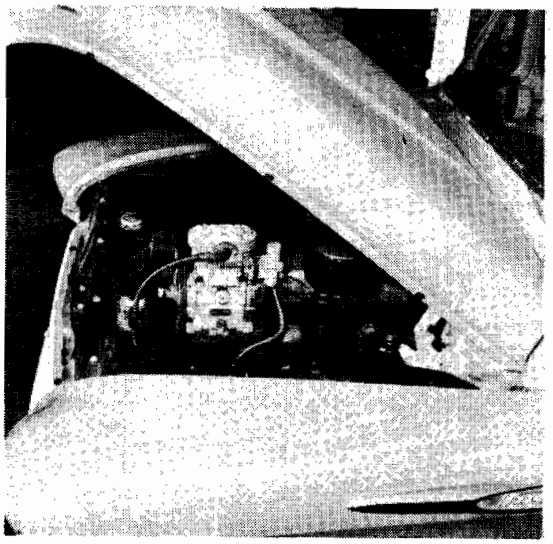
Pint dipper with golf club handle.

EQUIPMENT NEEDS FROM OPERATORS' STANDPOINT

Photographs

Orange County Mosquito Abatement District mobile equipment. District Office in the background.

Inspector-Operator equipment, Distri Shop Building center.



Bendix-Westinghouse Compressor mounted on motor of Chevrolet truck.

Equipment mounted in pick-up truck use of Inspector-Operator. Insecti pressure tank, water barrel and oil barrel.

FOURTH SESSION

TUESDAY AFTERNOON, JANUARY 26, 1:30 P.M.

President McFarland: The meeting is now called to order. As you know, this morning we had to cut our Civil Defense Panel slightly short due to scheduled buses that would not permit us to run over. We promised to give you a chance to ask questions as well as to give the panel a chance to ask questions of each other. At this time, I would like to turn the meeting over to Dick Peters of the Civil Defense Panel, and session Chairman for the afternoon.

Mr. Peters: Thank you, Gardner. We are now glad to be able to resume with a bit of time on civil defense. We left in sort of a hurry, and were unable to capitalize upon the sort of emotional response to be expected from a subject of this kind; however, if you can nudge the food aside, recover your wits, and make believe this is eleven thirty in the morning, we would be glad to have you ask the questions you were about to ask at that time. Mr. Koch, would you like to make a comment?

Mr. Koch: Gentlemen. After listening to the comments this morning, I have been meditating upon this. At the trustee level, at least in the district to which I belong, Orange County, we find that many of our trustees function in dual capacities. They are municipal employees, and in some cases, they do it to work with their civil defense director. For those of us who are not municipal employees, I propose to urge my Board when we get back home to establish a mechanism with the local government of which we are representatives. With this in mind, I feel that it will give our trustee members a first-hand acquaintance with our civil defense problems that we do not have at present. In our community where I live, San Clemente, the local director is our fire marshal. I feel that I would quite like to attend meeings such as those he surely must attend to acquire the necessary association of thought that I feel our people should have.

Mr. Peters: Thank you. Perhaps Mr. McLarty might benefit us with a description of how local is local, in terms of the civil defense organization. I think Mr. Koch has raised the question, or implied at least, that there could be some cross-connection of responsibility, depending upon one's vocational identity. Bill, would you like to tackle this question of registration locally? How do you achieve occupational identity and where is your first loyalty?

Mr. McLarty: That is a king-sized problem, because as I understand it, some of the districts may extend beyond county boundaries or joint city and county boundaries. I would suggest that the next higher echelon in which you are located would be the organization to which you would apply for admission to this civil defense effort. If your district is wholly within a single county's boundaries, then your association would be with that particular county. Should it extend over the boundary into an adjoining county, then I think we would have to do something about either associating ourselves with the largest civil defense organization of the two counties, or attempting to go into a sector organization. We have sector offices which are again geographical subdivisions of the regions which we showed you on the map, so that in some cases you could sign up presumably with one of our sector offices. This would be at the state level, below the regional level, but as agents of the state. We are attemping to iron that out now with our Sacramento office, to see if these districts which do go over more than one county boundary, or into two county areas, couldn't be assigned to a sector, or our regional offices, and work on that basis.

Mr. Peters: I think the important thing is not to let yourself get strayed from the two commitments which have been made, namely: decontamination of medical and public health facilities, and vector control under natural and artificial conditions. Whatever mechanism you achieve locally, stick to those two designations.

If there are no other questions to the panel members . . . Dr. Coggins would like to ask his own question.

Dr. Coggins: One point, ladies and gentlemen, that I think maybe we did not emphasize enough this morning is the shelter program. Our concern in the matter of shelters is this: Because ninety percent of our doctors in California live on target (so that we may be faced with a great shortage of medical skills), I ask the members of the county medical society to first prepare themselves a home shelter. A great many of you similarly live on target and of those who do not, a great proportion live in an area which can be affected by fall-out. You have only to refer to the literature which you can get from your civil defense director to determine the hazard from fall-out in your home community. It is true that this fall-out cannot be seen, smelled, or touched, but it can kill you just the same. I am talking about being available to do your job. If you first do not insure your survival ,there isn't much use of your being in an organization, because you won't be there to do the work that we are going to count on you to do. So, for this purely utilitarian reason, will you please very seriously consider the matter of fall-out shelters for yourself and your families.

My reason for mentioning this is that whenever we count on highly technical people—highly trained people—in our civil defense planning, we feel that we must emphasize to them their responsibility as citizens.

Mr. Peters: Panel members, once again, thank you. We will now adjourn the civil defense panel and make way for other fine things to come.

Since I have been more or less doubled up, first in the role of panel moderator and now as chairman of the afternoon session, I admit to having looked forward to the latter because it enables me to delegate authority and responsibility. I am now pleased to be able to make this delegation, both as a session chairman this afternoon and also in an official relationship. The gentleman to whom I am about to delegate the responsibility carries the aquatic title of "Water Projects Specialist" in the Bureau of Vector Control. So, Marvin Kramer, one of our newer Bureau members, but one who has

run the gamut in past experience, ranging from Federal to local to State employ, and his panel will now take over on "Cooperative Endeavor Between Mosquito Abatement and Conservation Agencies."

Mr. Kramer: Thank you, Dick. Members and friends of the Association: first of all, I would like to say that it is a distinct pleasure to meet again with the Association and my many friends in it.

I would like to introduce the members of the panel. We have some very fine talent assembled here for our discussion of the panel subject. Mr. Barnes, would you come up, please? Mr. Barnes is currently the Chief of the United States Soil Conservation Service in California. He started out in California a few years ago. Immediately after his graduate work in California, he helped to establish what is now the Institute of Forest Genetics at Placerville. After three years with this Institute, being young and adventurous, he decided to see what some of the foreign soils were like, so he did some soil and water conservation work with the Goodyear Tire and Rubber Company at a rubber plantation in Sumatra and the Dutch East Indies. From there he came back to Washington, D. C. at the time of the organization of the Soil Conservation Service and has been identified with that service since. He came back to California from Washington, and for the last sixteen years has been in charge of the soil conservation work in California.

Mr. Sweet—your program calls for Mr. Bonderson; but Mr. Bonderson called a couple of days ago and said, with all due apologies to the men from South Cook County, that unfortunately he had to go back to the Chicago area. He would much rather be in California at the present time. Mr. Sweet is the Assistant Executive Officer of the State Water Pollution Control Board and comes on very high recommendation. He has been with the State Water Pollution Control Board since its inception ten years ago. Before that he had been the Engineer and Secretary of the Orange County Sanitation District, and that is the reason he is a good friend of Jack Kimball's, which is another recommendation. He was born in Pennsylvania, but at a very young age he moved out to California, and that is another recommendation.

Mr. Cutts—Mr. Cutts is presently the County Manager of the San Joaquin County Agricultural Stabilization and Conservation Committee, a job he has held since 1943. Before that, he had been Field Manager for three years, and he is a home grown product. He was born and grew up in San Joaquin County, had some farm experience there and is well qualified to recognize the problems of San Joaquin County and to know and be effective in the cures for those problems.

I heard a definition a couple of weeks ago of the types of speeches that are prepared for a meeting of this kind. One is a nightgown address, and that covers the subect pretty well from head to toe. Another is a girdle speech, that is elastic but is somewhat restrictive and covers the bare essentials. And then there is the brassiere speech; that just hits the high points. I think in view of the fact that we are starting a little bit late, we had better just hit the high points. The title of this panel is

COOPERATIVE ENDEAVOR BETWEEN MOSQUITO ABATEMENT AND CONSERVATION AGENCIES

Panel Moderator: MARVIN KRAMER

Mr. Kramer: That you have long recognized the importance of healthy working relationships with other agencies is evidenced by the number of appearances at your annual conferences of papers, panels, and symposia on the subject.

Webster defines cooperation as: "The association of a number of people in an enterprise, ..., the benefits or profits of which are shared by all the members." Those benefits or profits are in direct proportion to the degree of sincere application by each of the participants. Cooperation is not a passive condition of chance occurrence, filed away neatly for observation and reassurance. It is continually in a state of mobility, and it must be nurtured constantly, or it will wither and die.

We are very fortunate in having on this panel, representatives of agencies that can be instrumental in furthering the effectiveness of the work of mosquito abatement agencies; so we would like to explore these opportunities, and demonstrate good faith by exploring also means of reciprocation. There are federal, state, and county organizations here, each of which has an important relationship to mosquito abatement agencies.

And now I would like to call on Mr. Barnes to speak on co-operative relations with the Soil Conservation Service.

Mr. Barnes: Thank you, Marv, very much. It is certainly a pleasure for me to be with you. I have already run across many of your members who are also directors of soil conservation districts in the State, and with whom we have been working for several years. We have also had very fine working relationships with the mosquito control people for a long time.

Before going ahead with this brief statement that I have here, I would just like to mention the manner in which the Soil Conservation Service works with Soil Conservation Districts and other agencies and districts. There is some confusion: sometimes it even gets into the press. We are a Federal agency that has no program. I am embarrassed at times because representatives of different agencies get up and say "program of our agency," and the Soil Conservation Service has no program. We are in an assisting capacity in a number of programs. The Soil Conservation Districts have their programs and we assist those districts in various ways. Flood Control, and Water Conservation Districts have programs and we assist various ways under Federal legislation. And we assist ACP in its program, and even at the State level, by California State Law, the position I occupy is as advisor to the State Commission. There again, I have no program. But we do try to give assistance in soil and water conservation and related problems to these various organizations and agencies.

COOPERATIVE RELATIONSHIP BETWEEN MOSQUITO ABATEMENT AND CONSERVATION AGENCIES

JOHN S. BARNES

California State Conservationist

U. S. Soil Conservation Service

A review of the Proceedings and Papers of the annual conferences of the California Mosquito Control Association shows many references to the importance of farm irrigation and drainage in mosquito control programs. In fact, I presented a short statement at your 1952 conference on the subject of Mosquito Abatement and Soil and Water Conservation. The California Vector Views of July, 1959 contains an article by Fred Haughton of our State Staff on Soil Conservation and Mosquito Aabtement Teamwork in solving Water Management Problems.

We have made a lot of progress during the past decade in working together for the improvement of farm irrigation and drainage which has resulted in important advances in both water conservation and mosquito abatement. However, the problem is one requiring continuous attention on presently irrigated lands and will also be a major problem on other lands to be brought under irrigation as additional water supplies become available.

Fortunately, the objectives of soil and water conservation and mosquito abatement go hand in hand. In the flat, poorly drained areas, such as much of the Central Valleys, mosquito problems are severe and are also the areas where Soil Conservation Service activities are largely those of improved irrigation and drainage. The beginning point of our technical assistance program to a farmer-cooperator in a Soil Conservation District is a detailed soil map. With this as a base, we are able to assist him in designing or redesigning his irrigation layout for efficient use of his water, adjusted to the soils and crops to be grown. Hardpan soils are a problem through much of the Valley areas and present problems in land leveling and water application which must be given careful consideration, if ponding and other conditions favorable to mosquito breeding are to be avoided.

Water is a precious commodity in California and it is becoming increasingly important that all available water be used witn maximum efficiency. We have a long way to go to bring this about. Today, in the West, I am told that for every acre of water that our crops use, between one and two feet are lost on the farm. That is to say, we must deliver two to three acre feet to the farm headgate in order to get one acre foot to the plant roots. If we look at our irrigation projects as a whole here in the West, we find that about four acre feet have been diverted at the project source for every acre foot actually used by the crops. It is apparent, from these figures, that we should do a better job of applying irrigation water.

In our work with farmers, we are emphasizng particularly the design of the irrigation layout and the timing of water applications, based on detailed soils information and on the crops grown. We cannot design a 100% efficient irrigation system, but we do know that it is quite practicable to design and operate irrigation systems that will operate at 65% efficiency, that is about 65% of the water applied to the field will end up in the root zone for plant use. Of the remaining 35%, on the average, about half will go into the deep soil strata, while the remainder, or about 17%, will go off as tailwater. On shallow hardpan soils, the amount of tailwater may, of course, be much greater. This brings us to the problem of farm drainage, which is also one of the principal problems with which you are concerned in mosquito abatement.

The disposal of excess irrigation water is an essential part of any conservation farm plant for irrigated lands. One of the most efficient tailwater disposal systems, and which is being increasingly used, is that of constructing a sump at the lower end of the fields where tailwater is collected and pumping it back into the irrigation system. The installation of tile drain systems, tailored to the porosity of the soil, are becoming increasingly used in the Central Valleys. Group, or community, drains for disposal of excess water from a number of properties are being used extensively and present particular problems of ultimate disposal where pollution is involved.

The degree of success which our technicians are able to achieve, in working with farmers on their irrigation and drainage problems, is dependent, to a considerable extent upon the programs and help of other agencies. While the Agricultural Conservation Program is represented here on our panel, I wish to specifically mention the importance of the ACP to the work which we are doing in land leveling, irrigation layout and the installation of pipe lines and tile drains. Without the ACP incentive payments for these practices, many farmers would have been unable to carry out their farm conservation plans.

Mosquito abatement personnel have given us much practical information on mosquito breeding habits which has enabled us to do a better job in making water management plans. Mosquito abatement districts have made it possible to complete many group drainage jobs which could not have been accomplished without this cooperation. I recall one incident where a property owner refused to participate with the group and the entire project would have failed had not the Mosquito Abatement District moved in and secured the necessary right-of-way. We look to your Association and the staffs of your member Districts to keep us up-to-date on technical information which will enable us to do a better job of farm water every day, are provided with guides which we endeavor to keep up-to-date with the latest technical information bearing on the problems of the particular districts with which they are working. As additional information becomes available on any aspect of mosquito abatement work, which can be put into practical application by our technicians working with farmers, we would certainly appreciate receiving it as soon as possible.

I know of no phase of the conservation program here in California which has had such whole-hearted cooperation as that which we have experienced in working with the Mosquito Abatement people. We look forward to continuing this very profitable cooperation and extending and intensifying it at every opportunity.

Mr. Kramer: Thank you, Mr. Barnes. I can say from

personal experience that I can see why there has been good cooperation between soil conservation districts and mosquito abatement districts. They have been excellent people with which to work. There are some points which I would like to enlarge upon in that excellent address by Mr. Barnes, but I will defer all discussions until we have heard from all of these gentlemen.

I will now call now on Mr. Sweet.

Mr. Sweet: Paul Bonderson has asked me to express his disappointment at being unable to be here. Unfortunately, the Public Health Service called a conference of State Water Pollution Control Administrators in Chicago, and Paul had to be there. I can assure you that he would rather be here. However, it is my pleasure to take his place. I don't exactly feel like a total stranger here, because a number of years ago I shared an office with Jack Kimball in the Orange County District. I ask your indulgence as I read the statement that has been prepared.

PROBLEMS OF MUTUAL CONCERN TO CALIFORNIA'S MOSQUITO ABATEMENT DISTRICTS AND WATER POLLUTION CONTROL BOARDS

C. A. Sweet

At the very outset of our interchange of ideas today, we want to make it very clear that we believe those of you who work in mosquito abatement and we who work in the control of water pollution have much in common, and certainly have common goals. Our intermediate objectives as well as techniques and methods may differ, but our ultimate objectives, namely the health and welfare of the people, remain the same. To achieve these objectives, there must be appropriate management of both water quality and quantity. Pollution control is one phase of water quality management. Mosquito control involves another phase. So you can readily see that our interests overlap.

Out of these areas of mutual concern arises the very real and practical problem of how we can be of mutual assistance to each other in achieving the end results in which we are both interested. What I have to say this afternoon will be our attempt to show, as concretely as possible, how we might assist you and how you might assist us.

First, let me briefly explain our organization and how we operate. Decentralization characterizes California's rather unique water pollution control program. In addition to the state board there are nine regional boards. The regional boundaries are based on major watershed areas and are shown in Figure 1.

Within each region there is appointed by the Governor a seven-man regional water pollution control board. Six of the members are selected from the fields of: water supply, irrigated agriculture, county government, city government, industrial waste, and recreation and wildlife. The seventh member represents the public at large. It is intended that this broad representation will provide an equitable balance in pollution control activities—activities that must consider both economical waste disposal and preservation of the beneficial uses of water.

The State Water Pollution Control Board consists of 14 members. Nine are appointed by the Governor from seven designated fields, namely: water supply, irrigated agriculture, county government, city government, industrial waste, industrial water use and public sewage disposal. The remaining five members are the State Directors of Agriculture, Fish and Game, Natural Resources, Public Health, and Water Resources. And, as in the case of the regional boards, representation on the State Board is designed to provide a balance of the interests of the water user with those of the waste discharger. A total of 12 major fields of interest are represented on the State Board.

In their control work, the regional boards have always enjoyed almost complete autonomy and have been assigned the primary responsibility for controlling water pollution within their respective regions. As regulatory agencies, they have three principal duties: (1) formulating and adopting long-range plans and policies for control of water pollution, (2) setting and enforcing waste discharge regulations, and (3) coordinating the interests of other agencies. The State Board, serving in an advisory and appellate capacity, is directed to: (1) formulate and adopt statewide policy for control of water pollution, (2) review acts of a regional board where the regional board has failed to take or obtain appropriate action to correct a condition of pollution, (3) administer statewide programs of research or of financial assistance for water pollution control, and (4) allocate funds for the administrative expenses of the regional boards.

The boards follow four steps in controlling pollution. They are:

First, enunciation of beneficial water uses which the board intends to protect.

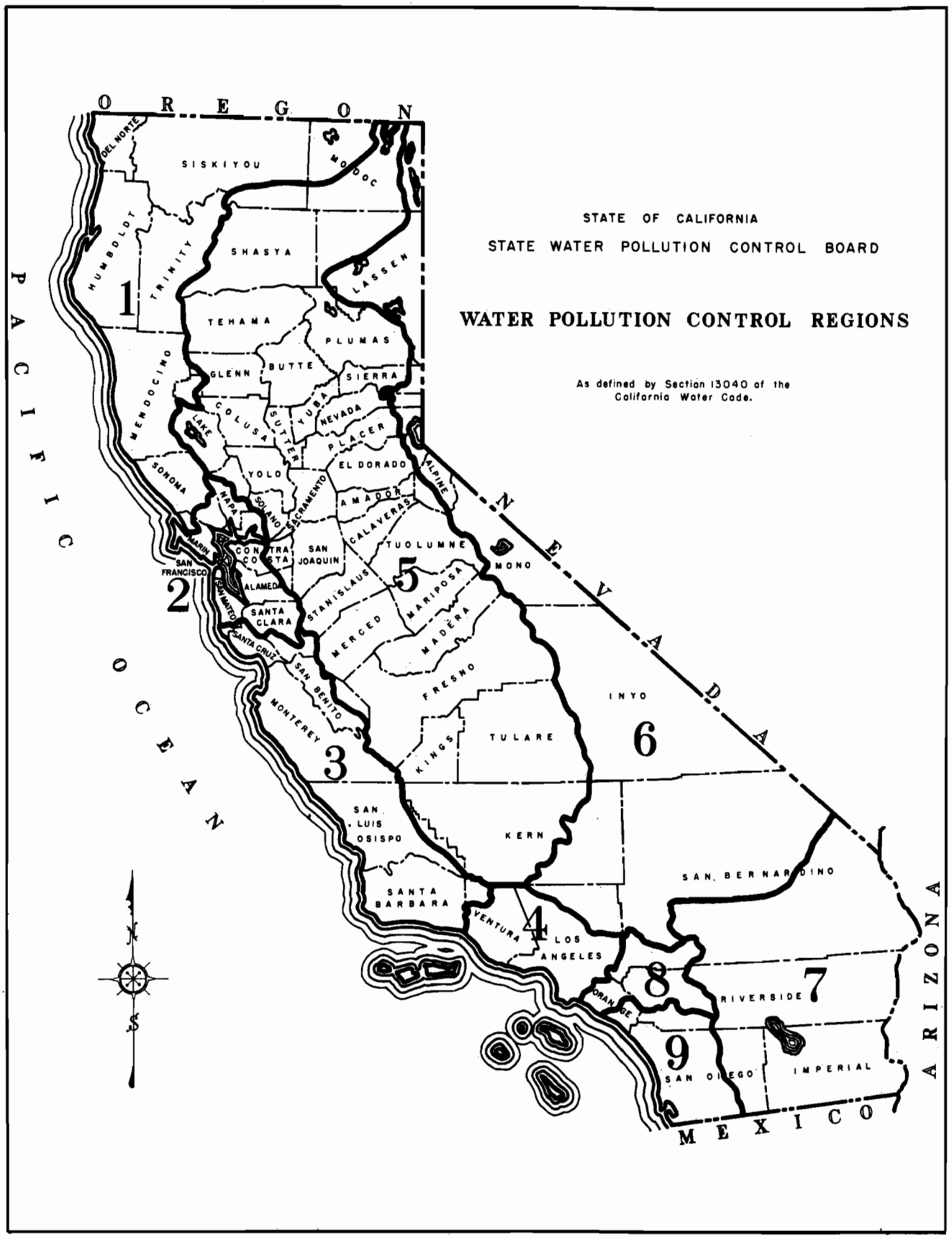
Second, definition of water quality criteria to protect beneficial water uses.

Thirdly, prescribing discharge requirements.

And finally, checking and enforcing compliance of requirements.

These four steps are inter-related, and all are important functions of the boards, but the most important for us to consider today is the prescribing of waste discharge requirements, for it is here that the water pollution control boards can render significant assistance to the mosquito abatement people.

