

Mr. Robinson: There is one more paper this afternoon -- that of Harold Gray. He will tell us something about DDT Control of Mosquito Breeding in Catch Basins and Underground Vaults.

THE CONTROL OF MOSQUITO BREEDING
IN STREET INLETS (CATCH BASINS),
UNDERGROUND UTILITY VAULTS AND
SIMILAR STRUCTURES, BY DDT RESIDUAL SPRAYS

By

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In the planned division of practical field studies of DDT agreed upon in 1945 between Mr. Hayes, Mr. Robinson and the speaker, certain studies were assigned to the Alameda County Mosquito Abatement District. These were principally urban in type, and related to various structures in which mosquito breeding occurs, such as street inlets for storm water, the underground vaults of the public utilities, and similar structures.

In June of 1945 we obtained from Chemurgic Corporation a sufficient supply of 25% DDT emulsion and solution to begin operations. Six utility vaults were selected and sprayed with a 2 $\frac{1}{2}$ % emulsion on June 9, and the water in an additional vault was treated with phenothiazine for comparison. In four vaults the walls and ceilings were sprayed; in two vaults the water only was sprayed with DDT. Each of the vaults selected had in past years been a prolific mosquito breeder requiring frequent oiling.

In addition, between June 6 and June 12 we sprayed 800 street inlets with 2 $\frac{1}{2}$ % DDT dissolved in Diesel oil, applying the material to the side walls for residual effect.

Inspections of the utilities vaults indicate that the DDT spraying was effective in preventing mosquito breeding down to the beginning of colder weather in November. For the same period, inspections of the 800 street inlets sprayed with DDT showed a remarkable reduction in mosquito breeding, although larvae were found in a very few cases. No mosquito breeding occurred in the vault treated with phenothiazine.

From June 15th to mid-October 8770 sprayings of street inlets with DDT (10 lbs. dry technical grade in 50 gallons of Diesel oil -- about a 2 $\frac{1}{2}$ % solution) were made, but with no attempt to cover the sidewalls completely. Exact numerical counts on re-inspections of this series were not made, but our general observation was that while an appreciable improvement resulted, much better results were obtained from the first series of 800 street inlets where the sidewalls were completely sprayed.

A series of 243 cesspools was sprayed in mid-August with DDT in Diesel oil (10 lbs. to 50 gallons), applying it heavily to the sidewalls and ceiling. Inspections made later, running down to the end of October, showed no breeding within the cesspools, but some larvae occurred in the overflow from four cesspools.

In addition, we have applied DDT as a residual spray to a wide variety of structures which were either heavy breeders, such as certain storm sewers (one nearly a mile long), or were day-time shelters for adults, such as the under sides of small bridges and road culverts. A sufficient time has elapsed in some of these cases to indicate to us that DDT residual spray is a very effective means for at least partially reducing, and in some cases, entirely eliminating mosquito harborage for at least several months.

Adequate quantities of DDT for extensive field trials were not obtainable during 1945, but will be available for our 1946 campaign. On the basis of our observations in 1945, we expect that one systematic spraying of the underground street vaults of the public utilities, made in April and May, will probably prevent breeding until about October, if not longer. We are now endeavoring to make arrangements with the utilities for such a cooperative project.

Beginning about May 1st we intend to thoroughly spray all the street inlets (catch basins) in the metropolitan area. We expect this will be effective for three months in perhaps 90% or more of the cases, but the remainder may need additional sprayings because of special circumstances. A general re-spraying will probably be needed in August.

We expect also to spray the walls and ceilings of all our larger storm sewers and covered drains, and the undersides of small bridges and larger road culverts, which are favored day-time shelters for adult mosquitoes. In addition, we expect to spray all cesspools in the district probably twice during the season.

In all of these uses we intend to use a 2½% (approximately) solution of DDT in Diesel oil, as this appears to be the simplest and cheapest method of application at present available. The solution is to be sprayed on the interior surfaces of the structures for its residual effect on the adult mosquitoes which alight there. We do not expect to use DDT to any great extent as a larvicide, though we will use it experimentally to determine relative costs and efficiency as compared with oil, phenothiazine and pyrethrum.

For situations where wall discoloration by Diesel oil will be objectionable, we will use the standard Xylene-emulsifier mixture. We have set up at our Oakland depot an apparatus, operated by an electric motor driven pump, for the preparation of DDT emulsions and solutions.

During 1946 we expect to try out DDT wettable powder in comparison with DDT solutions and emulsions. Applied as a residual spray in this form, it may have certain advantages. We also have hopes of obtaining sufficient supplies of "DDD" and of "666" for comparative field tests.

At this time we are not prepared to make any statement as to relative costs of using DDT under our conditions. We do feel optimistic that its use in appropriate places will result in obvious

improvement in control effectiveness, and we intend to use it to the fullest extent possible during 1946, and then assess effectiveness and comparative costs on the basis of an entire season's work.

Prof. Herms: What is your reason for delaying until May 1st?

Mr. Gray: It is a question of rainfall. On the street catch basins and, to a certain extent, on street vaults, while we have the rains the use of DDT would probably be somewhat interfered with. It would be washed away. After mid-April or early May when we have no rain or at least very slight rains, is the best time to begin DDT application.

Prof. Herms: Thank you. I just wanted that point brought out; I thought perhaps it was not quite clear to everybody.

Mr. Bendel: Is it necessary to have agitators on the sprayers?

Mr. Robinson: Not unless there is a low temperature. Hot weather makes a difference. The movement of the trucks is usually enough to keep the emulsions stirred up.

Mr. Menefee: When knocking around they get a lot of agitation. Walking around with one of these knapsack sprayers there is bound to be a lot of agitation.

Mr. Russell: When do you spray cesspools?

Mr. Gray: Cesspools are taken care of from March to October. Many are open all the time. Breeding occurs mostly during the summer months, though there is some winter breeding.

Mr. Russell: People in our district close their own cesspools up.

Mr. Gray: We tried to work that out. I maintain that open cesspools are primarily a public health department's problem, and the health department is primarily responsible for the abatement of these nuisances. I refuse to pull the County Health Department's chestnuts out of the fire. When we can get some working arrangement by which they will take their share of the enforcement program we will be willing to file nuisance complaints cooperatively.

Mr. Russell: We try to show consideration to our people and to give good value for their money, but the property owner has a responsibility. The health department comes in on it so far as cesspools are concerned, but the district has to eliminate mosquito breeding hazards. The district can require the people to close them. In our district the matter is only referred to the health department when citizens refuse to cover their cesspools.

Mr. Gray: You have me somewhat on the spot. My policy may not be defensible legally, but we have an administrative problem on our hands. What would happen if we served notices, Bendel?

Mr. Bendel: I think we'd be found dead some night. We have about 600 cesspools in our division. The County Health Department will take no action. So we simply oil them as part of the routine. It isn't any

particular hardship. If they did close them, the average citizen would only close them partially. I question whether many of them would close the cesspools sufficiently to prevent mosquito breeding. Unless a first-class mosquito-proof job is done, I would rather not have anything over a cesspool. It is easier to find and take care of it when they don't cover it up. The ones we have to dig down and excavate in order to locate are where we have trouble. I would much rather have them accessible.

A Member: I spent two years in Fresno where the cesspools were closed. If properly inspected they are no hazard.

Mr. Gray: In any case, we in our district have the proposition of whether we are going to stick our necks out and do the work of the health department. I think there is a principle involved in the thing.

Mr. Robinson: We have a few minutes for discussion before it is time to adjourn for dinner. Are there questions?

Mr. Bumiller: How toxic is DDT to water fleas, or Daphnia? We used 10 lbs. per acre and didn't get any kill on the Daphnia, but I'd like to hear something about that.

Mr. Gullin: I saw an article to the effect that DDT was very toxic to Daphnia and finally will kill.

Mr. Bumiller: Under the law it really is the duty of the District to eliminate all mosquito nuisances, isn't it?

Mr. Gray: By the powers conferred under the California act the Districts may take all necessary or proper steps for the extermination of mosquitoes, and they may abate nuisances. If after due notice the nuisance is not abated, the District can abate the nuisance, possibly by proper reconstruction, and charge the cost to the property owner. In our district we have not taken that type of action. We haven't felt it necessary and believe it would not be advisable. We feel we get better results the other way.