The prescribing of discharge regulations is a statutory responsibility—and almost a daily duty—of the regional boards. (The State Board may prescribe requirements, but only in the event that a regional board failed in a specific instance to take or obtain appropriate action to control pollution.) A prospective discharger of sewage or industrial waste is required to file only one report consisting of a simple, single-page form. The board forwards copies of the form and any other pertinent data to all interested and affected parties, thus starting the process of coordination. Where facts are lacking, the board asks state or local agencies to make special technical investigations. Before formulating tentative discharge requirements, the board invites comments and recommendations from interested agencies, and informal or formal hearings may be held to develop additional facts. All parties are noti-


STATE OF CALIFORNIA
STATE WATER POLLUTION CONTROL BOARD
WATER POLLUTION CONTROL REGIONS
As defined by Section 13040 of the California Water Code.
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
MENDOCINO
COLUSA
SUTTER
YUBA
NEVADA
LAKE
PLACER
SONOMA
YOLO
EL DORADO
ALPINE
NAPA
SOLANO
SACRAMENTO
AMADOR
CALAVERAS
MARIN
CONTRA COSTA
SAN JOAQUIN
TUOLUMNE
MONO
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
MADERA
SANTA CRUZ
FRESNO
INYO
SAN BENITO
MONTEREY
KINGS
TULARE
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
1
2
3
4
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8
9

FIGURE 1

fied when the board meets to prescribe the final discharge requirements. Then, the third step in pollution control process is completed with the waste discharger receiving a single set of requirements.

In developing certain discharge requirements there may well be existing or potential mosquito control implications which the regional board should consider. To insure that these implications are not overlooked, it would be well for the mosquito abatement district to bring pertinent facts to the attention of the board's staff. When such oversights do occur, they are not only embarrassing to the regional board, but are detrimental to the best interests of the people in the area, the waste discharger, and the mosquito abatement district.

Although every attempt is made by the regional boards to incorporate into their requirements the recommendations of interested parties, this cannot always be done because of legal limitations. However, the boards can, and frequently do, advise the discharger that he must conform to the desires of other agencies even though these desires are beyond the scope of the boards' legal responsibilities. Thus, through the mechanism of the boards' coordinating role, the discharger can be alerted not only to rules and regulations of other agencies, but also to the recommendations which may be merely good practice without legal sanctions.

Consequently, it would be most helpful to us (and to you, too) if we had information from you, which would make us aware of your interest in a particular situation and would aid you in your mosquito abatement and control work. Although we could not require that the waste discharger incorporate your suggestions into his sewerage design, nevertheless we probably could do much educational work for you by calling attention to your problems and your recommendations for their solution or mitigation. As a further adjunct to closer mutual cooperation between our two groups, I would like to suggest that, (if you have not already done so) you contact the executive officer of the regional board within the boundaries of which your district is located and let him know that you would like to be notified when he is considering matters which may include potential or existing vector problems in your area. I am sure that he will welcome any suggestions you may have concerning particular waste discharges and will be more than happy to establish a close working relationship with you. If any of you are interested, I have brought copies of the list of names and addresses of all of the regional executive officers.

We would like to mention one area in which we need —and solicit—your cooperation.

There is a growing concern among water pollution control people about the widespread use of pesticides. This concern extends not only to the direct spraying of water, but to the indirect effects on water caused by spraying or dusting vegetation—namely, entry of the residual chemicals into bodies of water through drainage systems or natural run-off. Reason dictates that insecticides deposited year after year on uplands will eventually get into lakes and rivers. Many of the compounds which are used extensively to control field and forest insects have long residual activity and low solubility in water.

Several instances are on record from various places in the United States where insecticides accidentally have been released over streams and have resulted in severe damage to aquatic life. Sometimes these applications have been made purposely, with damaging side effects. In 1955, such an incident occurred in St. Lucie County, Florida, where 2,000 acres of salt marsh were treated with dieldrin at the rate of 1 lb./acre for the control of sandfly larvae. The fish (in the canals bisecting the marsh) that were killed as a result of this treatment were estimated to weigh a total of 20-30 tons, and repopulation did not begin for at least four weeks. Aquatic crabs and other crustaceans apparently suffered near annihilation.

There is evidence, too, that insecticides washed from the soil by rains have entered surface waters and caused damage. In 1950, fish were decimated in 15 streams tributary to the Tennessee River in Alabama by toxaphene and other insecticides applied to cotton fields. Two of these streams were sources of municipal water supply, however, there was no evidence of adverse effects on humans. The daily deaths of goldfish, suspended in cages in the river at one of these water intakes, showed that passage of the toxic water required at least a week.

Mass killings of fish readily come to the attention of the public, but there may be more insidious damage. In 1953, scientists at the Robert A. Taft Sanitary Engineering Center in Cincinnati recovered DDT from the Detroit River and Lake St. Clair in both the raw and treated water. DDT was present in the initial sample taken in January and persisted in samples collected over a six-month period. It was recovered also from waters of the Mississippi River at Quincy, Illinois, and at New Orleans; the Missouri River at Kansas City, Kansas; and the Columbia River at Bonneville Dam, during the months of April, May, and June, 1957. It was presumed that large-scale insect-control operations were the source of the DDT, which was estimated to have been present in amounts varying from 0.001 to 0.02 ppm.

There is no record that aquatic life suffered from the presence of this DDT, although it is doubtful that an investigation was made. It can only be speculated that losses may have occurred. These losses need not have been to fish directly, but to their food supply. Therefore, the effects on aquatic organisms of the minute amounts of insecticides that trickle into rivers and lakes may be no less catastrophic in the long run than the sudden appearance of lethal quantities of these compounds. This possibility remains to be more fully evaluated.

Out of all this it seems reasonable to conclude that there is cause for concern about the possible long-range effects that repeated use of insecticides will have on water quality.

We have brought these things to your attenion so that you may be aware of our concern with the problem and its implications. I am sure that you can appreciate this concern, especially when insecticides are applied indiscriminately. Before initiating any large scale operation, particularly when repeated applications are contemplated, we would certainly encourge you to informally discuss the situation with regional board staff and get their ideas on the water pollution aspects of such an operation.

In conclusion, we would like to again call your attention to the fact that we are dealing with problems of mutual concern and that it is to our mutual advan-

tage to continuously seek out means for a cooperative approach to these problems. We can help you and you can help us. The best way to translate this idea into meaningful practice is to establish close liaison between the mosquito abatement districts and the water pollution control boards. I personally know that such a relationship already exists between a number of your districts and our control boards. There is no reason why this cooperative relationship can't be expanded.

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Mr. Kramer: Thank you, Mr. Sweet. We want to come back to you. It seems that there are some awfully modest people in mosquito abatement districts and some of the agencies with whom they cooperate. We have known for a long time about some excellent co-operative projects that have been taking place in San Joaquin County. We can't get Bob Peters to talk about them, we can't get Les Brumbaugh to talk about them, and Mr. Cutts said, "Well . . . . I don't like to make speeches, particularly; but, if you insist, we don't want to do anything to damage the nice co-operative relationships that exist in San Joaquin County, so, all right, I will come and talk to you about co-operative projects that have been going on in San Joaquin County."

We are not slighting Mr. Cutts in not having a slide for him. We discussed having a slide that would show the counties in which there are ACP offices, but every county in the State is represented, so there is no use in merely having a map to show every county in California. Mr. Cutts, could we prevail upon you, please, at this time, to give a summary of the experiences of the San Joaquin ACP office and the local mosquito abatement districts.

Mr. Cutts: Thank you, Mr. Kramer. Ladies and gentlemen; when I am asked, as a rule, to speak on conservation, I become an individual who feels as though I am very, very small. The word conservation is alarming. There is the old theory that we have had for so many, many years: Go west, young man, go west. We find ourselves today on the sands of the Pacific, no frontier left, and the question of what to do. Shall we stand to our furthest adventure? Or shall we go back on something that we have already covered. If we have agricultural interest, farming interest, we have to do one thing. We have to stand where we are and conserve what we've got.

I can't help but feel, from a farmer's standpoint—I will speak for myself and I think it applies for the rest of us, too, when it comes to agricultural interest—in some respects we are guilty, we are selfish. We have taken from the good old earth and forgot to give back. So, the day has come when we have to be conservation minded; not for us as individuals, because after all,

who are we? We are only given the privilege of being able to have agricultural interests whether we own, whether we rent, or whether we're a share-cropper—we are only given a privilege, and a great privilege to take from the good old earth to provide for ourselves and our family. But after we are all done, we have a larger responsibility—to leave again that good old earth for those to follow and have the same privilege. So from that, you can see, we are rather small. And again, I can say personally, I think it applies to a lot of us, practically all of us, we have been a little bit selfish.

Now when it comes to conservation, there is an unlimited field in conservation. That field has been broadened by man himself. He has been ambitious, he has been prosperous from the good old earth; but he has forgotten one thing, and that he has broadened his field in a development program and he has forgotten the most important part, and that is conservation. As an example, to how many of us does this actually strike home? We have had enough foresight, we have had enough ambition to go out and develop a piece of ground, to level it, put it under irrigation, increase its production capacity, but we forgot the most important thing. We managed to have the foresight to get water for irrigation, but we have not had the foresight to have proper drainage and disposition of the excess water. So that is where these conservation measures enter. And your conservation program with the Federal government, more commonly known as the ACP program, is whereby the Federal government has gone hand in hand with agricultural interests to encourage and perform some of these conservation measures, for which we are all responsible to our society and to our nation, to help pay and offset the cost, by, as is commonly known, meeting the Federal cost-share for an overall percentage of your project.

Now, as Mr. Kramer said, when it comes to conservation, I am quite sure that we could stand here for hours and never cover the entire field. So we will have to hit the high spots.

Our relationship in San Joaquin County, I can truthfully say, with the mosquito abatement districts, since their formation, Mr. Bob Peters, of the Northern District, we have worked with him for the first time—when Bob? In 1950? '49. I missed it a year. We started working with him then. Our last contact with Mr. Peters constantly since that date, has been six months ago, on a project. The other mosquito abatement district in the county, is the San Joaquin Mosquito Abatement District, Manager, Mr. Les Brumbaugh. Since its formation and up until the present time, I might say that we have had wonderful working relationships. There has been several and many projects that have definitely, without question, been of common interest, particularly, drainage. Naturally, we all know surplus water and mosquitoes go together. That brings up drainage. As far as San Joaquin County is concerned, I think it is a true fact, statewide, national-wide, there is just an unlimited margin of room for improved drainage. We have had several projects in which Mr. Peters and Mr. Brumbaugh had a particular problem as far as surplus water is concerned, through summer irrigation primarily, and also winter run-off. They in the field saw their problem, started to work on it, got interest created; and then we were brought into the field to see what could be done in the way of a conservation measure in improving the drainage situation. When we ended up, we had a very fine project through the efforts of the mosquito abatement district, my Board of Directors in helping to meet a percentage of the costs, and the co-operation and technical assistance of Mr. Barnes' organization, we had a project that no one could deny and be proud of, and we accomplished the problem. I might say, ladies and gentlemen, we have just scratched the surface.

Now the co-operative efforts, I might say, of the mosquito abatement districts, Mr. Barnes' office, and other local, State and national organizations can only do so much. The biggest responsibility and the greatest amount of effort lies with the individual himself.

Thank you.

Mr. Kramer: Thank you, Mr. Cutts. Some of these practices for which farmers can receive money from the ACP office include weed control, drainage projects, return flow systems and land leveling. So all these are examples of practices which will very materially assist in mosquito abatement and are practices for which the farmer may receive payment from the ACP office.

We have heard the means by which water pollution boards and mosquito abatement agencies can be of mutual help. Mr. Robert Durbrow, Executive Secretary-Treasurer of the Irrigation Districts Association, at the 27th Annual Conference of the C.M.C.A., offered as steps toward attainment of cooperation among agencies: (1) getting acquainted with personnel of the other agencies; (2) exchange of information, and (3) coordinating the program of the agencies to the advantage of all. They seem to me very logical steps, and now we have the offer to become better acquainted with Regional Boards and to develop close liaison, with the ultimate aim of coordinating the programs. I notice that public health is not represented on the Regional Boards. Perhaps mosquito abatement agency personnel could help to fill some needs of these important interests?

Mr. Sweet, do you think there is any possibility of that?

Mr. Sweet: Assuredly. The Regional Boards would welcome any contact with the mosquito abatement districts. I might point out, that although the health authorities are not directly represented on the Board by law, traditionally the Governor has appointed to represent county government, a county health officer, or chief sanitarian, or chief of the division of environmental sanitation, so we do have some contact—and of course, on the State Board there is Dr. Merrill. I might also say that at these regional board meetings there are a good many health department people in attendance at the meetings. However, I doubt if very often there are people from the field of vector control there, and I would certainly encourage you people to be there. Does that answer the questions?

Mr. Kramer: I think that is a very fine answer. Thank you. There are some very important considerations that we had prepared for, small watersheds, Assembly Bill 1144 projects, the 65% efficiency of irrigation systems mentioned by Mr. Barnes and what the probability is of attaining that, because the work of Husbands and MacGillivray in Merced County showed that if you have an irrigation efficiency of 66% or better you will not have mosquito production in the field. These are extremely important considerations. I wish that we had time to develop them further but we are running behind time. I wonder if we might just develop what are A.B. 1144

projects, and how might they affect mosquito abatement agencies. Mr. Barnes, could you answer that, please?

Mr. Barnes: Assembly Bill 1144 provides for some funds from Tidewater Oil to be made available for soil and water conservation. The amount at the present time is one hundred thousand dollars a year, and it is administered by the State Soil Conservation Commission. The Commission accepts application from the State's Soil Conservation Districts for some of these funds. They allot the funds available on the criteria that they have established for distribution of such funds. One of the criteria established by the Commission is that they do not pay for the entire cost of the job. If there is a worthwhile community job in the field of soil and water conservation, and the sponsors that join with them, they decide how much they can raise locally and then the Commission will consider puting additional funds so that the job can go ahead. The allotments have varied from a couple of thousand up to as high as twenty thousand, and they may be done in segments up to a period of several years. They have accepted a number that were in the field of drainage and they feel that drainage is an important conservation activity, and I am sure that drainage project proposals will receive very sympathetic consideration by the Commission. The final action is of course up to the Commission. As I said before, I am only an advisor to the Commission.

Mr. Kramer: Thank you, Mr. Barnes. I am sure that we appreciate your position on it. We also knew that as an advisor to the State Soil Conservation Commission, you were most aware of this item and could give us the details of it. Drainage, I believe, was only fairly recently accepted as a qualified activity. Also under consideration is enlargement of the amount of A.B. 1144 to considerably more money, so it occurred to us if there are mosquito abatement districts that have mosquito problems that are also a problem to the Soil conservation districts, it might be a means to co-operate and get your hand in the till in return for the cooperation that mosquito abatement districts can give. It looks like a case of mutual help on these cooperative projects.

I am sorry that there isn't adequate time to consider all of these questions because they are important in improving the work of mosquito abatement districts. But in the interest of time, we will turn it back to Dick Peters. I would like to thank each member of the panel for his participation.

Mr. Peters: Thanks to all four of you. I believe everyone enjoyed this presentation very considerably. At this point I would like to announce that the film on Virginia Mosquito Control will be shown in the evening by Tommy Mulhern.

We will recess at this time and return promptly at three o'clock to resume.

RECESS.

Mr. R. F. Peters: The final session of the afternoon is about to get underway. As you can see from your program we have been saving the most fundamental portion of the program for this particular session.

We have often talked in the past about mosquito control and about mosquito abatement, but the new term that was coined in the past decade to connote the basic emphasis needed is "mosquito source reduction." In this respect, we look to the Chairman of the CMCA Source Reduction Committe to take over as panel moderator. So, George Whitten, you are in charge for the rest of the afternoon.

Mr. Whitten: Thank you, Dick. Members of the Association, it is obvious from the program that the subject is Source Reduction Progress by Mosquito Abatement Districts.

PANEL ON SOURCE REDUCTION PROGRESS BY MOSQUITO ABATEMENT DISTRICTS.

Moderator: GEORGE WHITTEN

Delta Mosquito Abatement District, Visalia

I have taken the liberty and pleasure of including on this program a person who may benefit us all with his presentation. There is one door to this source reduction program that we have never been able to open up very widely; we have it cracked open a little bit, but it never seems to want to open all the way. I am talking about soil problems. Of course if all of our soils were sandy and took up water readily, probably a lot of us wouldn't be here today. But they aren't, and so we are here and must face the soil problems. For this purpose, we are very fortunate in that we do not have to start from scratch. I have invited Dr. Milton Fireman of the University of California Extension Service, who has charge of the Extension Service Soils Laboratory at Davis, he is also the Soils and Water Specialist for the University. He is here to speak to us today on these problems and what we can do to overcome them. Dr. Fireman is certainly well qualified to speak in this field, since before joining the Extension Service, he was associated with the U. S. Salinity Laboratory at Riverside for fourteen years and has been with the Extension Service for five years. He has spent time in Europe and Asia studying these soil and alkali problems. I am sure he doesn't have a magic wand to wave over our soil problems to get them all corrected; but I am sure he does have some good down-to-earth facts from which we will benefit.

Incidentally, Milt, I heard the other day that scientists had disproved that old story about the birds and the bees. If you put a bird and a bee together, nothing happens. Was he one of the Davis professors? Dr. Fireman.

SOIL PROBLEMS AS THEY AFFECT MOSQUITO ABATEMENT DISTRICTS

MILTON FIREMAN, PH.D.

Extension Soils and Water Specialist

University of California, Davis

The principal problem is one you have heard about over and over again, I know. It is just the problem of using proper water management so as to eliminate stagnant water and thereby the mosquito problem. I don't

have to lecture on what stagnant water is, how long you can leave it, etc. These involve a whole number of subjects which you have covered with irrigation men, drainage men and others, I am sure. I discussed this subject in part, at least, about a year ago at a meeting held by a portion of your organization at Davis. I will briefly cover some of the major topics involved, all of which you have heard about but which you may not have had collected together in a brief discussion.

The first thing you need is proper land preparation to eliminate the pockets and depressions, and to improve the stream and irrigation channels, etc. You do not need me to tell you about that—it is not a soil problem *per se*, but it relates to the problem that you have before you and it relates to the problems that soils bring about, because some of the problems in soils that concern you are the result of use or disuse of proper land management practices.

A second major topic is correct irrigation practices, so as to curtail or minimize waste and tail water, to apply water at a reasonable rate and by a satisfactory method, depending upon the soil, the slope, and other conditions, with sprinklers, by furrow, or by flood irrigation; to eliminate leaky headgates, etc.

Then it is necessary to provide adequate drainage, both surface and subsoil drainage. Surface drainage removes excess water, particularly tailwater, and along with this, ditches must be kept clean. Then subsurface drainage must be taken care of; this is a little more ticklish problem. It is not as obvious. The relationship between soil drainage and some of the problems which confront you are not quite clear, and in some cases the problem is not recognized; whereas in others it is recognized. However, the cost of improvement is so great it is difficult to get persons who are not directly concerned to move in the proper direction. These people have to realize considerable benefits to repay the relatively high costs of subsurface drainage. This involves rather careful considerations; careful diagnosis of just what the problem is, what is required to cure it; then proper design and proper execution. As far as we know, almost any soil can be drained, and drained well, but it can be quite a costly proposition, and this cost is the thing that stops most people.

The fourth major item is our disposal of wastes, such as sewage, tailwater, floodwater, industrial, etc.

A fifth problem, which doesn't occur to many people as a problem, is that of permanent pastures. Permanent pastures are used by many farmers; they plant them mainly because of the slope of the land or depth of the soil or some other aspect which renders this land unfit for other use. Because permanent pastures often do not give a high return, not much work is wasted upon them. Not enough care is taken in laying them out; not enough care in irrigating them; and not enough care in handling the cattle. Here is where improper handling can make a real problem out of what is otherwise only a minor problem. Proper handling entails keeping the cattle off the land when the moisture content of the soil is so high that it leads to inevitable and undesirable puddling— certainly a practice which should be avoided.

Mr. Whitten: Excuse me, but isn't there a way that we can get the name changed from permanent pasture to irrigated pasture? The connotation of the word is prety hard to get around. If they put it in twenty years later, it is still permanent pasture.

Dr. Fireman: Yes, you are correct, but I don't know of a way. This is an example of the type of problem that confronts us in soils. For instance, most people like to talk about heavy soils, meaning clay soils. But heavy soils are really light soils! If you weigh them, a cubic foot of "heavy" soil actually weighs less than a cubic foot of sandy soil or "light" soil; but you try to talk a farmer into calling a clay soil a light soil! If you can find an answer to my problem then maybe I can find your answer.

As I have mentioned, the third problem with irrigated pasture is that so often pastures are planted on undesirable soils. These undesirable soils often lead to problems that we don't have on desirable soils. At best, you can expect that they are going to be hard to handle, hard to irrigate, hard to drain and hard to manage in other ways.

A sixth group of problems that confront you people are caused by the planting of special crops, such as rice and Sesbania, crops that are flooded. I don't know about other years, because this is only my second summer in Davis, but the mosquitoes flew down to Davis from the rice fields, or were blown down ,in numbers beyond belief. Even today I killed mosquitoes in my house. I hadn't read the bulletin, "Mosquito Control On The Farm" very carefully, but I found that I can expect them any time of year. There just is ho way to handle these special crops except to keep the water moving and, at best, I know that control can only be partial.

Then there are special practices, many of which cause you some difficulty. During pre-irrigation, some farmers use a foot or two of water in deeply irrigating their soils. Sometimes in the fall and sometimes in the spring, this pre-irrigation of a tough soil may require several days or a week or more, and inevitably leads to some run-off and some accumulation of water in unfavorable spots.

Then flooding, for reclamation of saline or alkali soils adds to the mosquito problem. The best way to leach is to throw high dykes up and pond the water—to keep the water on the land until it penetrates into the soil. Ponding is generally done because moving the water doesn't help, and if water is at all expensive, it is the most economical way to leach. Water is held on the land for a great length of time on occasion, and I know it can cause some serious troubles, especially if you get on the really tough soils where the rate of penetration of water into the soil is probably not as great as the rate of evaporation from the flooded soil.

Then, there are such things as using the same ditch for irrigation and drainage, etc.

Now to get down to the particular things where I may have something to contribute. I refer to *soil characteristics* that contribute to the problem of mosquito control. I will discuss some of the things you can remedy and some you can't do anything about. One of the things you cannot do anything about is the mineralogical composition of the soil. Depending upon its mineralogy, a soil may be one which swells a great

deal or it may not swell. If it swells a great deal, we may run into permeability problem, difficulty in applying water, difficulty in getting water into the soil, difficulty in draining the soil and in getting water out of it. This is what we call a factor that is inherent with the characteristics of the soil, and there isn't much to be done about it, except to live with it and help it along the best you can.