Mr. Coburn: I don't happen to know much about mosquito breeding in cesspools. But I would like to know why different agencies come into a territory and make a survey, and don't let the adjacent districts know anything about it. Wouldn't it be advisable when they work in a district to notify the adjacent districts that they are coming? Possibly some of us might be of help to them in what they are trying to do. Some of us would be glad to help, and by this method learn something more ourselves. It seems to me it would be feasible and advisable.

Mr. Gray: Bring that up to Reeves. Would you be willing even to make a little trip to an adjacent county?

Mr. Coburn: Yes. We are only 38 miles from Bakersfield. When I found out about the Hooper Foundation work there, I was in Fresno, 150

miles from Bakersfield. Tulare, Visalia and ourselves (West Side District) would like to have seen the residual spraying demonstration.

Dr. Reeves: I think we could have used some men like Coburn and his equipment. The equipment we had to use wasn't much good.

Mr. Gray: If the six hundred thousand dollars goes through we will probably have better information and supervision. Maybe those things can be ironed out.

Mr. Robinson: I suggest we send a wire to the Governor asking him to sign the bill.

Mr. Gray: I make a motion that the California Mosquito Control Association request the Governor by telegram to sign Assembly Bill 28 appropriating six hundred thousand dollars for mosquito control.

The motion was duly passed by unanimous vote.

The Conference then adjourned to re-convene at 8 p.m.

The Conference re-convened at 8 p.m., Professor W. B. Herms presiding.

Prof. Herms: As our board of experts is fairly bubbling over with perspicacity, I will read each question which has been presented, and assign the questions to the men best qualified to answer them.

Question: Is DDT effective against termites? Dr. Stewart will please answer.

Dr. Stewart: I know very little about it. I am only drawing upon my memory but I have a vague idea which perhaps Dr. Freeborn can correct. Experimental work done upon termites to date has indicated that in certain sheltered conditions if impregnated in oil it is reasonably effective. Under buildings the soil saturation method is effective.

Mr. Murray: The Army had some experimental work done on the Florida coast. It worked O.K. in buildings. It was used in the barracks. There is a loose, sandy soil there.

Mr. Mondala: I want to mention the man of Mars outfit some folks think is necessary to wear when applying DDT. Did they wear it in Florida, for instance? In one lecture we are told to wear the whole protective equipment, and then in another lecture we are given the impression it is not necessary. And in the bulletin sent out, the Public Health Service shows a picture of a man in a Mars suit, and then another picture shows work being done with only the sprayer. One lecturer tells me all this protection is not necessary and another contends it is absolutely necessary. What am I going back to Washington with? What IS right?

I question the over caution on the use of DDT after the experience of those in Europe. They have been using great quantities. Some of them did wear something over the nose. DDT was applied by

means of a duster by opening the clothing and introducing it in considerable quantities. Apparently there was no ill effects. One of the officers told me when there was objection he simply took some of it in the palm of his hand (he may only have gone through the motion of course) and swallowed it to show there was no danger. It has been used in great quantities without any ill effects at all. Dr. Stewart pointed out that so far as the use of dust is concerned there is no danger but with oil and other materials it is another matter.

Dr. Stewart: Even if you are dealing with a material far less toxic than DDT you still have to be careful. Under military conditions they were dealing with a controlled and disciplined group. If something went bad the public would not hear anything about it. But as civilians in government work, if you use DDT you are faced with the responsibility to take all due precautions. That I think is fundamental. You have the very real responsibility of protecting or at least not harming.

As regards DDT I am not going to guarantee that every person is going to die who uses it carelessly or that everyone who gets it on his skin in oil is going to be sick. However, it has been proved experimentally that in oil it is absorbed through the skin and may be absorbed to a toxic degree. If a person is just going out with a squirt gun and perhaps handle one or two rooms, it is ridiculous to take all the precautions, but if he is using a great deal he should protect himself while he sprays because there is a very definite element of danger.

The dust should not be allowed to remain upon the skin indefinitely. There is no record of deaths from DDT dust, but if a person has an oily skin and the dust is not washed off within a reasonable time it may have some bad effect.

We also should guard ourselves not just against DDT but against the solvents. Many of them are either toxic or can be at least very irritating to the skin. We must take precautions not only on our own account but we have also our employees to consider. Where we have employees handling it all the time we are responsible to see that they understand they are dealing with dangerous substances which may bring unwanted results if they do not take precautions which have been made clear to them. If you do not give protection and do what you can to see that the precautions are observed, then you are responsible if something happens. And if you do not state precautions to householders and they suffer some ill effects from DDT or its solvents and decide to take the matter into court, at the least you are going to be embarrassed or annoyed and possibly fined or held liable for damages. We know DDT is toxic. We know there are certain precautions which can and should be taken.

Prof. Herms: The next question is as follows:

Question: What is the time effect of DDT on flies?

I will assign this question to Dr. Stewart also.

Dr. Stewart: Our work so far has not brought out any particular difference in effect upon different species of flies, as there are several variable factors. If DDT is irregularly deposited in spraying, there may be an appreciable time factor before the fly in moving about on a sprayed surface makes a lethal contact. However, DDT is much slower in its toxic action than many of our common insecticides. My impression is that about three hours is the average killing time after a fly contacts a residual DDT surface. That is why pyrethrum is added to DDT space sprays, such as aerosols, to get a quick knock-down, while the DDT actually kills more slowly.

Walls, ceilings and door and window screens should be sprayed with DDT residual spray for fly control. And of course the garbage can attracts flies anywhere.

Mr. Mondala: I'm still not satisfied about all that equipment. Did Reeves' men take all these precautions?

Dr. Reeves: We read all the publications telling what should be done and then I laid in a supply of respirators, rubber gloves, etc., and explained to the men the danger. I insisted that so far as we were concerned they should wear these things. In Kern County in the middle of June the temperature is around 110 in the shade and you can well imagine nobody wore the things. They did, however, take the precaution of washing often. It is almost unbearable to wear rubber gloves with the thermometer at 110. Several of the men who had cuts did wear the gloves until the cuts healed. But workmen generally just don't want to wear them. I don't know what would happen if we made an issue of it. I guess the spraying just wouldn't get done. We had the equipment, made it available, explained its use, and why, and then left it up to them. Our men were only working a few days at a time. The program only lasted over a few days.

Mr. Gray: I think we will have to use common sense in this. If you use straight Diesel oil in a spray can, some of it is bound to get spilled on you once in a while. With knapsack sprayers it may be spilled down your back occasionally. In hot weather this may result in a blistered skin, caused by the Diesel oil.

You are not going to be able to get workmen to wear much protective equipment in the hot climates. You are going to have to take into consideration the type of exposure. If men are working outside spraying DDT more or less broadcast you should take the same precautions as when spraying paris green. The men should work from the windward side and clean up thoroughly afterwards. When they are working in confined places, such as underground street vaults, storm sewers or inside rooms, much more material may get on the skin, or be inhaled. I think it is necessary to protect your men reasonably well under such conditions. I don't think respirators are necessary. We are providing transparent hoods for our men. That prevents a man breathing any appreciable amount of the material unless he is using it in a very fine mist. Insist that every man you have working with the material takes a good bath with soap and water at the end of the day. We have provided shower baths with hot and cold water and the men are required to clean up. We do this partly for the sake of the district

itself. We don't care about having a law suit on our hands. But it is also for the protection of our men. We don't want them injured in any way. We also have no desire to be charged heavy compensation insurance rates. I think if you talk to your men and explain to them the difficulties that may occur they will voluntarily take reasonable precautions. There is some danger there and we need to exercise reasonable precautions.

Dr. Stewart: I quite agree that respirators are only necessary in confined quarters. I think the men would be more willing to protect themselves if they use DDT in oil out of doors or in a large quantities if they understand the possible dangers. If we use it in large quantities and without these precautions which have been mentioned, next year or the following year we may hear at this conference a great deal of grief because of the material being absorbed through the skin. We cannot afford to ignore this matter. It has been carefully demonstrated by very competent people and we are taking a great risk if we do ignore these precautions. I would like to ask Dr. Bradley's ideas. He has had a great many men under him using DDT. How many have been affected? Have the men worn the equipment?

Dr. Bradley: We are teaching them and we are providing them with protective equipment, and telling them they should use it. We have then discharged our responsibility. If they, do not use it that is up to them. We can say "I told you so."

Although the men don't wear equipment to any great extent, we have not had any serious cases of injury. There has been a little dermatitis. What is going to happen next year I don't know. If we provide the equipment and tell the men to wear it that is about as far as we can go.