The second factor is the method of formation of the soil. If the soils are formed from washings of large rivers, like many of our soils along the west side of the Sierras—these are alluvial soils—the materials are set down pretty uniformly without much stratification or unusual layering, and they are relatively easily handled. However, when soils are laid down in a lake (lacustrine soils we call them) you get fines settling out and the result is thin and thick, almost impermeable, semi-compacted or compacted layers that are extremely difficult to get water through. The alleviation of this sort of a problem is difficult and expensive, if it is at all possible, and often it is not possible.

Then, the age of the soil—by age I really mean the stage of development of the soil. When the soil is newly formed it doesn't have much development; there isn't much consolidation. But as the soil gets older, or if it remains in the same place without new soil being added on top of it, in the deeper layers some of the clay and some of the soluble materials are washed out of the surface layer and are deposited in the subsoil. Here the clay content builds up, and the soil becomes more impermeable. Then cementing materials, such as lime, silica or iron bind the clay particles together, and then these layers become harder, almost as hard as rock and almost impermeable to water. There are two different kinds of pans: if there are no cementing materials, the result is a claypan, and if there are cementing materials, the result is a hardpan. A hardpan is just what it says it is; it is hard; quite often it is made up entirely of lime. It can't be handled by the addition of any chemicals we now know for a reasonable amount of money, but if the layer is not too deep, it can be ripped or chisled. This is done by dragging a tool through it to the depth of the pan, or just below it. If the hardpan is once shattered, it will not recement —not in a matter of a few tens of years; it may in a few hundred years, but not in the length of time in which you are interested. In some hardpan areas where you may have observed that trees grow well, there probably has been some dynamiting. This is done by drilling a small hole, putting in a part of a stick of dynamite, blasting, then refilling the hole, perhaps with some of the top soil, and growing trees in these holes. This has worked out quite successfully. Therefore, if you can rip, dynamite, or somehow break up hardpan, you can get water through it and prevent some water and mosquito problems.

In addition, you know that hardpans are never continuous over a very long distance. You know how difficult it is to set a good cement foundation for a house. It is obvious, therefore, that hardpan layers will not be solid and without cracks over a great distance under the ground. Hence, even though when you dig down and observe that the pan looks impermeable, some water does get through in some places. If you can accelerate this, you may have your problem solved. Claypans, however, are much more difficult to handle because, although they can shattered or moved by dragging tools through them, since they are not cemented together, when you wet them they move together again after you have dragged a tool through them.

The one thing we know to do about such soils is to grow deep-rooted and fibrous crops in them. If these claypans are not too deep, growing something like barley or rye, or some relatively deep-rooted and fibrous crop will do. If they are deeper than that, then we have to recommend some deeper rooted crop that will put roots through this material. The roots, in decomposing, will, with the aid of bacteria, aggregate the soil and aid the permeability thereby. If this practice can be incorporated into farm rotation, fine. If not, then it is pretty expensive to stop the normal farm practices in order to put in a crop of this sort to aid the permeability problem only temporarily. This kind of problem will take a long time to work out.

A fourth item in the soil characteristics that affect the permeability, and therefore mosquito production, is the texture of the soil. Sandy soils present no problem; silty soils may or may not present problems, and clay soils do present problems. The answer to the problem of a clay soil is the same as on a claypan. There are no chemicals that you can afford to apply for the negligible results that you obtain. Such chemicals work wonderfully in a small beaker in the laboratory, or in a small model, but on a field scale they are economically impractical. But you can grow green manure of some sort or incorporate a fibrous material. Adding the green manure or other organic matter will aid in aggregation to improve the permeability of the soil and help the problem of soil permeability.

A fifth item is structure and compaction. Now, we have both good structure and poor structure. Good structure presents no problems at all ,and poor structure does present problems. There are two kinds of poor structure; some man made, but others natural. In California, there are some soils that naturally have a poor structure. No matter what is done to them, no matter how little traffic, no matter how well the farmer handles them, he is going to get a plow-pan which interferes with water movement. On the other hand, there are other soils, in fact most of them, that can be helped by reducing traffic, by not cultivating when the moisture content is high, by using wide-track wheels, and by incorporating green manure and other materials. Again, if you do have compaction, this compaction can be reduced considerably—temporarily, by ripping, or by disking deeply, and the effects can be made semi-permanent by incorporation of sufficient green manures or other organic matter. Compaction can't be helped very much, except under unusual circumstances, by the incorporation of chemicals.

Another factor is organic matter. As indicated in what I have said before, if the organic matter is low, you are more likely to run into problems than if the organic matter is higher. But we have an anomalous situation in our climate. In most cases the organic matter, whatever we have, is pretty much in equilibrium with the soils and with the climate, and we can't build up the organic matter content very much. If we can

continue to add organic matter, we can make the tilth and the structure extremely desirable, so that we have a good soil, permeable, and easy to handle. However, we cannot expect to find any great change in the organic content itself. In fact, at Riverside, the Citrus Station of the University of California, has added fifteen to thirty tons of manure annually to the soil of a citrus orchard for about thirty-eight years. In this thirty-eight years, the increase in organic matter content of the soil has been just barely detectable by the best chemical tests that we have. However, the soil is in extremely fine shape, and it may be worthwhile to have incorporated this material for its fertilizing value and for the good structure that it imparted to the soil. The treatment has not increased the organic content of the soil, but has eliminated any soil permeability problems that may have been present.

Another problem which has recently come to the fore, and which has not been a problem in the past, is the effect of the application of extremely good water to some soils. We generally consider irrigation water quality primarily on the basis of the amount of salt that it contains. If it contains much salt, then it is a second class or a third-class water. We are now running into permeability problems in Tulare and Kern Counties and along the west side of the San Joaquin Valley because of changing from well waters of fairly high salt content to canal waters of extremely low salt content. Soil aggregates are made up of large numbers of sand, silt, and clay particles that are joined together by chemical and other bonds. If these aggregates are large enough, they allow air and water to move through them very easily, as well as roots to extend through them. This tendency for aggregation is promoted by a moderate amount of salt. On the other hand, if the salt content is extremely low, if you use relatively pure water, such as flood waters or some canal waters which contain twenty to thirty parts per million of salt, only a few pounds per acre foot of water, then some of the soil aggregates have a tendency to disintegrate, to break down into larger numbers of smaller particles. When this happens, we get what is called a poor tilth; the soil crusts, water penetration is poor because the large pores have been reduced in size, water does not enter the soil well, air does not enter well, and roots cannt penetrate well. This is a problem which can be handled or alleviated by the addition of some salt to the water, or a material which will dissolve in the water can be added to the soil. Gypsum is frequently used for this purpose by being added to the water. More frequently it is added to the soil, where it can be picked up by the irrigation water, and this tendency for dispersion and poor penetration is thereby decreased or eliminated.

George Whitten: Milt, would you clarify this difference between saline and alkali soils?

Dr. Fireman: Yes, I will. Saline soil or salty soil, or what is classically called a "white alkali" soil, contains an excess of soluble salts. By an excess, I mean enough to affect plant growth. If you are dealing with a tender plant, this isn't very much salt; if you are dealing with a tough plant it may be a lot of salt, even enough to see. This excess salt has the outstanding characteristic of being soluble in water. If you add water to the soil and have a place for that excess water to go, this soluble salt will be dissolved by the water just as is the sugar you add to your coffee or the salt you add to your soup, and will be carried out of the root zone into the drains, then into the drainage ways, and finally get to the ocean. This is salinity. This salinity affects plant growth directly, but it does not affect the physical properties of the soils; it doesn't cause the soil to freeze up; it doesn't cause permeability problems, or poor tilth, or anything of that sort.

An alkali soil, which has been called a "black alkali" soil, or a highly sodium soil, is a soil which, because it has been exposed to predominately sodium salts, has adsorbed some of the sodium. The adsorption is by the clay particles, the reactive part of the soil. The clay is composed of thin sheets very much like paper and they are closely piled one on top of another. They are extremely thin, they are extremely long, and they have a very definite mineralogical constitution. Because of its structure, there are some charges on clay surface which are not satisfied by the minerals within the sheet. Then these clay particles pick up anything that is positively charged, like calcium, potassium, magnesium, sodium, hydrogen or ammonium. A natural soil, a soil in good tilth ,usually has a little bit of sodium and a little bit of hydrogen, perhaps, but it has a fair amount of magnesium, and it has quite a lot of calcium adsorbed on it. When it is mainly calcium saturated it has a good structure and good tilth. But these sodium salts that we are speaking of tend to knock some of the calcium off the clay, especially if there are very much more sodium than calcium salts around. If these clay particles become high in sodium then they give the soil the unfavorable physical properties that we recognize in alkali soils. This is so because when these clay particles are partly sodium saturated the aggregates will break down from large aggregates into very small particles. The soil then will become extremely small, permeability will be extremely slow, and plants may die because of the bad physical conditions. These soils do not get enough air and especially not enough water to the roots in sufficient quantity to sustain plant growth.

So, again, to repeat, a saline soil has a lot of salt, but this salt can be washed out; an alkali soil has what we call adsorbed sodium, sodium sticking to it, and this adsorbed sodium cannot be washed out by water alone. What we have to do is add another chemical to displace the harmful sodium. Generally we want to replace the calcium that was present in the first place. We add this calcium in the form of gypsum. It could be in any form, but gypsum is usually the cheapest source of calcium, and then we add lots of water. The gypsum, which is called calcium sulfate, is dissolved by the water and as the calcium sulfate passes by these clay sheets containing sodium they knock off or displace the sodium. The calcium replaces the sodium and sodium sulfate is formed, which must be washed out of the soil by more water, and finally pushed out to sea.

In the case of salinity, you have no physical problem. What you need to do is add large amounts of water to get rid of the salinity. However, this presents a problem .How do you get rid of the excess water? You have the problem of providing drainage. The drains may be open or tile drains. Then there is the matter of grade, so that you can get the water to where you can get rid of it. You may have to use pumps or construct special

canals or pipelines to get the water to the river. The problem, then, with salinity is only that you need a lot of water to put it in shape for planting in the first place, and then proper management to keep the salt content down. This management requires that you add more water than the crop needs so that when salt is accumulated it is washed out of the root zone and down into the ground water before it affects plant growth.

Alkali soils present the same type of a problem, but a tougher one. In such soils, not only do you have to add a chemical amendment and as much water as in the salinity problem, but you have a soil that is initially so tough that the water remains on top of the soil for a long time in order to effect this leaching, and this leads to many of the mosquito problems with which you are quite familiar.

I think that with these two items, salinity and alkali, I have more or less completed my discussion. I might just recapitulate. You have mineralogical composition, which leads to inherently fast permeability or slow permeability; the method of soil formation, which leads to stratification or no stratification. Then there is soil development; if the soil is well-developed it may mean that you have some hard-pan or clay-pan formed. If the texture is fine you may have problems moving water through it, and you may have to do something about this. Structure and compaction can be helped somewhat by using the best known methods of cultivation, incorporation of manures, and so on. Organic matter is desirable and something which you should consider in your program—whether you use it or not depends upon whether it is profitable to use it. Water quality is a new problem which we will have to keep watching. Often an ideal water as far as plant growth is concerned is not ideal water as far as permeability of the soil is concerned.

Then there is one group of problems which I did not mention; these are soils with inherently slow permeability, but with seemingly good structure. We dont know very much about them. Salinity is the big problem because large amounts of water must be used and this water must be gotten rid of. Alkali is a bigger problem for the reason given above. Alkali, we estimate, makes up a quarter of the potentially irrigable lands in California. This means that as more lands are developed and put under cultivation and irrigation—the better lands being taken up by freeways and towns and industries—farmers are going to be moved onto these poorer lands, higher in alkali, salinity, more favorable in structure, texture, slope—and these are going to intensify the problems which you have before you.

Mr. Whitten: Thank you, Milt. If there are any questions, I hope you will come right out with them. I think that is the best way to answer them, because if you hold off, you are liable to forget what they were. Dr. Fireman has another meeting this evening, so any time you feel you have to leave, Milt, feel free to do so.

Ray McCart was the next speaker on the program, but unfortunately he is down with the flu. Gordon, are you here? How did I miss you? Gordon has some material of which he will give a brief summary.

Gordon Smith: This material has to do with chemical weed control in drain ditches, which I believe I will abstract rather than read.

CHEMICAL WEED CONTROL IN DRAIN DITCHES

RAY MCCART

Source Reduction Specialist

East Side Mosquito Abatement District, Modesto

Weed control in drain ditches is very important to Mosquito Abatement Districts. It isn't enough to dig a drain ditch to grade then forget it. Usually about the second year it becomes choked with weeds and will not provide satisfactory drainage, leaving the water in the field to produce mosquitoes. We find that most of the drain ditches in our district are more than adequate if they are not full of weeds.

The traditional way of cleaning drain ditches has been either to dig the weeds out with a shovel or by mechanical means such as a back hoe or drag line or use diesel or weed oil to kill them back. Neither method will give satisfactory control for any length of time. Weed oils must be repeated a number of times during the summer, so we turned to the new chemical controls.

Using the new chemicals we planned to kill the cattails in September, then in January apply a shallow soil sterilant and during May and June use a systemic weedicide to complete the job on the deep rooted plants.

We started our program during the fall of 1958, the latter part of September, with the use of Amino Triazole on cattails. We used four pounds of Amino Triazole per 100 gallons of water sprayed to wet. This probably ran about 200 gallons per acre or at a cost of about $15.20 per acre, not including application. This gave us very good kill on most of the cattails. We burned out these ditches in December to leave bare ground for sterilant application.

In January, 1959, we applied a shallow soil sterilant on the banks of these ditches using both Simazin and Diuron at the rate of 20 pounds per acre. The cost of Simazin was $47.40 per acre and Diuron $70.00 per acre.

During the first of May, 1959, we applied two applications of Dalapon 10 days apart. These applications were put on at the rate of 10 pounds per 100 gallons of water sprayed to wet. These applications were approximately 15 pounds per acre or about $17.55 per acre for materials. The results, we thought, were good. We did not get a one hundred percent kill on all weeds but the growth of weeds was not enough to interfere with the free flowing of the water. We hope that these applications will show effects for two or three years and make the job of maintenance a minor one compared with the use of weed oil or mechanically removing the weeds. We think that we may have to make another application of soil sterilant in two years from now.

This winter we are seting up plots with the hope of getting a combination of shallow and deep soil sterilants so that one application will control weeds for two or more years and eliminate Dalapon applications. We are planning on using combinations of Simazin, HCA, Atrazine, Urox, Urab and Chlorax 40. We are putting these on in plots at different rates and combinations in the attempt to get the best rates and combinations for good weed control for the least money.

Mr. Whitten: Thank you, Gordon. You are a good pinch-hitter. I think it would be a little superfluous for me to introduce these gentlemen. Everybody knows them so we will just go right through. Tommy Mulhern is next and will speak on "Varied Manifestations of Mosquito Source Reduction in California." Tommy.

Mr. Mulhern: I have here a paper which is fairly long, and I will submit it to the Secretary for publishing in the Proceedings, and then merely comment upon some of the points which were made.

VARIED MANIFESTATIONS OF MOSQUITO SOURCE REDUCTION IN CALIFORNIA

THOMAS D. MULHERN[1]

Source reduction is a relatively new term in the vocabulary of the California mosquito worker. However, source reduction is by no means a new activity in mosquito control in this State. Reference to accounts of early work will quickly convince the reader that our predecessors gave high priority to source reduction, or as they called it, "permanent control." And the use of oil larvicides was then generally regarded as supplemental to source reduction. Furthermore, much emphasis was placed upon the educational approach, and upon the cooperation of land-holders. Much of what we may say here today is apt to be a repetition of the words of earlier workers. Nevertheless, if by repetition we can bring the source reduction concept of mosquito control into better perspective, then the repetition shall have been profitable.

Some of the older districts in the State were established about the San Francisco Bay region. Here extensive natural mosquito sources (salt marshes, flood areas along streams, ponds, tree holes, etc.) annually produced great broods of mosquitoes which blanketed the area, interfering with all kinds of outdoor activities. Progressive citizens simply would not for long tolerate such a nuisance. Thus, shortly after permissive legislation was adopted in 1915, districts were formed in some of the areas about the Bay where mosquito infestations frequently occurred.

Thorough studies were conducted to locate and determine the extent of mosquito sources, and appropriate plans were made for their control. Filling, ditching, diking, and installation of tide gates were the principal activities, supplemented by inspection and spraying as necessary. Engineering services were employed in the design of water control structures, efficient earth-moving equipment of various kinds was procured and employed, and cooperation was sought from the public agencies, industries, and residential property owners. In due course of time, many of the planned improvements were accomplished, and the need for heavy equipment and personnel for earth-moving projects was minimized. Most of the Bay Area districts now concentrate on intensive surveillance, with temporary treatment and drainage maintenance as necessary. Generally where new developments create new mosquito sources, the agency responsible can be influenced to eliminate the mosquito source; thus flood control districts, highway departments, and other agencies have modified their projects to prevent the creation of mosquito sources.

Here we see an example of districts which, through the execution of carefully planned source reduction programs, have attained their objectives and have eliminated many major sources. As a result, their efforts are being devoted increasingly to the finding and correction of the smaller sources which are continually being created by man in connection with his varied activities. Thus a very high level of mosquito control is being provided at a relatively low cost.

During the period since 1946, while mosquito abatement programs have been expanding rapidly in irrigated agricultural areas, the problems of mosquito control through source reduction have become vastly more complex. It is essential to the economy of these regions that water be applied to the soil, and it is inevitable that some of this water will be allowed to stand on the surface long enough to produce mosquitoes. Furthermore, at the beginning of this period of expansion little knowledge was available about techniques which could be employed to permit the use of source reduction techniques in irrigated areas. As a consequence this represented an important potential for increased production of mosquitoes. This might be called a period of "learning how," a period when great dependence had to be placed upon the insecticidal approach. It has taken time, energy, imagination and resourcefulness to develop source reduction methods and to secure their acceptance by agriculture. Much has been accomplished, yet there remains a great opportunity for the refinement of techniques and for further expansion of source reduction programs.

Source reduction may be approached in many different ways and the more successful programs usually focus considerable attention on some of the following activities.

(1) *Entomological Surveys.* A thorough entomological survey constitutes the scientific basis for, and is prerequisite to a well-conceived source reduction program. It should provide data to indicate the relative importance of sources, the species present and their relative abundance, the periodicity with which they occur through the season, and the areas subject to infestation by emerging adults.

(2) *Collection of Engineering Data.* Geological survey maps and appurtenant data, plotted in detail to a convenient scale such as 660 ft. per inch, and aerial photos, at a similar scale, are useful in planning programs of drainage and water management. Data to be plotted may include lakes, reservoirs, canals, river systems, population centers, roads and landmarks, and the data resulting from engineering studies of projected future developments. When major mosquito sources are added, these devices become invaluable in planning immediate programs, and as a basis for planning a program to meet the changes which may be anticipated as far as 10 to 25 years in the future.

(3) *Plans for Control.* Each of the sources found to be important by the entomological survey may be studied to determine the alternative methods which can be employed for its elimination or reduction. The study

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should include a comparison of the engineering feasibility and the estimated costs of the various alternatives, and should provide an estimate of the incidental benefits which may accrue to the holder of agricultural lands as well as to the community at large. It is axiomatic that the greater the consideration that can be given the views and preferences of the landholder, the greater will be the likelihood of securing his active cooperation. Such studies have frequently yielded axillary information useful to other agencies or individuals from whom cooperation is being sought.

(4) *Inter-agency Cooperation.* Many kinds of agencies throughout the state have been helpful in guiding or accomplishing improvements beneficial to mosquito control. Some mosquito abatement agencies have been very active in organizing local "cooperative improvement councils" for the purpose of exchanging views leading to unified action in the interest of improved water and land management. Some of the agencies which have participated in these cooperative activities are:

CITY AND COUNTY AGENCIES
- Chambers of Commerce
- Councils, Supervisors, Managers
- Engineers and Surveyors
- Health Departments
- Planning Commissions
- Schools
- Street and Road Departments

DISTRICTS
- Drainage Districts
- Irrigation Districts
- Reclamation Districts
- Soil Conservation Districts
- Sanitary Districts
- Water Districts

FARM ORGANIZATIONS
- Cattlemen's Association
- Dairymen's Association
- Farm Bureau
- Grange

FEDERAL AGENCIES
- Bureau of Reclamation
- Corps of Army Engineers
- Fish and Wildlife Service
- Production and Marketing Administration
- Public Health Service
- Soil Conservation Service

STATE AGENCIES
- Agricultural
- U. C. Extension Service
- Public Health

SPORTSMEN'S ASSOCIATIONS

(5) *Education and Public Relations.* Public information activities normally fall into two categories: (a) those designed to provide general information to the residents of the District and to obtain their support for the total program, and (b) those carrying a specific message designed to motivate the landholder to corrective action resulting in source reduction. Among the more successful efforts in the latter category are those which provide local examples of the kinds of improvements sought. These may be either narrative accounts, or field examples. One district frequently uses as an exhibit the ranch of an owner who has redeveloped his fields in an approved fashion. In another district it is common practice to include in a widely distributed monthly report illustrated accounts of the better examples of improvements of the type being advocated by the district.

Agencies emphasizing source reduction have found that it is not safe to assume that all of the employees of the district are prepared to speak authoritatively on the subject in their daily contact with the landholders. For this reason all employees have been given sufficient source reduction-public relations training so that they may in their daily contacts persuade landholders to seek advice or assistance from the district when making improvements. A special feature of this training is to teach employees not normally engaged in source reduction to avoid making specific recommendations, at the same time suggesting that the landowner seek consultation from specialists on the district staff.

Even in the larger districts where a source reduction specialist is employed on a full time basis, it is frequently necessary for him to call in farm advisers, irrigation specialists, pump design engineers or others with special skills to provide advice on specific projects.

(6) *Policy Determination.* Most districts which have engaged in substantial programs of source reduction have found it desirable to adopt definite policies to guide this aspect of their work. The policy statements include such items as: (a) the portion of the total facilities of the district to be devoted to source reduction, (b) prerequisites for doing work on private lands where man-made sources exist, (c) the portion of the costs which must be borne by the property owner, and (d) the conditions under which legal measures will be used. Since these statements of policy are tailored to meet local problems, they may differ widely in content. They usually have a similar framework, however, in that each represents the best judgment of the local board of trustees as to the program which affords the greatest equity to all concerned. The underlying connotation of all are similar, in that there is implicit in each the spirit of helpfulness and cooperation, with the use of legal action only in exceptional cases.

(7) *Individual Mosquito Source Data.* The "section survey system" has been widely useful in recording mosquito breeding conditions and control operations performed in relation to individual sources. As a basis for securing active participation by the landholder in source elimination, it is desirable to keep a "case history," including records of all negotiations. Such data has been found useful in securing voluntary cooperation, and may be essential in legal actions.