Dr. Freeborn: In some of the places they just couldn't work with power sprayers without protection. They couldn't stay in there without the equipment. They'll wear it when they know they have to. On the other hand, with a hand sprayer a man wouldn't get enough on his glasses to have to wipe them.

Mr. Stead: We can take a chapter from our experience in the public health field in industrial hygiene. I feel we have a closely parallel situation in the question of lead. That is a toxic material and so is DDT. We must make a distinction between what is toxic when introduced into the body and what is dangerous. Lead is absorbed through the skin, and can be inhaled or swallowed.

The particle size is important in relation to inhalation. If it is greater than about 10 microns the particle is too large to enter into the lungs and get into the blood stream. Welders may get lead poisoning, and riveters on the Golden Gate Bridge had some trouble as a result of the effect of red hot rivets on red lead paint.

It has taken us a great many years to find out the conditions under which lead can be used with reasonable safety, but by making

exact quantitative measurements we now know what protective measures are necessary against lead poisoning. We should also be able to get, perhaps within another year, fairly good information on the toxicity of DDT, though tests under practical working conditions may well take more time. But many people are safely using lead, a poisonous material, today, and we will also learn how to use DDT safely.

One point should be emphasized and that is that the solvents for DDT are themselves toxic. Tetrachloroethane, carbon tetrachloride and other solvents are poisonous, and we need to learn to use them safely, also.

Prof. Herms: It should be remembered that in agriculture and in pest control work we have used poisonous materials for many years. Thousands of tons of cyanide are used, and even more tons of arsenical compounds. Years of experience have taught us how to use these very toxic materials safely. We can also learn to use DDT safely.

Question: What would be the radius of control and the flight range of the following mosquitoes: Anopheles freeborni, Culex tarsalis?

Dr. Freeborn: The flight range of a mosquito is a random flight. I don't think you can say a mosquito starts out with a fixed idea he is going four miles. He starts out and flies perhaps half a mile. The next night he may go in the same direction or he may double back. At the end of several days he may end up where he started from. Or maybe he will be four miles from the starting point. If you want a practical answer so far as control is concerned, you will get perfect control if you kill all of them within a mile or a mile and a half from the place you are trying to protect. However, this statement has no application to the spring and autumn dispersals of Anopheles freeborni. They start out in the spring of the year with plenty of water. Later the amount begins to decrease and so they concentrate. In the fall their breeding is over and they realize they are concentrated, and along about September or October or even earlier they start flying again without any limitation as to how far they will fly, perhaps as much as 27 miles.

Question: Does the wind make much difference?

Dr. Freeborn: Not with Anopheles. Some feel that they follow the wind. Rush used to say the north wind created a vacuum.

Prof. Herms: Again you say adequate or practical control. That is a very important angle for all of us.

Dr. Reeves: We don't know about the flight range of Culex tarsalis. We haven't been in a situation where we could trace them in our study, and so far nobody has made experiments with stained specimens. I wouldn't want to set any limits.

Dr. Freeborn: You can always find some tarsalis breeding within a very short distance of where you find the adults.

Mr. Gray: The flight range of Aedes dorsalis ranges in the region of 20 or 25 miles. If you really want a long distance traveler, Aedes

squamiger flies over 40 miles and some think in the region of 60. My own impression is that the flight range is about 20 to 25 miles for dorsalis and up to 40 for squamiger. Aedes squamiger would take about three weeks for a 40 mile flight.

Mr. Menefee: Does that apply to the salt marsh variety?

Mr. Gray: Yes.

Mr. Robinson: My experience would be that fresh water dorsalis and nigromaculus can be fairly well controlled for they will stay practically within the field from which they breed. If they over produce in that field they will move off. Search for food makes them move. A three or four mile flight would be natural for dorsalis in the valley and generally elsewhere. For vexans it would be a little more.

Prof. Herms: The flight range varies greatly according to species. The time of year and also local conditions play an important part.

Mr. Gray: Generally speaking, most of our domestic mosquitoes travel something like a few hundred yards from where they breed if the food supply is there. All of them most likely travel as far as necessary in order to get food.

Mr. Peters: A very ticklish situation developed in the Sacramento area. It is all well and good to say 1 mile or $1\frac{1}{2}$ miles for $\frac{3}{4}$ of the year. But what about the other $\frac{1}{4}$ of the year? Supposing you were the man in Sacramento -- what would you say then?