(8) *Construction.* Some agencies limit their source reduction activity to defining the limits and locations of mosquito sources, and notifying the property owner that he must take steps to eliminate the sources so defined. Other agencies go so far as to do the engineering work necessary, develop recommendations and cost estimates, and contract to do the work with their own equipment and personnel at an agreed upon figure. Between these two extremes there are all degrees of collaboration and joint endeavor, the particular agency functioning in accordance with local conditions. However, even in the best equipped agencies, the property

owners are encouraged to use their own equipment or facilities and to avail themselves of aid available through irrigation districts, soil conservation districts and other public and private agencies. This policy of encouraging the use of all available facilities offers the greatest promise of securing the early elimination of mosquito sources.

Mr. Whitten: Thank you, Tommy. You mention that there is a lot of information available, and there is, but sometimes it's difficult to find. In looking for information on specific phases of source reduction, I have had to go through a very great deal of literature. Your Source Reduction Committee is trying to bring some of this material together and make it a little more available to people who are looking for source reduction information.

The next speaker is Dave Reed on "Return Flow Systems."

ECONOMIC SIGNIFICANCE OF RETURN FLOW SYSTEM AS USED IN TULARE M.A.D.

DAVID E. REED

Manager, Tulare M.A.D.

Before a farmer decides that he has need for a return flow system several questions, with definite economic implications, should be considered and answered.

How many acres will there be included in the system?

What crops are going to be involved?

Is there a real need for a return flow system?

Is there another as effective but less expensive drainage system that will work in this particular case?

What will be the cost of a return flow system?

What will be gained in the use of a return flow system? Crop gains? Milk production? Higher income?

Will the financial returns outweigh the total costs in the long run?

What kind of assistance (financial) can the farmer get? (governmental, private)

After the system is installed, what are the costs? Maintenance and repairs, utilities, added taxes?

The approach that the Tulare M.A.D. has taken in its mosquito source correction and prevention program has been one which includes the consideration of these and other questions. We are all influenced by what will affect our pocketbook—and farmers are no different. If good farming practices are the habit, minimum of trouble mosquito-wise may be expected. Thus good farming practices are encouraged with the idea that, once in effect on a continued basis, mosquito production will become minimal.

It is agreed that there are many avenues of approach in the correction of mosquito sources, though they *all* involve soil and water management. What approach a mosquito control source reduction specialist will take depends upon the condition of the area in general and the conditions *at* the problem in particular. Recommending a new irrigation approach, a simple drain, one linked to a master drain, or a return flow system, will naturally, depend upon the local conditions. The first thought that must be considered by the source reduction specialist when he faces a mosquito problem is how he must convince the farmer that it is to the *farmers'* advantage to effect corrections.

Let us, then, consider some of the favorable economic factors to be considered by the farmer before he will even think about the installation of a return flow system on, for example, 80 acres.

a) Crop. An alfalfa field with 10 acres which are burned out or drowned out represent 12.5% of the field. Yearly production ranges from 5-7 tons per acre with average of approximately 6 tons. Prices in 1959 on alfalfa were up to $30.00 a ton. At $20.00 a ton, the 10 acres of drowned out area represents a loss of $720.00; at $30.00 per ton, $1,080.00.

An irrigated pasture can sustain three head of cattle per acre. Profit amounts to about $5.00 to $6.00 per head per month. Using $5.00 per head a month as income, the lost income would amount to $1,800.00 per year if feeding area lost was 10 acres.

b) Water. Here we have a problem of vast economic significance when viewed from an over-all vantage point. The individual farmer will be most concerned with filling *his* particular needs. The excess water the farmer leaves at the end of his fields is not going to do *him* any good. It will not raise his water table nor cut down on his irrigation cycles. A return flow system will cut down the use of his irrigation pump thus reducing his part in the depleting underground supply. In addition, it is cheaper to run a 3 HP or 5 HP pump than a 15 or 20 horse pump.

c) Other factors. There is the element of time saved. With the increasing demands upon a farmers time, through expansion of his farming activities, it is essential for him to find time and labor-saving devices. Misjudgements and irrigation accidents may prove very costly. A return flow system will provide for the added needs in both of these cases.

"I'm sold on the use of return flow systems, particularly when tight soils are involved," says Mr. Tony Gomes, a Tulare rancher. "My return system paid for itself in one years' time," he added. Although there are no records to back this latter statement let us see what has prompted Mr. Gomes to make it.

Mr. Gomes owns four small irrigated pastures comprising a total of 48 acres. In August 1957 an 1,800 foot return pipeline, sump, and 3 horsepower sump pump were installed. Drain ditches were made so that water ran freely into them from border strips and down to the sump. Total cost for the project was $2,836.00.

Approximately 15 acres of Mr. Gomes' pastures were drowned out or ruined because of ponded water. He had, in addition, trouble holding his water within the pastures because of gophers and breaks in tail end boarders. The result was a flooded roadside and pressure from the County Road Department.

Approximately 25% of the unsuitable pasture area was gained in 1958, and 30% of the balance in 1959. In cash, what did this mean? In 1958 he could increase his herd by 12, meaning an added gross income of $720.00. In 1959 he could add 10 more cattle to his herd adding another $600.00 to his gross income. Thus in two years' time Mr. Gomes has potentially increased

his pasture yield sufficiently to add 22 cattle to his herd with a gross increased income of $2,040.00 during these two years.

Also gained during these two years was a reduction in operating costs and the all-important element—*time*. Gained, in addition, was better mosquito control at a considerably reduced cost. In 1957 total cost for control was $173.90 and in 1959 it was $44.98. This not only meant better mosquito control on these fields but also elsewhere.

Mr. Whitten: Thank you, Dave. I think Dave has a very important point there—that if you are going to get some source reduction done, you had better find an economic factor to sell the farmer on, because that is what it will take. It is pretty hard to sell him on mosquito control as such.

Steve Silveira is our next speaker. Steve.

Mr. Silveira: Gordon says to make it short. My assigned topic is "Minimizing Mosquito Production on Sewer Farms by Proper Planning." Now, not being an expert on the subject, I probably should make it short. I will relate to you some of our experiences with sewer farms in the Turlock Mosquito Abatement District.

MINIMIZING MOSQUITO PRODUCTION ON SEWER FARMS BY PROPER PLANNING

S. M. Silveira

Manager, Turlock Mosquito Abatement District

We in the Turlock Mosquito Abatement District also have to live with sewer farms. In the TMAD there are 5 towns with public sewer systems. When the District was formed in 1946, only one of these had a sewage treatment plant sufficient to allow the effluent to be discharged directly into the San Joaquin River. The other 4 towns, with populations of two to four thousand, had little or no sewage treatment facilities. If a treatment plant existed, it would be one overloaded Imhoff tank from which the effluent would find its way into a natural slough well concealed by a heavy growth of willow trees, plus a bountiful stand of cattails and tules. Most of you are acquainted with this type of situation, and you are well aware of the futility of attempting mosquito control in a source of this type.

Our first step was to contact the City Councils and inform them of the situation. We had no difficulty convincing them of the tremendous numbers of mosquitoes produced by these sources. One visit to the area would do it. The people living near these ponds were continuously harassed by mosquitoes and would let us know about it in no uncertain terms. Of course, we were always careful to explain the reasons for these mosquitoes.

Small towns are usually short on money and cannot afford the latest equipment for sewage treatment. To suggest the type of sewage treatment facility we would like to see is well and good, but you will seldom get a relatively small city to construct such a system. We have to compromise.

In the case of the Turlock Mosquito Abatement District, our primary concern was to get the effluent out of the woods—out where we could handle it. This was done by constructing deep lagoons or oxidation ponds with wide levees so that equipment could be used for larviciding and weed control. We found that where the water is ponded at least 4 feet deep, most aquatic plants are eliminated in the pond itself. We also found that when the banks are kept absolutely free of vegetation, mosquito production is held at a minimum.

There are exceptions to this, as you might expect. One is when the effluent contains large amounts of solids, or organic matter, which remains in suspension. When this condition exists, you may find mosquito breeding over the entire pond rather than around the edges, as in the case of ponds relatively free of organic matter. This can be overcome to some extent by constructing the ponds large enough to allow some wave action. We have small one-half acre ponds that require gale type winds to produce any wave action. Our larger ponds, covering three acres or more, develop some wave action with our normal afternoon breezes. We've found mosquito breeding less intense in the larger ponds where wave action occurs. I might sight one example of one pond where the water was tested. The pond covers an area of five acres to a depth of 8 feet. The BOD (5-day 20 degree) count varied from 200 to 250 ppm. The dissolved oxygen content of the water coming into this pond was 0. Mosquito breeding in this pond is practically non-existent.

When the ponds recede and the water depth gets down to less than one foot, we have mosquito breeding regardless of size of pond or vegetation. We larvicide our large ponds with the airplane. If a district does not have the use of aircraft, large ponds would be difficult to handle when larviciding is necessary. While the larger ponds may be desirable, they may not be the most practical.

We haven't had any great difficulty in getting our smaller towns to construct these ponds. Cost of construction is not excessive and maintenance is low. Proof of this is that 14 years later the 4 towns I mentioned now discharge the waste water into well constructed ponds. We still have the Imhoff tanks, however.

In closing, I would like to say that after the ponds are constructed as per district recommendations, the local citizens will not tolerate more than one mosquito within a five mile radius of the sewage farm.

Mr. Whitten: Thank you, Steve. Dick Peters just asked if I was saving the best for last. I didn't give him a direct answer, so . . . .

I have been running a dairy drain survey this last year, mainly because it is one of our toughest problems right now. I am sure that some of the other districts have pretty good sized dairy drain problems also, and this study should be applicable anywhere in the State.

The four dairies selected for study (Allan Grant Dairy, Jim Reed Dairy, Taylaker Dairy and College of the Sequoias Dairy) have permanently installed dairy drain disposal systems, the main parts of which are (1) a gravity drain from the dairy barn and holding corral, (2) a concrete sump on which is mounted a (3) sump pump activated by a float switch discharging into an (4) irrigation standpipe. The material discharged into

the standpipe is thoroughly mixed with irrigation water and distributed throughout the ranch by pipeline.

None of these dairies were causing any significant mosquito problem, and these dairies seemed to have a very adequate answer to this particular problem. Of course, there isn't any cure-all, any complete answer, but this type of thing seems to be practical, so I decided to find out just what the economic return to the farmer was. The complete study will be published in pamphlet form and will be available to anyone requesting it from the Delta Mosquito Abatement District.

The statistical data compiled in this study is listed on the following chart.

I have about seven slides which will show the four dairies, and the results of the test. (Mr. Whitten proceeded to show the slides with comments thereon.)

Thank you very much for your patience. I will now turn the meeting back to Dick.

DAIRY DRAIN STUDY TO ESTABLISH ECONOMIC VALUE OF LIQUID MANURE

Jan. 1958 to Jan. 1959	Alan Grant Dairy	James Reed Dairy	Taylaker Dairy	College of Sequoias Dairy
Total K. W. H.	2960	580	85	126
Gals. of liquid manure	22,000,000	3,100,000	515,000	681,000
Av. # cows milked/day	435	71	71	25
Av. gals. liquid manure per day per cow	140	120	20	75
CHEMICAL ANALYSIS				
Dry solids Av. 5.9#/100 gals.	1,300,000# or 650 tons	182,000# or 91 tons	30,380# or 15 tons	40,180# or 20 tons
NH_4-Nitrogen Av. .15#/100 gals.	33,000 lbs.	4,650 lbs.	770 lbs.	1,020 lbs.
P-Phosphorus Av. .02#/100 gals.	4,400 lbs.	620 lbs.	100 lbs.	140 lbs.
K-Potassium Av. .13#/100 gals.	28,600 lbs.	4,030 lbs.	670 lbs.	890 lbs.
½ dry solids as organic material at $2.00 per ton	$ 650.00	$465.00	$ 15.00	$ 20.00
NH_4 Nitrogen Value .10¢ per lb.	$3,300.00	$ 91.00	$ 77.00	$102.00
P-Phosphorus Value .10¢ per lb.	$ 440.00	$ 62.00	$ 10.00	$ 14.00
K-Potassium Value .05¢ per lb.	$1,430.00	$201.00	$ 33.00	$ 44.00
Total potential value as compared to commercial fertilizer	$5,820.00	$819.00	$135.00	$180.00
Operational cost	$ 63.40	$ 37.77	$ 28.67	$ 20.34
Potential net return	$5,756.60	$781.21	$106.33	$159.66

By: George R. Whitten, Agricultural Engineer, Delta Mosquito Abatement District

Mr. Peters: Thank you, George, and the other panelists on source reduction. Even though you extended the amount of time that we had scheduled for this particular afternoon for your panel, there is no subject that we would rather be extended with than source reduction. Does anyone have any question he would like to present; we might entertain a question or two.

Then we will turn the matter back to President McFarland, for I think he has a statement to make.

(Mr. McFarland presented announcements on alterations of time schedules for the evening program, and the session was adjourned.)

FIFTH SESSION

WEDNESDAY MORNING, JANUARY 27, 1960,

8:30 A.M.

President McFarland: It gives me a great deal of pleasure to see you all here, bright and early. Everybody looks as if they are as fresh as when they first started. We have a full session this morning so we don't want to get started any later than we can possibly help. If you will notice on your program, Mr. Frisby was scheduled to moderate the morning session, but he was unable to be on hand. One of his fellow board members, A. Sandy Steiner, a charter member of the Orange County District for more than seven years with a one hundred percent attendance record, will serve as Chairman of the morning session.

Mr. Steiner: Good morning, ladies and gentlemen. Mr. Frisby, who is the President of the Orange County Mosquito Abatement District, was unable to appear this morning, so I have been asked to introduce the first panel moderator. He is Dr. A. Ralph Barr, who, I understand, is better known to you than I am, so I need not go into any extra introduction so far as Dr. Barr is concerned. We will ask him to take my place and start right off, Dr. Barr.

Dr. Barr: Before this panel or symposium gets started, we have a member here who no one seems to know quite how to introduce; but it seems she wanted to make an announcement. I am not sure whether to refer to her as Helen Louise (Trembley) Durkee, or just how; but the Review Editor of the American Mosquito Control Association would like to make a brief announcement to you.

Mrs. Durkee: First of all, the American Mosquito Control Association, as some of you know, has a Journal, and the Journal has a review and abstract department and my announcement has to do with that. First, an excellent book is being reviewed by Ralph Barr, and you researchers will want to get a copy when it comes out. Is is by Christophers, and Ralph says it is the most important work on mosquito anatomy to date, and that there is no one in this field of work that should pass this by.

The other publication that I would like to bring to your attention, since this is a research panel, is a very new publication by Dr. Snodgrass. The author sent it to me just before we went to press for our last issue; and it is "The Anatomical Life of the Mosquito." It is written in Dr. Snodgrass' masterful style with his usual sparkling wit; and even though I am addicted to detective stories, I think that this is on a par. It is a gem and easy to read. If I were in charge of a laboratory now, I would see that everyone working with me had a copy. This is an historical occasion. It is the only time that any will see me speak so few words, and it should be remembered.

I don't know what the price is, but it is a Smithsonian Miscellaneous Publication, and I am sure that if you write, they will send you one. If you owe them any money, I am afraid that they will tell you what you owe.

Dr. Barr: This is Smithsonian Miscellaneous Collections, Volume 139, No. 8. Incidentally, I have written for these before, and you usually write to the Superintendent of Documents, U. S. Government Post Office, Washington 25, D. C. They never send them to you. They always first send you the price, how much it costs. Unfortunately they sell the Miscellaneous Publications, and unless you know Dr. Snodgrass or have a friend in the Congress, you will have to pay fifty cents or something like that for it.

In the brief time at our disposal this morning, we are not making any attempt to try to go over the research program of the Bureau of Vector Control in any great amount of detail. We have been doing quite a few things during this past year that you will not be hearing about this morning. On the other hand, we tried to select a few important developments for presentation and allow ample opportunity for discussion. However, we are getting underway some twenty minutes late now, so we will either run over a little bit, or we will give up our discussion time, one or the other. We would just as soon have some discussion from you on some of these topics which we will talk about this morning.

I am not going to bother to introduce all of these people in a long-winded fashion, because, again, you have known most of them longer than I have myself. Our first talk will be on measurement of larval populations. Somehow we got standardized titles for all of these talks, and this one is entitled "Advances in Population Measurement." This will be given by Dick Husbands, whom I am sure you all know very well.

ADVANCES IN POPULATION MEASUREMENT

RICHARD C. HUSBANDS

Bureau of Vector Control

California State Department of Public Health

Abstract

The results of sampling immature mosquito populations were discussed. Sources of error were pointed out as they pertained to traditional methods. To overcome these errors a new device was developed which trapped not only immature mosquitoes but other forms of aquatic life such as scavengers and predators. The device is a jar with an inverted cone which, when two-thirds full of water and placed in a vertical position, will trap surfacing aquatic organisms. Preliminary results indicated that the trap could be used successfully with *Aedes nigromaculis, A. melanimon, Culex peus* and *C. pipiens quinquefasciatus*. With *Aedes* species the trap was efficient even when densities as indicated by dipping, were low or negative. Adults and larvae of hydrophilid, dytiscid, and corixid predators were also taken by the trap. Since the traps were in position and undisturbed for 24 hours the data represented both diurnal and nocturnal sampling. It is believed that this method of capturing immature mosquitoes may eventually

prove to be a useful tool in the estimation of population density of immature mosquitoes.

Dr. Barr: Thank you, Dick. I am sure that many of you have questions that you would like to ask Dick about this device.

Mr. Grant: I don't believe Dick indicated whether this device or method was an operational practicability or an evaluating practicability.

Mr. Husbands: I think there is only one way to test that, Don, and that would be to ask some individuals to try it out in their daily operations. I think that there are several limitations in the use of this device; we recognize this; and we do not expect it to work overnight as a magical device. I am only just beginning this work, and I would like some additional people to try it.

Question: You have the mean figures, but I would like to ask what the variation was. How many cages did you have to put out to get reliable data?

Mr. Husbands: This is an unknown factor; it is still to be examined critically. The range in the number trapped is an important factor. In some traps we captured only a few specimens; in others quite a few were taken. For example; some traps would recover less than a hundred, and some higher than one thousand per trap. However, this variation provides clues or data to help understand the ways to use this tool. This is something we can develop as we gain more knowledge about the cause for this variation. I could show you data from our study and this might explain the reason for my evasive answer.

Mr. Stage: Did you see what happened when mosquito predators get into the trap?

Mr. Husbands: That is a good question. Do predators actually consume a percentage of the population in the trap? Yes they do. However, we can count the siphons or head capsules that remain and get a close estimate of the numbers that the predators took in the trap. In certain circumstances this factor seems to be important. In the experimental pond tests, predation was not high enough in most cases to significantly reduce the number of larvae captured. However, in field tests, predation in the traps has proved to be very significant, because it has reduced numbers tremendously.

Predation in the field, however, is an important factor that should be evaluated. When you examine the data obtained from these traps, you begin to realize that this phenomenon is being measured. This is important and is especially significant when you compare dipping with trapping. It is interesting to note that the predator factor did not show quantitatively in the dipping samples but was found to be very significant in the trapping method.

Question: Do the traps collect different amounts of the same species under different conditions? How will this effect the trap as a sampling tool?

Mr. Husbands: I believe that there are differences in the behavior pattern of *Culex* larvae under different conditions (we all know that there are differences in the habits of species and that *Culex* species are less vigorous movers than the *Aedes* species). Under certain conditions *Culex* larvae tend to remain fixed, more or less, within their environment. They have, perhaps less up and down movement, and also there are certain conditions where*Aedes* larvae are bunched together and are not disturbed uniformly in the environment. This presents less opportunity to recover them in traps. This we are going to test by a laboratory designed experiment, and I think we can actually show differences in the habits of species based on their movements or rate of movement and environmental influences. How this will eventually influence this tool as a sampling device, I cannot predict.

Captain Holway: How does the depth of water affect the percentage of different species?

Mr. Husbands: Again, this is an unknown. We had to assume a standard, and we always placed our traps at a standard depth from the bottom. You might think that such traps should be placed at a standard distance from the top, but we didn't have much choice. We realized that the water level always dropped on these traps during a twenty-four hour period, so we had to place them deep enough so they wouldn't be emptied if the water got down too far. Therefore, we selected a depth —we knew if the water would drop three or four inches in a pond—that always placed the traps with the bottom above a standard depth. However, depth probably is an important factor in how many larvae or pupae will be recovered.

Dr. Barr: I am afraid we will have to move along at this point. Those of you who would like to find out more about this are invited to get in touch with Dick after the session this morning and discuss it with him.

The next speaker is Charlie Judson, whom I am sure most of you know by this time. He will give a presentation on some of his findings this year on *Aedes* eggs and stimuli which induce hatching of *Aedes* eggs. Charlie Judson.

ADVANCES IN KNOWLEDGE OF AEDINE EGGS

CHARLES L. JUDSON

Bureau of Vector Control

California State Department of Public Health

Abstract

A correlation between the level of dissolved oxygen in the flooding medium and the hatching of various Aedine eggs has been known for several years, having first been shown by Gjullin *et al.* in 1939. Two distinct effects of dissolved oxygen on Aedine eggs are known. In one case, when the eggs are flooded with water of various low but constant dissolved oxygen levels, the amount of hatching stimulated varies inversely with the oxygen level, i.e., the lower the oxygen the higher the proportion of eggs hatching. In the second case, a reduction in the oxygen concentration occurring after the eggs are flooded provides a powerful hatching stimulus, even when the decrease in oxygen is not great compared to the first case. This dissolved oxygen stimulates hatching of Aedine eggs by either a very low unchanging concentration, or by a relatively slight but continuous decrease in concentration.

In attempting to determine which of these mechanisms was the one which operates in nature we measured the dissolved oxygen, and its changes in concen-

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tration, in the region (within 1/8") of the soil-water interface, by means of a polargraph. We found that the dissolved oxygen level of the water starts decreasing immediately on flooding, at the rate of 1-2 ppm per hour, but that this rate of decrease drops off with time so that several hours are required to reduce the dissolved oxygen level to 1.0 ppm or less. This information on the dissolved oxygen levels at the soil-water interface, plus the common observation that most hatching occurs shortly after flooding, seems to indicate that a decreasing, rather than a low static level of oxygen *per se* is the natural mode of stimulation.

Of importance to us here is how this knowledge of the stimulus can be used in the development of new control measures. The first step in such a development, following the definition of the stimulus, is in determining how the stimulus affects the egg, and what occurs in the egg which leads to hatching.

During experiments designed to investigate this phase of the hatching process it was found that by means of the appropriate chemical, hatching could be nearly completely inhibited in the presence of a strong hatching stimulus, or could be induced in the absence of the stimulus (lowered dissolved oxygen).

While these results do not yet lend themselves to practical control techniques, they do indicate that a considerable degree of control over hatching can be attained, and that this ability to manipulate hatching could lend itself to both new and existing mosquito control methods.

Dr. Barr: I am afraid that at this point we are well behind our expected schedule, so I think we had better not throw this paper open for discussion, but rather proceed with the next paper. Any of you who are interested in talking with Charlie further about this will find him at the close of these meetings in the smoke-filled corridors.

So, we will then go on to a relative new-comer in our organization, Dr. Kellen, who has joined us this last year. We have felt for many years that something should be known about diseases that kill mosquitoes and whether they can be manipulated to our advantage or not. Dr. Kellen has started on this project in the last year and he has now been able to find parasites all over the place. We find that mosquitoes are no better off than are human beings with respect to diseases. He will show you some of these this morning. Dr. Kellen.

RECENT ADVANCES IN BIOLOGICAL CONTROL IN MOSQUITO ABATEMENT

WILLIAM R. KELLEN

Senior Vector Control Specialist

Bureau of Vector Control

During the past year we have initiated a biological control program which will study the general subject of natural control agents as they are applied to the problems of mosquito abatement. There are two broad problems under investigation in this program, (1) to determine the role of biological agents in the natural regulation of mosquito populations in the field, and (2), to develop methods by which we can increase the effectiveness of these agents. The objective of the program is to develop biological control methods which will promote a long term economical level of mosquito control.

The importance of biological control has been recognized for a long time in the field of agriculture as a reliable method for establishing effective pest control. The method has had, however little application in the fight against arthropods of public health importance. In particular there has been a general lack of support for the development of a strong biological control program directed toward mosquito abatement. This lack of interest in the past has been in part due to the belief that mosquitoes were not attacked by the proper kinds of enemies which would lead themselves to exploitation for biological control purposes. Moreover, chemical insecticides have always been readily available, convenient to handle, and usually relatively inexpensive, this, of course, did not stimulate a desire for research or interest in biological control. However, the picture has changed in recent years. The hazards of handling new chemical formulations are well known; but more important, the increasing spectrum of mosquito resistance to chemical insecticides makes it apparent that we must look to biological and other naturalistic control measures for lasting effectiveness.

Biological agents have been highly successful for the control of insects in the past and it has been demonstrated that the method can provide economical control for a relatively small investment. Unlike chemicals, biological control agents never pose a threat to the health or well being of man or his property. Moreover, there have been very few instances of pest species developing protective adaptations against the biological control agents introduced by man. It is evident from the facts that biological control will continue to grow in importance in the future, while it is likely that the popularity of chemical control will eventually decrease and be restricted to emergency situations only.

The field of biological control is rather broad and requires the integration of many different subjects, such as ecology, systematics, microbiology, biochemistry, and many more, depending upon the particular application. Moreover, it is a study can can be approached from several different ways. It has been found, for example, that pests which are not indigenous to an area frequently do not have their normal complement of control agents; this kind of pest frequently is brought under control by importing natural enemies from the native habitat. The importation of control agents has also been successful against indigenous pests which appear to lack or have inefficient natural enemies; in these cases exotic agents are sought which normally attack closely related species and which will adapt to new hosts. Furthermore, occasionally the indigenous enemies of a pest can be assisted to gain a higher level of control with man's help; this usually has been achieved by rearing the agents in large numbers and distributing them in the field at critical times most favorable to the control agent.

Experience gained from the application of biological control in agriculture has indicated that the most profit-

able approaches to the subject are dictated by the nature of the organisms which must be controlled. One of the first prerequisites, therefore, is a good knowledge of the pest species. Its biology, distribution, and habitat must be well known. Many questions must be answered, such as, which particular stage in the life cycle of the pest is most exposed to attack by natural enemies? Is there any particular time or season when the stage is most vulnerable? What is the nature and distribution of the habitats where these stages are found? What kinds of predators, parasites, and pathogens are present, and which ones of these offer the most promise for control purposes? This kind of information coupled with a thorough understanding of the host-symbiont relationship places one in the best possible position to evaluate the probability of achieving successful control.

In our biological control program we have chosen to restrict our attention to an investigation of the pathogenic microorganisms which cause diseases of mosquitoes. Since the mosquito species with which we are concerned in California are probably indigenous, we are faced with the possibilities of importing exotic pathogens to attack our native hosts and finding ways to increase the effectiveness of our naturally occurring diseases.

Just about all of the known pathogens of mosquitoes are members of the Fungi (*Coelomyces*) and Protozoa (Microsporidia). It is perhaps significant that although a large number of pathogens have been recorded from all parts of the world, practically nothing is known about their host specificity, modes of transmission, seasonal abundance, or distribution. Information of this kind is very fundamental and extremely important.

In our work during the past year we have found a large number of microsporidians infecting our Californian mosquitoes. Populations of *Culex tarsalis* larvae, for example, have been found at Hanford with fatal infection rates running over 15%. Other species found infected during the year include *Culex peus*, *C. apicalis*, and *Anopheles franciscanus*. Although we have not yet found parasitic fungi attacking larvae in the field, we have discovered the first known instance of a fatal bacterial disease of mosquitoes.

All of these organisms are now under study, while the search for new diseases continues.

Dr. Barr: I wish we could spend some period of time discussing this paper, because we think it is a completely new and very important kind of information that we are getting; bu due to limitations of time, we will have to proceed.

Our last speaker will take only a few minutes. Bettina always runs through things without waste of time, so I am sure it will not be long before the break. In the last year we have started a new kind of project. We are always being asked: How far does a mosquito fly? We have gone through the literature and looked up the techniques and so forth, and the techniques available for such a study as this are practically of no value whatsoever. So we are trying new approaches to this and related problems, and Bettina is going to give you some idea of the work that we have been doing in this area during the last year.

Bettina, how do you tell how old a mosquito is?

ADVANCES IN BEHAVIORAL STUDIES

BETTINA ROSAY

Bureau of Vector Control

California State Department of Public Health

What kinds of studies are behavioral? We have all wondered where mosquitoes in a certain area come from; we have wondered about migrations and whether biting populations could be correlated with breeding sites. These are examples of behavioral activities. In the past we have been unable to study some of these phases of mosquito life because we have lacked the techniques to do so.

Russian entomologists have been working on this for years in relation to their malaria epidemics. They wanted to find out all they could about the transmission of the disease. But not until recently were we able to benefit from their studies. The most significant information involved techniques for determining the age of mosquitoes. The physiological age of an individual female mosquito can be known by the number of batches of eggs she has laid. Each time an egg is developed and laid, a scar remains at the site of its development. Therefore, if a female is dissected and five scars are found, that female produced five batches of eggs. The five egg batches are related to the epidemiological significance of the female because five blood meals were probably taken to produce those batches of eggs, and each blood meal, after the first one or two, may have contributed to disease transmission.

In the past year, the research staff at Fresno has added other techniques to those used by Russian entomologists.

It was found that tissues from the larval and pupal stages are carried over into the adult body where they remain for a few days after the adult has emerged. The tissues are gradually autolyzed and used for other purposes. The amount of tissue found in the adult indicates how recently it has emerged.

The tubes in which the eggs develop are greatly distended at the time of oviposition and require about two days to return to their original size. If a female mosquito is dissected and found to contain such stretched tubes, we know that oviposition has occurred recently and, if she hasn't already done so, is ready to take another blood meal.

Examination of the stomach reveals the recent history of the feeding habits of the female. The amount of blood and the state of its digestion can be correlated with egg development. This makes it possible to predict when the eggs being developed would have been laid.

These techniques are used to study wild populations of mosquitoes. For the purposes of age determination, there are two kinds of mosquito populations in nature. One kind is brooded such as pasture or snow mosquitoes. These mosquitoes hatch and develop during the time that temporary water sources are present. When large numbers of eggs hatch at one time, a mass emergence of adults occurs and that emergence occurs during a relatively short period of time. The age of the whole brood can be estimated by dissecting samples of the population. This shows us the activities of a group of mosquitoes in a specific area—what they have done,

what they are doing, and what the ones remaining in the area are going to do.

The other kind of population is constant, such as the *Culex* breeding in log ponds and the *Anopheles* in rice fields or other permanent source that continually produces mosquitoes. In this kind of popluation new mosquitoes are replacing older ones as they die. Samples of these populations are likely to reveal all ages at all times, and all states of feeding and egg development.

The Fresno staff has successfully used age determination methods for several field studies. Two of these were on pasture mosquitoes. Broods of *Aedes nigromaculis* and *A. melanimon* were sampled daily from the time of emergence until mosquitoes were no longer present in sufficient numbers to provide adequate samples. We were able to study the activities affecting their behavior. As long as the tissues from the immature stages persist in the adult body, the mosquitoes remain relatively inactive. After the tissue has been resorbed, mating takes place, then the females feed, and several days later the first batches of eggs are laid. The females refeed and soon the second batches of eggs are laid—and so on. Information from these two studies, one was done in March and the other in June, gave us very useful data on the lengths of times required for each phase of adult activity at those seasonal temperatures under field conditions.

Another age determination study was at a duck club. The primary species of concern was *Aedes melanimon.* The purpose of the study was to learn if mosquitoes collected at the duck club were actually breeding there or if they were migrating in from other sources. Based on previously obtained data from the field and from the laboratory a timetable was constructed to determine theoretically the aging sequence of the population from the known date of emergence. Samples of the adults on the duck club were dissected and the actual physiological ages of the females compared satisfactorily with the theoretically determined ages. The evidence was that the *A. melanimon* were breeding at the duck club.

Behavioral studies based on age determination techniques are extremely new to us. The application of them is unlimited. Future work in mosquito research has a new dimension. This is the *AGE* of the segment of the population that is to be examined, whether it is the mosquitoes that enter light traps or the mosquitoes that develop resistance after exposure to insecticides or the mosquitoes that are being studied to answer behavioral questions.

Dr. Barr: Since we are about twenty minutes behind schedule now and everybody is beginning to fidget a good deal, I think that again we will not have questions on this paper.

I would like to thank the panel members for their participation this morning, and I would like to thank our audience for their indulgence with our being as long-winded as we have been. Now we will turn the program back to our chairman, Mr. Steiner.

Mr. Steiner: The next item on our agenda is a panel discussion; and I would like at this time to introduce Mr. Harvey Magy, who is going to be the moderator for the panel discussion.

Mr. Magy: Thank you, Mr. Fellow Southern Californian. I think that for the year ahead we are really going to dominate this organization.

First of all, I want to explain why I am up here. Dr. Mulla has been quite ill and unable to attend, so I have been asked to stand in his place.

This subject is quite close to my heart. Being the Southern California Area Representative for the Bureau of Vector Control, I have been spending as much time on problems of aquatic and terrestial gnats as I have been on the many other aspects of our multitude of functions. I remember a statement that Dick Peters made about five years ago. He said: "Harvey, I think that gnats are in our future." Well, I would like to advise Dick that gnats are here. The future is the present. You can see from the number of different genera involved on the program, that many organizations are seriously concerned with gnats.

Since we have a limited time, I would like to ask the panel members to spend about ten minutes at the most, so that we may conclude in time to go on wtih the next item of the agenda. I am switching the subjects around a bit so that we can take care of the aquatic gnats first, followed by the terrestrial gnats. We have another change in our program: Dr. Lauren Anderson, who was supposed to present a paper on "The Chironomid Midge Problem in Los Angeles County Flood Control District Spreading Grounds,' was unable to attend, and Mr. McFarland will present this item. Before he begins to read the paper, I would like to have him give a little background as to the interest of his particular agency, and incidentally our interest, in this particular problem.

Mr. McFarland: (for L. D. Anderson): Thank you, Mr. Magy. The background of our Chironomid problem is one that is, or at least was, quite serious. As you know, southern California, as northern California, is expanding rapidly. People are moving close to natural lakes, artificial lakes, reservoirs, ponds, and so forth, and problems develop that may have been existing all the time, but actually weren't recognized. As an example, the Los Angeles County Flood Control District is responsible for water conservation in Los Angeles County, with over 1,000 acres of spreading grounds located in a population center of over 200,000 people. Until two years ago, the water percolated into the spreading grounds was the water that fell naturally in the San Gabriel Mountains. This was collected in flood control reservoirs and saved through late winter or early spring and then percolated in these 1,000 acres.

As you know, the water situation is becoming more difficult in Los Angeles County; therefore, the Central Water Basin District was formed to work with the Los Angeles County Flood Control District to buy Colorado River water from the Metropolitan Water District. This water is purchased in sufficient quantities so that the spreading grounds have water in them the year around with consequent development of serious Chirronomid populations.

Of course, there is no disease picture, but people that have thousands and thousands of Chironomids flying into their homes and getting on their laundry get pretty exasperated. Additional distressing developments were expense and damage in industry. You might wonder how Chironomids could hurt industry. As one example, midges would fly down ventilators of plastic factories and contaminate sheets of plastic unknown to the factory. As a result, defects would appear in the plastic sheet as it was processed into articles at other plants. The economic loss of returned plastic, transpor-

tation loss, customer dissatisfaction, and material loss amounted to over $5,000 in just one factory.

Another problem occurred in automobile painting booths where Chironomids would enter in large numbers and adhere to freshly painted cars requiring complete resanding and repainting. One company with a production paint line had over $10,000 worth of damage in less than two weeks.

The question then arose, what is the solution? Water needs require spreading grounds, yet people who live near the water say "We don't want the Chironomids." As a result, we were asked to advise on the problem. There was very little that had been done in this particular type of situation as far as we could determine, so we asked the State Health Department to consult on the matter. After preliminary investigations, recommendations were made by the State Health Department and the Southeast Mosquito Abatement District that the Los Angeles County Flood Control District finance the project, with the research to be carried out by the Entomology Department of the University of California at Riverside. Our recommendations were followed with the project started in late winter of 1959. Dr. Anderson's paper is a preliminary report which the lateness of the hour precludes reading at this time but which is submitted for inclusion in the proceedings.

Mr. Magy: Thanks, Gardner. There is one item that I would like to add to this. The flood control district, which is not in the mosquito or gnat control business, has contracted with the University for about $8,500 for this one year's activity. In addition to that, I received the word that they must have spent an equivalent amount of money on the engineering of those particular study basins. So, you can see how interested a non-vector control agency is in a vector problem. This might be the pattern for the development of similar types of investigations in vector problems.

The next paper will be by Robert E. Dolphin, Manager-Entomologist of the Lake County Mosquito Abatement District, regarding the Clear Lake Gnat. Mr. Dolphin.

DEVELOPMENTS IN THE RESEARCH AND CONTROL PROGRAM OF THE CLEAR LAKE GNAT *CHAOBORUS ASTICTOPUS*, D. & S.

ROBERT E. DOLPHIN

Manager-Entomologist

and

ROBERT N. PETERSON[1]

Research Entomologist

Lake County Mosquito Abatement District

Lakeport, California

The present high population of the Clear Lake gnat, *Chaoborus astictopus*, (D. & S.) in Clear Lake, is sufficient cause to warrant a continued research program for the development of alternate and supplemental gnat control methods and materials. When DDD or TDE, which abated the gnats for close to a decade, became defunct, as discussed by Dolphin (1959), the Lake County Mosquito Abatement District was not able to shift to other control devices since none had been developed. Consequently, the past several seasons have seen the return of gnat flights in numbers reminiscent of years prior to the first control treatment of Clear Lake in 1949. Stop-gap control measures utilized in the Summer of 1959 gave partial relief, but the gnat infestations along the shores of Clear Lake were still well above the nuisance threshold.

The present research program has been in operation for a period of one and one-half years. The main function of this program is to discover and develop possible larvicide substitutes for DDD for use in the established control operation employed by Dr. A. W. Lindquist, *et al.*, (1951). In the past year, additional equipment has been acquired which will be used to conduct bacteriological toxicity tests on the aquatic gnat larvae as time permits.

STOP-GAP CONTROL METHODS

In an effort to reduce the gnat problem, two stop-gap control methods were employed during the summer of 1959. Gnat eggs laid on the surface of Clear Lake, float and accumulate into extensive, visible rafts or drifts, as described by Lindquist and Deonier, (1942). Daily inspection of the lake by airplane during the gnat season was followed by application of Richfield Larvicide[2] on all egg drifts located. This oil was applied by Stearman or Piper Cub spray planes at a rate of 5 gal./acre. A total of 5,500 acres of drifts of varying size and composition were sprayed. Field collections of sprayed eggs invariably indicated 96%-100% mortality. A population survey of the lake by Eckman dredge sampling in November 1959 was 42% lower than the previous year at the same time.

Weekly adulticiding of lakeside resorts, parks and beaches were a supplementary control measure. A Malathion emulsive spray was applied to the tree and shrub resting area of the adult gnats by Buffalo Turbine sprayer mounted on a ¾-ton truck. The residual action of this spray was observed to produce several days of local control in the sprayed areas.

By the season's end, it was apparent that the stop-gap control methods did not produce effective results and that the desirability of adequate gnat control by the lake treatment method is still predominant as our immediate research goal.

GNAT LARVAE TOXICITY TESTS

Ideally, for our use, a gnat control insecticide should fulfill the following characteristics: (1) high gnat toxicity, (2) low fish toxicity, (3) low mammalian toxicity, (4) long residual in slightly alkaline water, (5) eventual degradation to innocuous products, (6) moderate in cost, and (7) non-accumulative in the biota, subject to food-chain transfer, (Hunt & Bischoff, 1960). The majority of the screening tests have been

[1] The authors wish to express their gratitude to L. W. Davidson who assisted in the laboratory work.

[2] Trade name of a petroleum product manufactured by Richfield Oil Corporation.

with organic phosphate insecticides. The chlorinated hydrocarbon insecticides were not included because of their tendency to accumulate in vertebrate fatty tissues.

Two botanical insecticides, Barthrin and 2, 4, Dimethyl benzyl ester of Chrysanthemumic Acid indicate susceptibility of *C. asticopus* for this class of compounds. Budgetary limitations prohibit practical application with these expensive chemicals at this time, but this group of compounds will have many desirable features for a lake treatment when they become economically available.

In the screening tests, 1.0 gm. of technical or purified insecticide is added to acetone to produce 100 ml. solution. This acetone solution is further diluted with distilled water to make a .0005% solution. Aliquots of the latter are then added to 1½ liters of Clear Lake water to produce final concentrations. This solution is divided into three glass fruit jars and approximately 100 gnat larvae are added to each jar. The tests are conducted in a darkened room to simulate natural conditions, at a temperature of 70°F. (± 2°). Control larvae are held in plain lake water. Abbott's formula is applied to any resultant mortality in the controls. Toxicants that produce a 48 hour LC90 at concentrations not greater than .02 ppm are considered promising. The averaged results of insecticides that have met this standard are listed in Table 1, (Geib *et al.*, 1957).

Other insecticides which have been tested include, Co-ral, DDVP, Delnav, Diazinon, Dylox, Ethion, Guthion, Korlan, Malathion, Phosphamidon, Phostex, and Sevin.

TABLE 1

24 HOUR RESULTS OF TOXICITY TESTS OF

CHAOBORUS ASTICTOPUS LARVAE

	Parts per million							Approximate ppm	
	.1	.04	.02	.014	.013	.01	.005		
INSECTICIDE	1:10mil	1:25	1:50	1:70	1:75	1:100	1:200	LC50	LC90
EPN			100 [1]			81 [1]	74 [1]		.013
Parathion			96[12]		72[16]	47[14]	34 [1]	.009	.018
Dicapthon			95 [2]			80 [2]			.016
Methyl Trithion		100 [2]	85 [4]		43 [2]	32 [5]	[1]	.013	.025
Methyl Parathion			80 [1]			54 [1]	17 [1]	.010	.015
2,4 dimethyl benzyl ester of chrysanthemumic acid*	99 [1]					63 [1]			.057
Barthrin*	97 [2]	76 [2]	65 [2]			31 [2]		.015	.074
Trithion			55 [1]	42 [1]				.018	

*Larvae collected from Scotts Valley pond.

Small numbers indicate the number of tests reported.

FISH TOXICITY TESTS

As a result of the screening tests, Parathion first and later Methyl Trithion, were selected for consideration as potential lake treatment insecticides. Both materials were further tested to determine toxicity to fish found in Clear Lake. Bluegill, (*Lepomis machochirus*), are easily collected from Clear Lake and were used as the test species. The procedures as outlined by Henderson and Tarzwell, (1957), were followed as closely as possible.

In these tests, aliquots of toxicants, prepared as in the larval toxicity tests, are added to Clear Lake water to make the various dilutions. The solutions are held in 5-gallon aquaria to which five test fish are added. Aeration is always a problem. It is preferable to forego aeration in order to minimize volatilization and oxidation of the toxicant. Yet, in the absence of acration the dissolved oxygen levels often fall below the required minimum for fish life. A number of tests were conducted in which the solutions were aerated by compressed air applied by porosity tube. The results of the aerated tests were always of a lower toxicity than those of the non-aerated tests at the same concentration. The tests indicated that Parathion was toxic to Bluegill at treatment dosages while Methyl Trithion seems to be relatively non-toxic to these fish as shown in Table 2.

TABLE 2

RESULTS OF TOXICITY TESTS WITH CLEAR LAKE FISH

Insecticide	Type of Fish	LC50 Parts per million 24 hr.	48 hr.	72 hr.	96 hr.	148 hr.
Methyl Trithion tech in Acetone	Bluegill	------	------	.42	.185	.16
Parathion, tech in Acetone	Bluegill	.013	------	------	------	------
Parathion, tech in Acetone	Bluegill (aerated)	.026	------	------	------	------

FARM POND TESTS

In the Summer and Fall of 1959, five ponds were treated with Parathion or Methyl Trithion. Four of the ponds were of regular dimensions, having been constructed by excavation according to specifications of trapezoidal dimensions. The volumes of the ponds were calculated by geometric computation of soundings and surface measurements.

A one to ten acetone-pond water formulation containing the necessary amount of technical grade insecticide was distributed in the pond by means of a Hudson pack sprayer. This mixture was injected into the wake of a small boat which was rowed back and forth along the length of the pond.

Allen's pond test differed from the other four ponds in a number of respects. The pond itself is irregular, having been created by damming a small stream. The volume was calculated by a salt recovery process wherein 213 pounds of potassium chloride were introduced into the pond. Water samples collected 2 and 4 hours later were analyzed for potassium and chloride content. The data obtained were compared with pre-innoculation blanks and the volume computed from the results. The formulation used in Allen's pond was Methyl Trithion 4 lb./gallon emulsion mixed with pond

TABLE 3

RESULTS OF 1959 POND TESTS

Name of Pond	Date Treated	Formulation & Dosage	Percent mortality *C. astictopus* Days 1	2	3	4	5	6	7	8	9	14	Pre-treat. fish mortality	Post-treat. fish mortality
Jackson's Pond	6/22/59	Parathion in Acetone 1:60 mil	57	86	97	100							0	*2 weeks* 388 Green Sunfish 11 Bluegill 12 Brown Bullhead
Fitzgerald Pond	7/8/59	Parathion in Acetone 1:100 mil	12	15	32	45			45	52*		....	0	*2 weeks* 4 Bluegill
Jones Pond	7/21/59	Methyl Trithion in Ace. 1:100 mil		26					57*			....	0	0
Wetmore Pond	8/5/59	Methyl Trithion in Ace. 1:75 mil	51	74	95	97	97	98	99	99	100	....	5 Green Sunfish[1]	*2 weeks* 15 Green Sunfish 1 Hitch
Allen's Pond	10/5/59	Methyl Trithion 4E 1:90 mil		76		73				89*		....	0	0

[1] Fish removed prior to insecticide application.
* Maximum mortality during test.

water and introduced into the wake of a small outboard motor boat. A continuing cold wave starting after treatment was of probable significance in the results of Allen's pond. A night survey of larval activity, two and one-half days after treatment by mud sampling indicated that only 54% of the larvae were emerging into the water. It is assumed that the gnats are protected from the insecticide as long as they remain in the mud botom. Furthermore, phosphate insecticides have been shown to be less toxic at lowered temperatures.

Spawning activities of the Green Sunfish (*Lepomis cyanellus*), were observed one week prior to treatment in Jackson's pond. These activities probably weakened these fish, and may have contributed to that species susceptibility to the Parathion treatment. Of interest, were observations of several schools of ¾-in. Centrachnid fry in healthy active condition two weeks after innoculation.

It is believed that the fish mortality observed in Wetmore's Pond primarily represents a natural mortality since five dead Green Sunfish were removed from the pond on the day of the treatment, prior to the application of the insecticide.

The pond tests further confirm the laboratory tests in respect to the greater toxicity of Parathion to fish as compared to Methyl Trithion.

On the basis of these tests, it appears that a 1:75 million concentration approximates the minimum dosage that will yield 100% gnat control in a single field application of Parathion or Methyl Trithion to a small body of water.

The larva and fish mortality observed in these ponds, are included in Table 3. Additional pertinent information is given in Table 4.

TABLE 4

PHYSICAL CHARACTERISTICS OF 1959 POND TESTS

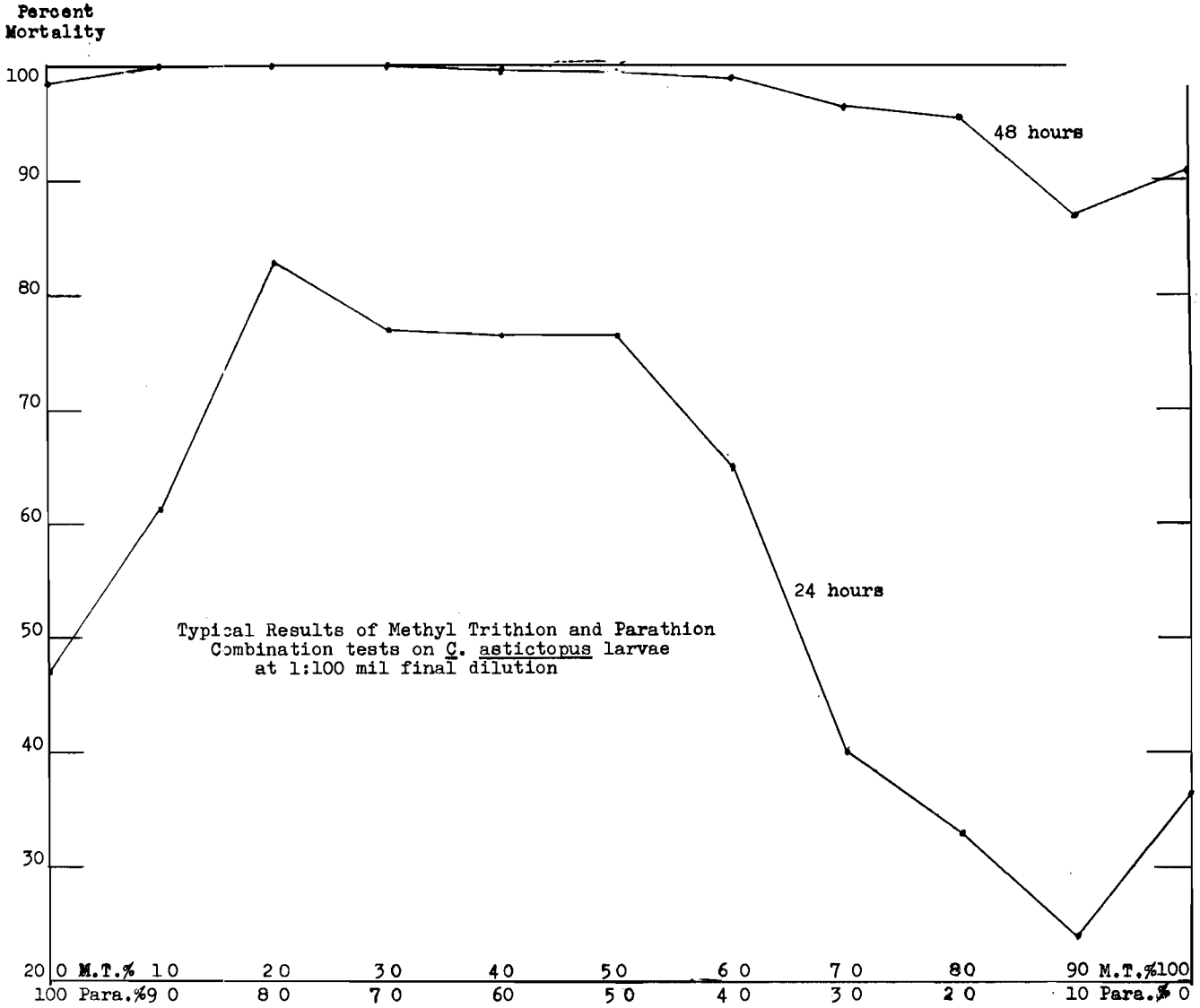
DURING TWO WEEK TEST PERIOD

Name	Dimensions or Surface Acres	Volume in gals.	Surface Temp. °F.	Bottom Temp. °F.	pH	Total Hardness ppm.
Jackson's Pond	168′ × 47′ × 10′ max. depth	320,000	76-86	72-75	8.1	138
Fitzgerald Pond	60′ × 45′ × 9′8″	96,000	80-84	70-76	8.4	118
Jones Pond	168′ × 57′ × 9′3″	308,000	75-78	73-76	8.3	50
Wetmore Pond	78′ × 57′ × 9′3″	170,000	73-84	70-75	8.3	170
Allen's Pond	98 acres	13,034,000	63-66	60-61	7.2	122

COMBINATION OF INSECTICIDES

In the past year, Parathion and Methyl Trithion have both come under consideration as a replacement for DDD in lake treatment operations. Parathion was ruled out because of the apparent hazard to fish at or near treatment dosages. Methyl Trithion has been temporarily removed from consideration because of cost limitations. In an effort to resolve the limitations of these toxicants, larval toxicity tests of various combinations of the two were undertaken. A typical 24 hour and 48 hour mortality curve of one test is shown in Table 5, to indicate the increased toxicity which was disclosed by these tests. This synergistic effect is most pronounced from 40% Methyl Trithion-60% Parathion to 20% Methyl Trithion-80% Parathion. Within this range, a combination will be selected which will give the greatest gnat toxicity with the least fish toxicity. Fish tests using Bluegill are now in progress. Mammalian tests of this combination will follow as soon as practical. Field tests using farm ponds and small lakes are scheduled to begin as the weather warms to a degree when gnat larvae activity is resumed.

TABLE 5



THE GOALS OF THE RESEARCH PROGRAM

Our immediate goal in gnat control is treatment of Clear Lake as soon as possible, whether by a Parathion-Methyl Trithion combination or whatever insecticide is discovered to be most practical. Once control of the Chaoborid gnats is regained, a constant search will be made to have additional gnat treatment chemicals on hand to be used as replacements when resistance or other problems develop. When these requirements are met, emphasis will be shifted to our long-range program of biological and ecological control studies. We remain optimistic in the belief that the results of the long-range program will eventually resolve our seemingly perpetual gnat problem on a continual, economical basis.

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Mr. Magy: We will proceed to the next item, Mr. Don Grant, Manager-Entomologist of the San Mateo County Mosquito Abatement District, who will discuss a summary of recent investigations on *Leptoconops torrens* and of Tendipedid Midges.

STUDIES ON LEPTOCONOPS TORRENS AND CHIRONOMID MIDGES IN CALIFORNIA[1]

C. DONALD GRANT, *Manager*

San Mateo County Mosquito Abatement District [2]

INTRODUCTION

Studies on the biting black gnat *(L. torrens)* have been undertaken for the past five years by this District; being greatly augmented in 1958-60 through research funds awarded by the State Department of Public Health. In the current year, 1959-60, an evaluative study has also been undertaken to provide basic information on the Chironomid midge problem in California. The objectives of the black gnat studies have unnecessarily entailed a long range study of their biology, larval habitat and soil ecology, and experimental control, since their life span may endure several years depending upon the period of larval diapause.

Acknowledgement is gratefully given to other workers, not only for their previous studies and information, but for direct aid in cooperatively working on experimental control aspects. Special appreciation is extended to Dr. Austin Morrill for his cooperative efforts in behalf of experimental sampling and control work done at the U. S. Navy Radiological Station near Dixon, California.

Since this paper is presented as a progress report, complete summaries and correlation of data are not possible.

BLACK GNAT *(L. torrens)* STUDIES

This small (1.5 mm.) member of the Heliidae is found in numerous areas of California in its valleys and lower foothills where deposits of heavy, cracking adobe soils are deposited. Records show their presence from the northern Sacramento Valley intermittently to San Diego, both in the Central Valley and in pockets along the coast. These breeding habitats have been long existent or endemic from our earliest history. There is no indication that recent alterations have led to an expanded range in the breeding sites or potentials of this species; but rather that man's modification of the environment tends to eliminate the suitability of the soils for the development of the gnat larvae. It is probable that utilization of these clay or adobe soils will eventually greatly limit the prevalence of this biting gnat; however, the current trend of development in many of these unmodified adobe areas has intensified population exposure to their severe bites and has ellicited a strong demand for control measures which shall apparently continue for the next couple of decades.

Considerable background study and information on the biology of these gnats has been previously published, although many necessary observations and confirmed details of their life history are lacking or yet in need of verification. A few of the necessary observations entail habits of the adults, but since the adult lifespan is of such short duration (about 2-5 days) and populations are continually renewed through emergence over a four to six week period, the most significant studies toward effecting control are felt to lie in the restricted, but durable, larval habitat.

The Larval Habitat of L. torrens

It has been previously established that the larval development occurs at depths of 24-40" in clay (adobe) soils which exhibit high cracking potentials with summer drying—cracking to such depths, but not much deeper, by early May (Smith and Lowe, 1948, Fontaine and Green, 1957, and Lauret, 1958). Extensive use of emergence traps on suspected potential sites of developing larvae, as well as checking varied negative sources, soon indicated a positive correlation between actual breeding sites and a gross soil picture as seen by soil cores taken to a depth of fifty inches under the gnat producing traps.

Since any control work directed at the larval habitat entails a means of determining the locations of such habitats in the many thousands of acres of cracked adobe in the vicinity of adult gnat populations, a primary objective of these studies lay in an extensive program of study and coring in such soils with the use of emergence traps as an indicator of positive sources. Evidence from the data shown by such emergence traps over a period of years indicates that oviposition and larval distribution in a "breeding" area is anything but uniform and may vary considerably from square yard to square yard in some sites, both from measurable variance in physical factors of soil formation and apparently from chance oviposition sites selected by the female even where soil conditions and zone of larval habitat appear to be ideal for larval development; hence it is apparent that the significance of correlative data must depend upon an adequate body of data for statistical analysis and correlation.

For this objective, extensive coring was done in varied adobe formations of the Sacramento Valley and selected points of the San Francisco Bay area (Contra Costa, Solano, Alameda, Santa Clara and San Mateo Counties). Because of the problems of emergence trap maintenance and collections, not all such sites were trapped, even though adult gnat populations occurred at these locations. Particular emphasis was placed on gaining correlations at selected points in San Mateo County and at the USN Radiological Station near Dixon where emergence trapping could be routinely maintained. A detailed test area was established on the Stanford University campus and soil depths, change and characteristics carefully plotted, but unfortunately low adult emergence in 1959 considerably reduced the value of this study area. The different adobe formations in San Mateo County were extensively cored and trapped for comparative analysis in both demonstrated positive sites and apparently negative sources.

The soil cores—or standard samples at established levels and formation changes were subjected to measurements of soil moisture, total pH, temperature gradients and organic content at certain zones. The vertical physical features were diagrammed to indicate consistency, macroscopic inclusions and levels of discernable change. Selected samples were submitted to the soils laboratory at Berkeley for more detailed analysis of their chemical and physical features. Consultation was

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[1] Studies conducted under a matching research grant from the California State Department of Public Health.

[2] Conducted by District personnel: T. H. Lauret, H. E. Munsterman, R. H. Whitsel, and C. A. Vickery, Jr.

held with many different soils specialists concerning divers aspects of formation, consistency, inclusions, distinctive features and agricultural potentials of these abobe soils for which information we are extremely appreciative. A more detailed presentation of the adobe soil formations and their correlation with the gnat larval ecology is planned for the future.

Since the 1958 and 1959 gnat emergence seasons must be evaluated as poor or atypical years for such gnat emergence, a much higher number of negative or undemonstrated positive sites are represented than was planned, with the effect of lowering the statistical significance of the data.

Control Progress

Experimental testing of insecticide applications on precise sources with proper checks and controls has led to some degree of success, even with relatively low amounts of active insecticides; however the erratic emergence patterns of the adults and difficulties of adequate physical coverage of the soil sources with insecticides leaves much to be done in providing for practical control techniques of even temporary nature. Tests run in the laboratory on a repetitive basis using WHO kit impregnated papers having known levels of Dieldrin and DDT show a high susceptibility by *L. torrens* for both of these insecticides where contact is provided. Chemical control appears to be a problem of providing exposure to residual insecticide applications at the emergence sites, and this is in turn largely dependent upon providing the needed physical form of dispersant as governed by practical methods.

Long range control through environmental modifications is being studied on experimental plots at Dixon as well as locally, involving irrigation, agricultural use, disking, etc.; but the evaluative data will be necessarily slow in forthcoming.

CHIRONOMID MIDGE PROBLEMS IN CALIFORNIA

A secondary aspect of our gnat investigations lay with an initial review and investigation of the potentials, occurrence, and problems presented by the increasing midge populations in California. The extent of the needed studies in aiding ultimate control measures far exceeds the capacity of a single study project; hence, only a preliminary investigation and initial groundwork were attempted during this year. Further studies on specific aspects of midge biology and control procedures are anticipated for the future.

Review of Publications

Although far from being completed, the literature concerning pertinent aspects of our Chironomid problems was reviewed on a comprehensive basis and a selected bibliography is to be included in this report. Principle stress is given to surveyworks, biological studies, problems and control methods, and to the principle taxonomic papers including these species occurring in California. The number of possible references is voluminous, but the number of applicable and constructive papers are considerably more limited.

Current Status of Work

During the last decade there has been a considerable increase in demand for control efforts upon Chironomid midges which has resulted in an increase of work by entomologists and biologists on the taxonomy, biology and surveys of this group. Control work has been undertaken primarily in areas of rapid development and population growth, notably Florida, suburban areas of the Atlantic Coast, California, and a few mid-western States.

With the increased significance of this group, several biologists have turned to this group for their doctorial theses at our universities in recent years and are continuing with work in this field. In California there are now several people working with this group of aquatic insects under several different auspices. Among these are the University of California at Riverside with Lauren Anderson and Ernest Bay, The University of California at Davis with Rollo Darby's study of the midges of the rice fields, the identification section of the Bureau of Vector Control with Gail Grodhaus and others in part time study, and this District with Richard Whitsel, Carl Vickery and C. D. Grant in part time studies.

A stumbling block to studies of the Chironomids in California has been the inadequacies of taxonomic work on the very large number of species occurring in California which have made difficult problems of effecting reliable determinations for even described adult species, let alone the many undescribed forms and the proper association of the adults with their larvae. Recent workers have aided considerably in describing the larvae of many species and publication of figures and adequate descriptions of many more are anticipated for the near future, so that the majority of prevalent species may be far more readily identified than in the past. This District has undertaken individual rearing of several of the prevalent species which will provide reliable association of the progressive forms for illustration by Mrs. Sylvia Barr and promised determinations to be generously afforded by Dr. Sublette in Louisiana. This material will be published at a later date.

Midge Habitats and Population Factors

A given area of twenty miles and varied terrain may readily harbor as many as 150 different species of Chironomid midges, which may represent almost as many different specific ecological habitats, but only a small portion of these are of significance in relation to general public nuisance. Investigation was made of the forms occurring in such populations as to cause public annoyance, and the sources of such species were placed under routine sampling and elementary measurements for comparative data to guide more specific studies. Analysis of the midge species existent in each of the sources shows variances in ecological relationships, yet analysis of the evolution of all of these sources of increased midge populations indicate at least one apparent causative factor. This is land development leading to increased production of organic solutes and silt deposits from the cumulative raw organic wastes entering the drainage system. This affects not only ultimate midge development but an evolution of plant and animal succession basically in accord with organic decomposition processes and their resulting metabolites.

It is apparent that these sources of high midge production are representative of a time interval in prog-

ressive evolution of the aquatic habitats following some years after the initial increase of organic wastes. Successive stages which may render the habitat unsuitable for such midge production is dependent upon a great many factors, especially improved drainage provisions for quick remedial action or upon ultimate stabilization of land development with a more persistent ecological pattern leading to the development of natural factors such as predators, diseases, deleterious metabolities and competitive forms to curtail such population blooms. The latter may take one to several decades to fulfill without directed aid toward this end.

Limited source sampling has been done outside of the San Francisco Bay area, but the few points examined in the central valley indicate a vast growing potential, already noticeable, for production of Chironomids at a public nuisance level in the slow moving water sources near the expanded suburban development. With our predicted population growth for the future, there is every indication that midge control shall be an extensive and expensive need.

In San Mateo County sampling stations were established in selected sources with population counts of the larvae for unit area made on a two week basis. Larval development rates, seasonal changes in species constitution, environmental changes (temperature, pH, vegetation, etc.) and contributing modifications were recorded.

Computation and tabulation of this data during the current fiscal year has not been completed, and hence cannot be included in this paper, but will be presented at a later date.

Extensive sampling and standard collections in San Mateo County show that species in the genera listed below are consistently present in quantities capable of producing local nuisances although major infestations are usually represented by only 3 or 4 species found in our more extensive and widespread sources.

Tendipes
Smittia (Hydrobaenus)
Procladius
Anatopynia
Pentaneura
Cricotopus
Calopsectra

Population peaks occur at almost any time of the year within the variety of species and sources, but general outbreaks of given species appear to have definite cycles of development times and peaks in accord with climatic conditions. Further studies in such evaluation shall be undertaken.

Public Nuisance Evaluation

There has been no implication of human disease associated with Chironomid midges, nor do they possess biting or piercing mouth parts to enable the adults to feed upon or indirectly annoy human populations. Primarily, their nuisance rating stems only from the effects of sheer numbers, wherein such extensive infestations renders living conditions almost intolerable over significant areas and greatly interfere with several types of industry.

Under favorable rainfall and water conditions, *Tendipes* species, especially *T. attenuatus* Walker, may develop two or more succeeding broods in a wide variety of large and small sources with larval populations running from 500 to 5,000 larvae per square foot in the organic ooze of such sources. Since there are a great number of these sources in and proximal to our suburban areas as well as scattered industry, the emergent adult populations may literally blanket large areas of residential housing, interfering with normal functions of outdoor nature (especially clothes drying) and entering houses with every door opening so as to cause considerable cleaning cost and effort in removing dead and mashed bodies by the thousands.

Paint solvents appear to be a special attractant to some species and even moderate populations of midges ellicit many thousands of dollars in repainting and cleaning costs in our local area. In the Los Angeles area the midges brought automobile assembly lines to a standstill by penetrating the ventilator system and stopping the car enameling process.

In San Mateo County where night shifts are commonly employed, midge populations have greatly interfered with electronics firms and aviation maintenance stations (TWA), since most species are positively phototrophic and manage to enter such lighted buildings in great numbers. As reported by McFarland (1960) a costly result of such infestations in the Los Angeles area occurred at a plastics firm producing bulk quantities of clear plastic sheeting. The firm was unaware of the significance of the problem until they received many costly rejects of their shipments due to the large number of midges not too decoratively embedded in the clear plastic sheeting.

The degree of public annoyance and direct or indirect cost to industry in the Los Angeles and San Francisco Bay area must place such midge populations under the classification of public nuisances. In many areas abatement measures are demanded by the public, and again, in most cases such abatement can be afforded at feasible costs at the present time. The variety of habitats and species involved, however, lead to many control failures and demonstrate a need for increasing complexity in control procedures. Currently such control is primarily of chemical larviciding and at best is a temporary stop-gap pending knowledge on more efficient approaches.

Since the extent of such conducive environmental sources for midge development appear to be on the rapid increase for an extended period of time, since public annoyance demands abatement efforts be made towards such midge populations, and since the nature and extent of these aquatic sources creates a control problem beyond the scope of private pest control agencies, it is apparent that the natural agencies for such responsibility are the mosquito abatement districts and their counterparts in various areas. To efficiently meet these problems in the future will demand a vastly improved knowledge of these midges, their biology, habitats and control procedures over our current status of knowledge.

Appraisal of Control Practices and Programs

Most Chironomids have aquatic larval habitats and control procedures have been aimed primarily at the

destruction of the larvae in such water sources or, where possible, prevention of larval development through environmental modifications. The latter means was notably effective at Moriches Bay, New York, where deflection of the tidal currents increased salinity of the water habitat to the point of eliminating the midge problem.

In the above case, careful studies were made of the habitat and susceptibilities of this species locally *(Tendipes attenuatus)*, and the site lent itself feasibly to exploit the knowledge derived from such studies. In San Mateo County, the abatement district has also effectively utilized flushing with salt water from San Francisco Bay to destroy midge larvae developing in the low creek bottoms which are shut off from the bay by tide gates. A reverse situation has also been observed wherein a different species of *Tendipes* adapted to brackish water was apparently destroyed by a heavy rainfall that significantly lowered the salinity in the habitat. The dying larvae exhibited swelling and haemolysis attributable to the sudden lowering of salt concentration in the water.

Dredging or removal of the organic silt in sloughs and drainage ways will temporarily stop larval development until again formed; but the cost of this operation must be justified by other ends than merely midge control unless further drainage modifications can serve to prevent redeposition of such organic silt. Fluctuation of water levels has effected control for certain species *(Hydrobaenus, Calopsectra,* and *Cricotopus)* where such larvae live higher in the vegetation of shallow areas.

Midge control through aerosoling or residual spray applications for adults has been incidentally effected, but not as a careful program or against known species and measured effectiveness. The erratic results reported from chemical applications against divers species in varied habitats indicates that there is a wide range of susceptibility to given insecticides in different species and that habit, as well as habitat, greatly modify the effectiveness of different physical forms of materials in insecticide application.

The majority of control programs undertaken (most of them in the last decade) have resorted to application of various insecticides into the larval habitats. Such application have been principally with chlorinated hydrocarbon and organic phosphate insecticides in emulsion and granular forms and reported in dosages as amount of active insecticide per acre. The great variation in effectiveness may be attributed not only to species present, but to factors of water depth (i.e., into dilution better expressed as parts per million), to the composition of the substrate and water pollutants, and to the physical form in which such active materials were applied.

Recent controlled testing by Bay and Anderson at UC at Riverside (unpublished report) have provided susceptibility levels for *Cricotopus* and *Tendipes* spp. to several different insecticides, but unfortunately, malathion and other organic phosphates were not run in the initial tests. Presentation of reliable data on a comparative basis is difficult at the present time due to the many unknowns as to species and conditions involved in the reports of the control efforts by other agencies.

Although testing of control techniques is not considered a part of this report, this District has had several years field experience in larvicidal control for several species of midges in various types of aquatic sources. As indicated by other results, the effectiveness of treatment is very dependent upon the source, species, and physical form of the insecticide applied. DDT has effected kills at 0.5 lbs./ acre in one foot of water and completely failed with 4.0 lbs./acre as an emulsion in three feet of water—both from the same concentrate. In shallow water on the salt marsh, malathion emulsion at approximately 0.2 lbs./acre has effected good kills of *Tendipes* where mosquito larvae in the same source were unaffected. Again malathion emulsion applied at 2.0 lbs./acre in 1½ feet of highly polluted water killed less than fifty percent of midge larvae. Aldrin emulsion in the same and similar sources has frequently been ineffective at 1.0 and 2.0 lbs./acre as an emulsion, although the same species *(T. attenuatus)* has been readily controlled in our sources of less polluted water at a maximum of 0.5 lbs./acre of Aldrin.

Since most of our prevalent species prefer larval development in the organic ooze or algal growths at the bottom of water sources, insecticide application should aim at this zone. To this end granular forms have thus far proven most effective, but even granular formulations must be carefully selected. Heavy granules will readily bury themselves in the soft substrate preventing diffusion of the active insecticide and its rapid adsorption, absorption, and inactivation by the fine particles of the ooze and its chemical contents. The best universal results attained by the district thus far has been with a 10% malathion granule of attapulgite with fine mesh (30-60) for better blanket coverage and quick release of the active material. This may obviously be improved upon by avoiding clay granules which tie up a portion of the active insecticide and by using an even lighter inert material as carrier. Further work is merited in this regard.

Of considerable interest in the control aspect is the use of fish as being studied under the project at Riverside. Apparently, species of carp have evidenced good possibilities in destroying midge populations by eating the algae with which the larvae are associated. Further investigation of fish and predators as control measures for various midge sources is planned under the Riverside study project.

Mr. Magy: I will try to get you out of here in fifteen minutes which we have left to cover the next two papers, since there is another panel following this one. We have a rather unique individual who will discuss the problem of *Hippelates* in one of the many, many lovely areas of the better part of California. Mr. Hazeltine is a Trustee of the Borrego Valley Mosquito Abatement District. To save a lot of time, we will just introduce Mr. Hazeltine, and he will discuss this rather unique problem which he has there. Mr. Hazeltine.

THE CHALLENGE OF HIPPELATES EYE GNAT CONTROL IN AN AGRICULTURAL-RESORT COMMUNITY

STUART HAZELTINE, *Trustee,*
Borrego Valley Mosquito Abatement District

The gnat we are concerned with in our area is the *Hippelates* or eye gnat. *Hippelates* can be propogated under laboratory conditions at the rate of 6,000 per square foot of area. They will travel four and one-half miles in a matter of hours, and live as long as thirty days; so you can see we are dealing with a rather tough adversary.

Our area is in the northwest corner of San Diego County. The district consists of 367.5 square miles. However, only 128 square miles of this area taxable—the balance being State Park. Our assessed valuation is only $4,503,800, so that unless we can persuade the Board of Supervisors to assess the full 25 cents, thus giving us a 40 cent tax rate, our funds are extremely limited and even with the full 40 cents our income is only about $16,000 annually.

Good irrigable land is assessed at $120 per acre, and considerably more than half of our total land is unimproved and much of it unfit for development. So you can see that the bulk of our assessed valuation comes from improvements rather than land. We have around 20 motels or hotels in the area, ranging from the regular $8.00 to $10.00 per night, up to those charging $35.00 per night per room, so you can well imagine the hotelman's wrath when he has guests check out because of the gnats.

The *Hippelates* gnat breeds in loose, sandy soil with the proper amount of organic matter and moisture. This normally means that they breed only in irrigated soil as the balance is too dry. However, once in a while, we have summer thunder-storms that drop up to an inch of rain in a short time causing heavy run-off and creating ideal conditions in the uncultivated areas for the breeding of gnats. The recommended control measure is to disk DDT into the soil to kill the gnat in the larva stage. This is not too bad a problem with vineyards or cotton, but it is impossible on a golf course and uncultivated areas, and extremely difficult on alfalfa where the alfalfa is cut as much as ten times a season and the ground is so sandy that very little renovation is ever done. We have 1300 acres of alfalfa.

We have tried control measures against the adult. We tried Debrome applied with a Buffalo Forge Blower on the golf course, but had no success as the gnats seem to be able to fly out of the way. An aersol with Malathion, applied by plane, gave two to three days relief when applied to a 400-acre area, but when tried again over a 16,000-acre area lost its effectiveness again, due to our inability to build up a sufficient concentration.

The University of California at Riverside has been working for the past three years on this problem, and we are hopeful that a poisoned bait may prove a boon to us. That would attract the gnats away from a limited area and kill them. With this means we could give the residents some of this material that would free their yards or homes of the pest.

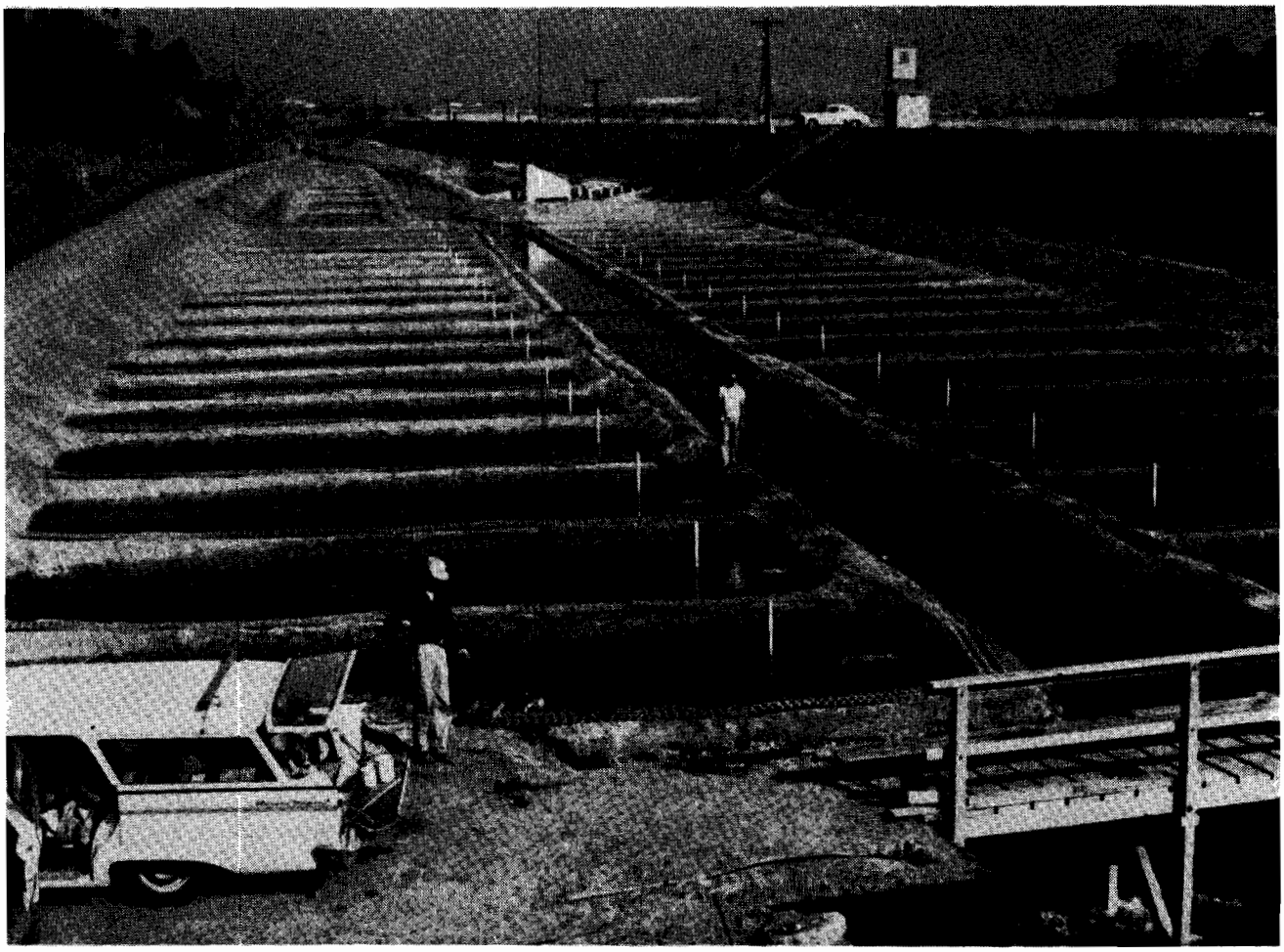
With a 40 cent tax rate and no successful means of control, it is plain to see why public opinion runs rather high. Particularly in an area that is more or less dependent on a tourist trade for their livelihood. Publicity has been tried and no doubt helps some, although it is hard to measure its results; and it is amazing how few people read what you publish. Actually, the wisest thing for us to do would be to wait until some more successful means of combat can be developed. However, as to public opinion it appears that as long as you are doing something, you are not criticized as much as you are if you do nothing, even though your money is practically wasted trying to stem the tide.

PRELIMINARY REPORT ON THE CHIRONOMID MIDGE PROJECT AT THE LOS ANGELES COUNTY FLOOD CONTROL DISTRICT WATER SPREADING GROUNDS ON THE RIO HONDO AND SAN GABRIEL RIVER NEAR WHITTIER, CALIFORNIA

L. D. ANDERSON,
University of California, Riverside
and
A. A. INGRAM,
Los Angeles County Flood Control District

Preliminary observations were made and discussion conferences were held with regard to this problem by the Mosquito Abatement District (McFarland and others), California Bureau of Vector Control (Peters, Magy and others), and the Los Angeles County Flood Control District (Salisbury, Laverty, Ingram and others). As a result of these conferences in early 1959, the need for more extensive research was recognized and the Entomology Department at the University of California, Riverside (Metcalf, Mulla and Anderson), was approached with regard to taking on this project. By September of 1959 a formal agreement was completed between the Los Angeles County Flood Control District and the University of California at Riverside, in which the District would furnish facilities and manpower at the spreading grounds, and finances of salary and expenses for a trained entomologist are to be furnished by the University. The University Department of Entomology is to plan and carry out the research program.

On September 28, 1959, L. D. Anderson (University of California, Riverside, Department of Entomology) was put in charge of the project and the Unniversity research program was started at that time. Mr. A. A. Ingram, Los Angeles County Flood Control Investigation engineer, is in charge of the Flood Control facilities and operations to be involved in this project. Preliminary arrangements and research plans were completed by October 1 and field studies were started within a few days.



The following is a list of some of the more important activities and results that have been obtained since October 1, 1959:

1. Thirty-six insecticide basins have been prepared (1/80 acre each, 18″ deep), with precise water control conditions (see pictures).
2. Six fish basins have been prepared (1/50 acre each, ¾′ deep).
3. A larvae sampling scoop has been developed and methods of use have been studied.
4. Insecticide basins have been treated and frequent observations have been made on larval populations (See results given in Table 1).
5. Carp and catfish have been collected by seining various reservoirs in the Los Angeles area (in cooperation with Beland, of Fish & Game, and Southeast Mosquito Abatement District). These fish have been used to stock fish ponds mentioned in item 2 above; the effect of these fish on chironomids is given in Table 2.
6. Larvae and adult population surveys have been made at frequent intervals since October 1. These findings have resulted in suggestions on pond rotation that have reduced midge outbreaks.
7. General field life history studies have been made; they indicate that the midges can complete a generation in less than two weeks during warm weather.
8. Large-scale applications of lindane-oil treatments have been made in several basins and this method of treatment was found to give poor control of larvae on bottom of ponds. This is the commercial treatment that has been used in the past in this area and elsewhere.
9. Preliminary study has been made of effect of shore birds on larvae populations in shallow water. (The Least Sandpiper was found to feed extensively on these midge larvae.)
10. Preliminary tests indicate that rotation of ponds (leaving them dry up for a period of 5-10 days) practically eliminates a given larval population.
11. Heavy adult emergence has been observed to occur within 10-12 days after filling a basin which has not had water in it all summer.
12. Many other arthropods have been observed to occur in the spreading basins and they undoubtedly have some influence on midge populations (fish are scarce).

13. A rapid build-up of larvae was observed to occur when water temperatures were between 55° and 64° F., and population increases slowed down materially during January when water temperatures were between 46° and 55° F.
14. Water soluble granular materials and treatment methods have been developed for the small basin tests.
15. Soil has been pre-sampled in all test plots and has been submitted for chemical analysis.
16. Preliminary test indicate insecticide treatments on sand granules were not as effective as on water soluble urea granules.
17. Insecticide tests show Dieldrin, DDT and DDD (Rothane) to give good control for nearly a month at dosages used. Lindane, Korlan, Co-Ral and Dipterex (Dylox) were poor or ineffective (see Table 1).
18. Carp were more effective in controlling midges than catfish but both show promise.
19. Larvae-counting methods have been developed; however, they are still too slow and time-consuming and need improvement.
20. There are many biology, taxonomy, cultural, etc., studies in progress. Present tentative identification indicates several species of *Tendipes* are involved.

TABLE 1

INSECTICIDE TESTS–SUMMARY OF CHIRONOMID INSECTICIDE TESTS, WHITTIER NARROWS AREA, WHITTIER, CALIFORNIA, 1959-60

Plot No.	Treatment Materials*	Time Treat.	Lbs./ Acre	Larvae/9 Samples** and % Control					
				Dec. 10-13-14		Dec. 20-21-22		Jan. 1-3-7	
				#	%	#	%	#	%
1	Lindane emulsion spray	11/17	1	1144	−3	1505	−8	2996	−72
2	Lindane emulsion spray	12/3	1	1060	5	1654	−18	2713	−56
3	Lindane-oil spread	12/4	1	722	35	1073	23	3672	−111
4	Lindane granules	12/3	1	563	49	1321	6	3868	−122
5	Lindane wettable spray	12/4	1	597	46	1341	4	2763	−58
6	Korlan wettable spray	12/3	1	976	12	1333	5	3173	−82
7	Co-Ral wettable spray	12/4	1	830	25	1224	12	2761	−58
8	Dieldrin granules	12/4	1	59	95	177	87	700	60
9	DDT granules	12/3	5	49	96	136	90	1054	40
10	DDD granules	12/3	5	90	92	235	83	1057	40
11	Dipterex granules	12/4	2	992	11	1290	8	1793	−3
12***	Untreated check	----	--	1114	----	1397	----	1744	----

* Sprays applied to surface of soil in No. 1 and all other treatments made to surface of water when midge larvae beginning to show on bottom. Granules applied with small hand-operated grass seeder, except Dipterex which was applied with hand duster. Plots 1/80 acre and replicated 3 times for each treatment and check. Lindane-oil poured on surface of water near the edge of basins and allowed to spread. Dipterex granules on sugar, all other granules were water soluble urea. Good coverage obtained in all treatments. Lbs./acre = actual toxicant.

** Species not differentiated or identified, but previous specimens from the area have been identified as *C. decorus* and *C. californicus*. Three samples of ¼ square foot size taken from each plot (9 per treatment) each sampling time, and samples screened and washed in the laboratory. Dieldrin, DDT and DDD only treatments giving a good control which lasted for about 30 days.

*** Larvae for nine samples in checks January 14, 1960 = 3,117, and February 2, 1960 = 2,667.

TABLE 2

EFFECT OF FISH ON CHIRONOMID LARVAE POPULATIONS

NOVEMBER 1959 TO FEBRUARY 1960

Basin No.	Fish/ Basins 11/13	Fish/ Basins 11/24	Chironomid Larvae/3 Samples *					
			12/7	Fish Basins 12/10	12/21	12/29	1/21	2/1
37	35 Cat	25 Cat	34	None	415-21	990-17	354-60	283-41
38	None	None	223	None	524-158	692-65	716-132	764-202
39	None	None	205	41 Carp	55-4	35-3	10-2	25-12
40	35 Cat	25 Cat	36	None	334-45	1237-69	572-122	535-95
41	None	45 Cat	27	None	172-37	541-96	551-99	729-168
42	None	None	246	None	241-71	577-134	267-84	824-243

* Three samples equal approximately ¾ sq. ft. area of bottom. The count for 12/7 only large worms were counted, done by screening in the field. In the 12/21 and 12/29 counts, samples were taken in the laboratory and carefully examined; the first figure indicates total larvae count (large and small), and the second figure, the large larvae only (¼ to full grown). Most of the small larvae were newly hatched and the fish probably did not have time to get them so the large larvae are the best index. The 12/7 count shows catfish gave 86% control, and the 12/21 count shows they gave 70% control of large worms and carp gave 96.5% control. The 12/29 count on large worms shows reduction by catfish of 61% and carp 95%.

On large worms the 1/21/60 counts show 98% control for carp and 13% for catfish, while the 2/1/60 count shows 95% for carp and 55% for catfish. Count on total worms for 2/1/60 shows 97% control for carp and 35% for catfish.

Notice—The carp also seems to give better control of the small larvae. There has been a loss of some catfish and possibly a later count of fish may explain some of the variance in these ponds. Effect of fish on silting and water percolation is being studied.

Mr. Steiner: It is my pleasure to introduce at this time Mr. Ernest Campbell, who is the Manager of the Contra Costa Mosquito Abatement District in Concord. He will be the moderator for the next panel discussion.

Mr. Campbell: Like always on the last morning, things get a little ragged on the schedule. We have a very high-powered panel here, and it is too bad time is running short—high-powered with the exception, perhaps, of the moderator.

URBAN MOSQUITOES; THEIR HABITS AND CONTROL

ERNEST CAMPBELL, *Manager,*

Contra Costa Mosquito Abatement District

The subject "Urban Mosquitoes; Their Habits and Control" implies the habitat, urban, and the ecology or inter-relationship between the organisms and this environment. The organism man is continually changing the environment, and the organism mosquito continually adapts to changed conditions.

A library of newspapers or Sears Roebuck catalogues would reflect and record the transition of American culture. Had mosquito control been established for sufficiently long a record of its activities in urban areas would also reflect the cultural transition. It would reflect the passing of the universal outdoor privy as an occasional mosquito source; the transition from cesspool to septic tank to the sanitary sewer and oxidation ponds; the transition of the horse trough from a uni-water barrel, tank or cistern as a household necessity for soft water for shampooing mother's and daughter's long versal necessity to an adjunct of recreation; the rain-hair, until better water and soaps were available; the coming of telephone and power lines with underground vaults; the building of railroads and the engineering concept that culverts were devices to regulate the maximum safe height of water impoundment; the prohibition area and the wine tank in every back yard filled with water waiting for the fall harvest; the underground storm drain with its catch basin inlet to trap heavy material from unpaved, half-paved or graveled streets, and catch basins became a bad habit—only recently has this engineering compulsion given way to the modern and efficient drain-dry street inlet; the development of modern transportation and the unified school with high building standards and extensive ground drain layout, including underground drain systems and catch basin inlets; etc.

Probably the most unusual "cultural phase" *Culex pipiens* source to trouble our District was an excavation done in stealth by hand to make room for an illegal still under a "main-street" building. The excavated material placed on the perimeter of the area was an effective shield to prying eyes. After the still and our culturally noble experiment had been abandoned, plumbing from the now-respectable bar overhead became faulty and leaked water into the erstwhile still room. This became a haven for hosts of *Culex pipiens.* The excavated material to shield prying eyes was effective, and it took some

determined searching to find the source of the *pipien* infestation which was disturbing the serenity of this main-street business neighborhood.

Building expansion by man in the last twelve years, especially along certain coastal regions and inland waterways, has made massive changes in the environment. The mosquito with about the same degree of planning will adapt and do its best to survive. In California as in other places, industrial, urban, suburban and agricultural activity merge in extensive heterogeneous continuity, and the term urban has lost some of its classic identity.

Probably a very real factor in present day urban mosquito control are subdivision standards. We got off mosquitoes. Man is less stolid as a result of gradually increasing tensions which have reached a climax with the advent of earth-shattering bombs poised and waiting. So that man's tolerance of mosquitoes is lower than in more placid times.

This panel is composed of Managers from three geographically, somewhat culturally, and climatically different areas, so that each member has a background of experience from which to make worthwhile contributions to a balanced cross section of the subject.

As for this urban problem, I don't think the mosquitoes know the meaning of the word ur*bane*, and I don't think any of them have good habits. Actually the urban ecology of mosquitoes is changing through time as man's culture changes. A big change is the current building expansion whereby large subdivision tracts become urban peninsulas, islands, or part of an expanding urban mainland, and an important matter in mosquito control are subdivision standards. We got off to a rather bad start when the building expansion began and the subdivisions weren't too well laid out, weren't too well drained; but that has been pretty well corrected now. The flood control district and other County personnel recommended that new drain ditch requirements up to a capacity of 36″ pipe be placed underground. That fell through, but other than that we are in pretty good shape. No more catch basins are being constructed so as to hold water—it has been several years since any of those have been built in our district.

Our District is in part a rough topography, so that we have many creeks which, in the urban areas, become somewhat polluted, resulting in a little more potential for mosquito breeding with perhaps some change in the variety of species. Tree holes are a big problem with us—it is not so much of a problem as a headache. We have, as others also have, the crowding of agriculture, industry and residential areas all in close proximity, so that adjacent rural mosquito control becomes a little more important and the urban requirement continuously more extended.

Inasmuch as time is growing short, one is inclined to feel that turning in a paper and going home might be the desirable thing, but as I said, we have some high-powered people here. Jack Kimball couldn't be here, but Jack Shanafelt is substituting for him, so at this time we will hear from Jack.

Mr. Shanafelt: I have been attending these meetings for about eleven years and this is the first time I have been invited to give a paper. Jack said, "Shany, I will be unable to attend, so you take my place."

Since the type of paper I have prepared is not on research, we do not do any research there and our investigations are rather few and far between, about all I can say is that when I look over mile after mile of roof tops and potential breeding sources fifty by one hundred feet surrounded by six-foot fences, I get awful tired. So, I will just turn my paper in. It was prepared on the basis of some interesting things that were encountered in inspecting backyards, but we let it go.

URBAN MOSQUITOES, THEIR HABITS AND CONTROL IN ORANGE COUNTY, CALIFORNIA

J. G. Shanafelt, Jr., *District Entomologist*
Orange County Mosquito Abatement District

Urban, in this paper, refers to a heavily populated community of long standing. This designation is necessary to avoid confusion with a heavily populated area of recent origination. Urban areas of recent origin in our county are located in, on, or around or surrounded by rural or suburban areas and as a result are often invaded or annoyed by rural or suburban mosquitoes flying or drifting into the suburban areas.

The species of mosquitoes with which we are concerned in urban areas of long standing are, in order of importance, *Culex peus, C. quinquefasciatus, C. tarsalis* and *Culiseta incidens. C. peus* apparently does not bite but its presence in shrubbery outside the house results in a service request by the alert householder. *C. quinquefasciatus* is our biter, and one in the house creates another plea for help. *C. tarsalis* is not commonly found except in one community where it breeds in almost any type of water. *Culesta incidens* is occasionally found in an ornamental pool. It is not a bashful creature and won't hesitate to sit down for dinner early in the evening. The types of containers in which the *Culex* species may be found are many and sometimes unusual: a five gallon can of steer manure steeping in water (somebody told the women this process did something to it!), a crock of water with an arm full of cuttings shoved into it, a trough in a flower shop used to rinse flower stems, etc., and finally, one party who thought she was raising tropical fish in her aquarium but couldn't figure out who had given her the fish!

Immediately after the formation of our district all obvious standing water was inspected and sprayed (larvae were usually present) and since sources were numerous and easy to find, a cycle of insepction-treatment soon had the major breeding sources under control. An occasional miss on the salt-marsh or on a pasture or two just added a little zest to our business. Almost two or three years elapsed before our urban dwellers noticed that there were other mosquitoes around, the ones now a nuisance were biting them at night. It was at this time and up to the present that we began searching for the small local breeding source.

About five years ago someone found out what I had known for many years, that Orange County was a very desirable place to live. Word got around somehow and since then our population has more than tripled. It is

still a shock to see mile after mile of potential mosquito breeding sources carefully laid out in 50 x 100 foot plots concealed by 5½-foot fences. Fortunately trouble flairs in only two or three spots per day during the summer months, and many of the producing spots are quickly located and eliminated.

If one could inspect an urban area without personal contact, most breeding sources could probably be located in short order; however, a typical day of inspecting would be as follows: Ring the doorbell; after all, barging into a stranger's backyard can be as dangerous as waving a flag of red flannel in a bull's face! In short, there is hardly a better way to destroy good public relations. When the door opens one must explain who he is representing and why he is at this particular front door. In this case permission is being sought to inspect the backyard for possible mosquito breeding sources. Of course the answer to that request is that "We do not have any mosquitoes in our backyard!" Now you play your trump . . . . "I did not really expect to find any in your backyard, but from your yard I shall be able to peak over the sides and rear fences and see what is in five backyards without annoying your neighbors." This method saves considerable time since a look into these yards can indicate which if any needs a closer inspection.

You are now ready to leave this backyard; but wait, if you are an entomologist this is going to be almost as hard as getting in. Every home owner seems to assume that a man looking for mosquitoes is an entomologist and an entomologist is one who studies insects so . . . . "What is eating the leaves of my roses? Should they be sprayed? What with?" "What causes the brown rings in my lawn, and what can be done about them?" "The leaves on my peach tree are all curled up, should I pull it out? While you are here, how should I go about pruning this tree?"

At the end of the day you have entered seven or eight backyards, looked into 30 or 40 backyards over fences and have not yet found a positive breeding source. Incidentally you will have learned about the mosquitoes from Minnesota, Florida, Texas, etc., all are larger and more vicious than anything out here, but when are you boys going to get rid of these things, we would like to enjoy the outdoors!

The personal contacts made in the above paragraphs are comical, unfortunately they are vital to good public relations even though they cut an inspectors efficiency way down. In an attempt to surmount this difficulty, our district is stressing education. At the time of each contact we tell about our operation, why, when, cost and end up giving two pamphlets (our own pamphlet which lists the Board of Trustees, explains our District's policy and illustrates the life cycle of the mosquito, and a copy of "Mosquitoes About The Home."

To further educate our people, the district has prepared a "Mosquito Study Kit" which contains an egg raft, mosquito larvae, pupae and two or three mosquito fish. These kits are requested by school teachers and are kept for one week during which time the children watch the eggs hatch, watch the adult emerge from the pupal case, feed the fish mosquito larvae and see the movie "The Life Cycle of the Mosquito."

We feel that the average householder will not knowingly allow mosquitoes to develop on his property providing, of course, that he recognizes an immature mosquito when he sees it. As usual there will always be exceptions, to wit . . . the resident on Lido Isle. An inspection revealed a swimming pool not in use, filter off, and breeding mosquitoes. No one was home at the time so a note was left telling the resident the pond had been larvicided and requesting corrective measures be taken to prevent further mosquito production. Incidentally, for homes in this area, fences 10 to 12 feet high are permissible and this house was surrounded by just such a fence. The problem was solved by this character by locking the gate and refusing to answer the doorbell!

In closing may I say, we have found that we can't talk a mosquito to death, but a little talk in the right places can go a long way in eliminating these small sources. We expect to hire more men in the future in order to do a more thorough job of urban inspection, and between inspection and education we are certain to come out on top.

Mr. Campbell: I am sure we would have been interested in a summarization by Mr. Shanafelt who is from a rather distinctive geographical and cultural area. However, we will defer to Mr. Shanafelt's wishes and look forward to a discussion of their urban problem in the Proceedings. Mr. Ed Davis from Fresno Mosquito Abatement District is next. Ed.

(No manuscript submitted.)

Mr. Campbell: Thanks very much, Ed. I think sometimes that the valley districts have more of a problem than we do because of cheap water. Do you have meters in Fresno, Ed?

Mr. Davis: No. That is another problem; I didn't touch on our lawn irrigation. We do not have meters in Fresno, and, of course, our gutter problem is tremendous, due to the fact that we do not have meters. We would like to see meters go in. It is a city system belonging to the City of Fresno; and, of course, we encourage meters, but we have had a lot of trouble getting them accepted. Our curbs and gutters give us a lot of trouble in the summer time due to our heavy water use.

Mr. R. H. Peters: May I ask Mr. Davis if it is possible that the Department of Motor Vehicles got their idea for license tags from Ed's idea of tree hole stamping?

Mr. Campbell: Ed spoke of tree hole problems, but I don't think his problems compare with some of those around the bay area. We haven't had any particular problem the last two years. This lack of tree hole mosquitoes last year can be accounted for because it was a year of extremely light rainfall. The reason for the lack of tree hole mosquitoes the prior year is something we cannot readily account since we had one of the heaviest rainfalls in years, yet our service requests from tree hole mosquitoes were almost nil. In contrast to these two years of little or no difficulty from tree hole mosquitoes, in 1957 we received 250 phone calls in about a week complaining of the presence of tree hole mosquitoes.

Now we have Chet Robinson from Alameda; I believe his assessed valuation will make all of your mouths water, it has hit over a billion dollars. I don't know if he is the first to do that, but anyway Chet, go ahead. Mr. Robinson.

TRANSITION IN AN URBANIZED MOSQUITO DISTRICT

E. CHESTER ROBINSON[1]

Transition in a basically residential mosquito abatement district has two phases:

(1) In public acceptance and demands.

(2) Operational.

The population of a district at time of formation is quite tolerant of a few mosquitoes because of the comparatively high percentage of control. But as years pass, they, and particularly new residents, expect one hundred percent freedom from mosquitoes twelve months of the year. The Alameda County Mosquito Abatement District was formed in 1930, primary emphasis being on control of hordes of salt marsh mosquitoes (*Aedes squamiger; Aedes dorsalis*) breeding along the forty-five miles of Bay shore, which were invading most of the District and holding up development of the southern end of the County, now comprising Fremont, Union City and Newark.

These marsh lands and most other large areas of mosquito production have, over the years, been drained, diked, filled, disked and pumped, so that each year the percentage of spraying necessary for area control has been reduced. Problems arising from duck clubs, industry, agriculture, and community sewer disposal plants are being corrected by properly defined ponds with weed-free banks, kept free by disking or using soil sterilants. Now let us move out of the mud flats into the orchards, hayfields and row crop lands that are being transformed into residential subdivisions at the rate of nine hundred living units per month. These crops were on good soil and did not produce any mosquitoes. Nine hundred homes require one hundred fifty acres. Each year eighteen hundred acres which required relatively litle mosquito control are being converted into ten thousand eight hundred new homes requiring inspection for fishponds, swimming pools and other mosquito breeding sources, in addition to gutters, catch basins and utility vaults.

On the subject of catch basins and equipment, we had a Willys dispatch jeep built with automatic transmission which you saw at the equipment demonstration. This unit has increased the efficiency of our catch basin spraying by over thirty percent.

The population expansion is also to the hills, from Berkeley to Fremont, where in years past over one hundred thousand eucalyptus trees were planted. Many of these have been cut off a few feet above the ground and the center of the stump has rotted out leaving an excellent place for the tree hole mosquito, *Aedes sierrensis*, to propagate.

We have divided these areas into three sections, each to be treated every third year with 50% wettable DDT powder. This work is done in the off-season of November, December and January, treating about twenty thousand tree holes a year. During the last two years we have not received a service request caused by *Aedes sierrensis;* yet we have left a few stumps untreated as test plots and have obtained some larvae and pupae from them.

How can we maintain the same standard of mosquito control with the same manpower under these circumstances? My answer is: We can't, unless we get the most efficient equipment and speed up our source reduction program so that we can divert the effort and material spent in other areas to the residential problem.

Mr .Campbell: I think at one time we were presumed to have one of the highest concentrations of swimming pools in the State. We had about 1200 in 1957. I believe we probably have 1500 or so now. I don't think more than 5% in any one year gives us any trouble. What percent of swimming pools in your area occasionally breed mosquitoes, Chet?

Mr. Robinson: Our so-called good swimming pools, those with cement, filter systems and drainage lines, give us no problem at all. It is just with the wading ponds, these plastic ones especially that are being bought for twenty to a hundred dollars or so, that give us all the trouble because there is no circulation, no cleaning, and they don't dump the water out.

Mr. Campbell: Chet mentioned that Mr. Gray had things so well organized that now he hasn't much to do. I think he likes it that way. He is trying to duck fly control now.

Mr. Robinson: You are so right.

Mr. Campbell: If there are no questions from the floor, fellow panel members, we shall consider the panel adjourned. Thank you.

Mr. Steiner: Thank you very much, gentlemen. Our next panel will discuss "Problem Solving by Local Mosquito Abatement Agencies"; and I would like to introduce at this time Mr. Robert F. Portman, Manager-Entomologist of the Butte County Mosquito Abatement District at Biggs.

Mr. Portman: Apparently from the time schedule we are done. We have had a very excellent Conference this year I feel, but irrespective of how good a Conference is, or otherwise, it is the last Conference period, the last item on the agenda, which is afflicted with syndromes which we all know. We are all tired, we are restless, we are irritable, our minds wander, and we don't know whether we want to go home or just go to bed. So, we are faced with that unfortunate situation and we have no time; but we are perhaps going to take some. I would like to call on Mr. John Brawely, Engineer-Manager, Kings Mosquito Abatement District, Hanford.

Mr. Brawley: I will be very brief. Our first problem was in finding information for presentation on this program. We were fortunate in that we have no time anyway. Actually these fellows were not reluctant to share their experiences with you; it just happened that most

[1] Manager, Alameda County Mosquito Abatement District, Oakland.

of these items have already been included in the program.

However, there were three districts, including my own, which had some items which we thought might be of interest to you. I will summarize these for you, give you some information of my own, and if you wish more information, I am sure that they will be glad to furnish it . . . .

PROBLEM-SOLVING

JOHN H. BRAWLEY
Engineer-Manager
Kings Mosquito Abatement District

Obtaining information from the Mosquito Abatement Agencies in the Southern San Joaquin Valley region turned out to be quite a problem in itself. However, in spite of the difficulties encountered I do have reports from three districts, my own and two others.

District Owned Airplane

The first report is from the Tulare Mosquito Abatement District. The problem: How to increase control coverage in spite of a drastic budgetary cut due to the virtual elimination of state subvention during 1959. After a great deal of study they decided to reduce the number of district employees, eliminate contract airspray, and to use a district owned airplane.

The report says that the results were very satisfying. In the calendar year 1958, 66,711 acres were sprayed, by ground and air, for a total expenditure of $131,169.00 or $2.00 per acre. In 1959, 69,856 acres were sprayed for a total expenditure of $112,551.00, or $1.64 per acre —and 18% drop in the per acre cost. Additional information including an aircraft cost analysis for the year 1959 can be obtained from the Tulare Mosquito Abatement District.

Routine Cholinesterase Tests

The second report is from the Corcoron Mosquito Abatement District. The problem: How to keep employees aware of the need for careful handling of organic phosphate insecticides.

This district makes use of routine laboratory checks on the cholinesterase levels of all men handling parathion. By contacting the District Manager you can obtain helpful tips on how to keep the cost down, the psychological effects, changing employees with critical levels to other insecticides and other information that may be helpful if you are having any difficulty with personnel becoming sick from exposure to these insecticides.

Insecticides for Parathion Resistant Mosquitoes

The last report is from the Kings Mosquito Abatement District. The problem: Resistance of *Aedes nigromaculis* larvae to Ethyl parathion.

Since August of 1958, metathion has been used successfully for the control of parathion resistant *Aedes nigromaculis* larvae. This material is a special formulation of Methyl and Ethyl parathions. The application rate is the same as for Ethyl parathion. Precautions to be used handling are the same. The 7½-lb. formulation is not too stable but this is the one we have been using. The cost per acre is only a few cents higher than for regular parathion. If you have any questions about the use of this material I will do my best to answer them.

Mr. Portman: Thanks, John. I would like to now call on Howard Greenfield. I am again asking that it be brief.

Mr. Greenfield: I have left my notes on the chair and I will be very brief. I have only one district in the Coastal Area that has actually solved their problem. That is quite obvious because no one sent any information in to me other than this particular District to indicate what had happened.

If you want to have a new shopping district, burn down the old one. I know that Pete has a solution and a formula that you can use on it. Any other problems are still in the process of being solved. So, all I can say is that I have enjoyed this Conference, and the Coastal group wishes everyone a safe trip home. Thank you.

Mr. Portman: Thanks, Howard. Now we will call on Norm Hauret from Ballona Creek Mosquito Abatement District.

Mr. Hauret: I think the first problem I should solve is how to pronounce my name. It is the same as Lauret, pronounced "Hor-ay."

PROBLEM SOLVING BY SOUTHERN CALIFORNIA DISTRICTS

NORMAN F. HAURET, *Manager*
Ballona Creek Mosquito Abatement District,
Culver City

A summary of the problems and actions taken in the Southern California region are herewith given consideration by the separate Districts as follows:

South East Mosquito Abatement District

A joint project co-ordinated by the Bureau of Vector Control, State Health Department, between this district and the Orange County Mosquito Abatement District, was initiated in March. The project consisted of the installation of six American model light traps and the use of twelve artificial resting stations plus a number of natural resting stations. Orange County Mosquito Abatement District carried out a similar program in their territory. The experiment involved a continuing study from March 1, through October, 1959.

Careful sampling of mosquito larvae in all breeding areas was also carried out. The area involved a common boundary of approximately five miles, with a vertical depth of approximately three miles.

Light trap counts were made twice weekly and mosquito species identified. Preliminary evaluation of light trap counts and resting station counts indicated flights of *Culex quinquefasciatus* of a distince of up to two to three miles. The use of the light traps to determine populations of *Culex quinquefasciatus* was quite successful. At least the increase in counts beyond 20 per week resulted in complaints, which correlated with emergence of adults from breeding grounds two to three miles distance.

Of interest, also, was the great predominance of *Culex quinquefasciatus* males in the light traps which ran as high as 70 to 80 percent at times. Other species found in lesser numbers were *Culex tarsalis, Culex peus,* and an occasional *Anopheles freeborni, Aedes taeniorhynchus,* and *Aedes nigromaculus.*

After due consideration of recommendations made by the district and the Bureau of Vector Control, Southern office, the Los Angeles County Flood Control District entered into a research contract with the University of California at Riverside, to do research leading to control of Chironomids in the Whittier Narrows Spreading Basins and concrete lined drainage channels in the southeast area of Los Angeles County.

The district has co-operated with the University of California representatives and Flood Control representatives by providing free use of laboratory facilities, furnishing project with certain catfish for study in naturalistic control of midges, and recommending the sweeping of inverts of concrete channels, plus periodic spraying of channels by district personnel, to determine the best insecticides to be used and to determine length of residual.

Antelope Valley Mosquito Abatement District

The Los Angeles County Sanitation District sewage treatment plants at Palmdale and Lancaster were responsible for a large number of midges. The district recommended to the Flood Control District, that perch and catfish be planted in the oxidation ponds. Within a very short time, the midge problem was solved.

The area covered by the district has a wide range of temperatures, extending from ten above zero to over one hundred and ten during the summer. Last winter, a number of *Culex tarsalis* were found frozen in blocks of ice. Upon thawing, followed by successive freezing, the larvae eventually matured into adults. Many larvae as well as pupae were found in the mud which when transplanted into rearing jars eventually completed their cycle.

Orange County Mosquito Abatement District

Culex quinquefasciatus and *Culex peus* from the City of Fullerton, which is not in the district, caused many complaints from the City of Placentia. The source of the breeding was a natural channel below a flood control dam. The district contacted the City of Fullerton and the Flood Control District and recommended the type of control, the breeding has been completely eliminated.

The district made a survey of all the flood control channels to determine sources of breeding. Pictures were taken of all the sources to show faulty design. The Flood Control Engineer was invited to attend a meeting of the Board of Trustees, the pictures and the results of the survey were discussed. As a result, the Flood Control District is making the necessary changes in their installations.

Ballona Creek Mosquito Abatement District

Construction of the Boat Marina in the Playa del Rey area was started this year. The Los Angeles County Engineer is responsible for the execution of the actual contracts. A clearance contract was let and through an error, a workman knocked a large hole in a dyke which flooded about 15 acres. The County Engineer assisted the district in rebuilding the dyke.

A broken sewer line was found to be a large source of breeding. Since the source was in the City of Los Angeles, the Los Angeles City Health Department was contacted and requested to make an investigation and take whatever steps may be necessary to repair the line.

A manually operated tide gate that the district installed, was destroyed by natural erosion. Attempts were made to save the gate, but it was impossible. This gate controlled flood waters and the intrusion of the high tides, thereby protecting a large residential area. After a comprehensive study, it was determined to install two 24-inch flapper type gates at another location. The new location was chosen because of accessibility. Three other governmental agencies, having an interest in the installation, assisted the District in the installation.

Mr. Portman: Thank you, Norm. And now I would like to call on Mr. Bob Peters, Manager of the Northern San Joaquin Mosquito Abatement District.

Mr. R. H. Peters:

(Report not returned.)

Mr. Portman: Thank you, Bob. Bob mentioned that his district lay in what is termed "Superior California." I have been thinking about that recently, and I believe they are going to change the name of this region in a few years. It will probably not be known as Superior California, but rather as *Freeborni* California.

I have talked to Bill Bollerud, I shouldn't have to introduce him, and I believe he has a few words.

Mr. Bollerud: Let me emphasize this: that I have a few words. I have a special animosity for people who overrun their time on the program, and I can assure you that you are not going to pin it on me today. My remarks, for those of you who can read, will be extended in the journal. We are approaching the witching hour, and in a few minutes both hands of the clock will be straight up and my solid gold Cadillac will turn back into a pumpkin. What do you say we knock it off?

Mr. Steiner: Thank you very much, Mr. Campbell and Mr. Portman, and the other gentlemen who were on the last two panels. Believe it or not, but at great sacrifice of time, we are now three minutes ahead of schedule. At this particular time, I would like to say that I have been a member as a trustee of the Orange County Mosquito Abatement District for eight years. I have had the opportunity for the third time to attend these Conferences and, not being a technical man, just a layman, I soak up as much as I can of this knowledge you hand out. And I am personally very appreciative of the opportunity of being here and in behalf of the Orange County Mosquito Abatement District and our members, I thank you gentlemen very much. One of our members, Mr. Koch, happened to mention that he is extremely amazed at the high caliber of men that give out this information. I wanted to use the term "expert," but I am told that an expert is one who knows everything about nothing and nothing about everything. At this particular time, I would like to turn the meeting back to our new President of the California Mosquito Control Association, Mr. McFarland.

President McFarland: There will be a brief Board of Directors' meeting after the Conference. Although the list of Committee Chairman is not official until ap-

proved by the new Board of Directors, I would like to read the names of the Chairmen so that they may be aware of their assignments. The full listing will be published in the minutes and yearbook. Duck Club: Bill Rusconi; Education and Publicity: Gordon Smith, your past President; Entomology: Dick Frolli; Forms, Records, and Statistics: Jack Kimball; Insecticides and Herbicides: Leon Hall; Legislative: Les Brumbaugh; Operations and Equipment Procedures: Ted Raley; Publications: Don Grant; Research: Don Grant; Source Reduction: George Whitten; its Sub-committee on Dairy Wastes: Steve Silviera; Ways and Means: Howard Greenfield; and Program Committee: John Brawley.

I want to take this opportunity to extend a few compliments. To Gordon Smith for the wonderful job you have done this year. To Dick Sperbeck for the bangup job on the local arrangements. We just can't take the time to thank everyone individually, but I want to extend my thanks to everyone who attended practically all the sessions and to all of the speakers and panel members. Everyone did a fine job.

Are there any additional announcements? Thank you for being here. The Conference is adjourned.