Dr. Freeborn: There is no point in trying to control mosquitoes when you are not breeding them. Consider the Sacramento Valley area. Breeding occurs all up and down the valley, yet some areas need no control work at all. There can be good control in Sacramento from March 10 to August 30th, but for September and October and the big flight in February, there would be no guarantee at all.

Prof. Herms: What can you assure them with reference to malaria?

Mr. Raley: I have had some experience in a freeborni district. We increased our control roughly $2\frac{1}{2}$ miles in the control area. We still found that during the winter months we were badly bothered with freeborni, so in setting up our district we went as far as legal and natural boundaries would allow. We went to the county line in both counties. Apparently these mosquitoes travel many miles.

Dr. Freeborn: Anopheles freeborni when it migrates is a random migrator. About 1% probably succeed in straightening out their travel and going half a mile in a night. In 4 nights they will have gone 2 miles on this basis. But probably only about 1% will do this. Some of them are going to get into the district. If you have 1,000 10 will get into the district. The more you have of breeding concentration on the edge of the district, the more are going to get in until they get to where they are a real pest. A big concentration on the boundary means they go further. The bigger concentration on the boundary you have, the

greater the number that will go further than a mile will be. Then you will have to go further than a mile to control them.

Prof. Herms: If the new law is passed, it will be possible to go further in control work.

Question: Will the control of Mosquito breeding in the larval stages eliminate adult mosquitoes in a local area within two weeks under average conditions?

Prof. Herms: This question pertains to the length of life of the mosquito. Dr. Freeborn, supposing you take the question.

Dr. Freeborn: A great deal depends on climatic conditions. High temperatures and low humidity mean a short life span for the mosquito. They won't live too many days. But some species can live all winter, and the snow mosquitoes about a month. We used to say we would give ourselves a month for control results.

Mr. Robinson: About ten or twelve years ago one superintendent said he always told people that it would take two weeks before the work of the district would become really effective and he has never failed yet. He knew that when they had a flight of mosquitoes it would last just about two weeks.

Prof. Herms: Occasionally it was necessary for me to go out into the state and when some lady would see me she would tell me how glad they were I was back because the mosquitoes had been just terrible while I was away but that now they had completely gone. The flight was over. I hadn't done a thing about it. This business of guaranteeing a certain length of time in which the trouble will be cleared up can be dangerous. Under certain conditions you may expect a considerable reduction in a certain time but you can't just generalize.

Mr. Gray: My very excellent secretary receives every year a number of complaints of local breeding. She tells them when they call that someone will be out to take care of the situation for them and thanks them for letting us know. She also tells them to kindly let us know if they are still troubled after a few days; to phone us again if there is not a decided improvement by say next Wednesday or Thursday. We figure that in about four days after the men have been out there should be a definite improvement and, in some cases, no more mosquitoes at all. If there is no improvement in that length of time, we figure that though we may have found a place where the mosquitoes were breeding or even several places, there is some other place not yet located.

Mr. Robinson: In our experience down in the valley we do the same thing Mr. Gray does. We tell them that if the mosquitoes are still bad the next week to be sure and let us know. As a rule, there is a difference in three or four days and then they disappear altogether.

Question: What about food for fish (Gambusia)?

Mr. Gray: If there is no natural vegetation in the water, plants should be obtained and planted in the breeding pond. It is well to

plant some green algae also in the pond. If it is an artificial pond, it is usually necessary to feed the fish at first until algae and vegetation become established. Dog biscuit broken into small pieces is good. We have used Friskies. Fish will also eat stale bread, but this is deficient in protein. There are several large ponds at Mission San Jose which we have the privilege of using for Gambusia breeding. In the summer we have to clean out the excessive growths of algae and aquatic vegetation. If you have a natural growth such as we have there, you do not need to feed the fish at all. If you have large concrete basins or tanks, simply plant some aquatic plants and within a comparatively short space of time there will be enough natural algae so that no other feeding will be necessary.

Prof. Herms: I have found it unnecessary to feed the fish. If once established, year in and year out they will maintain a population adjusted to the available natural food supply.

Question: How long will DDT be effective on the inside walls of concrete irrigation pipes?

Mr. Robinson: I haven't used it in pipe lines.

Mr. Gray: We have good results for at least three months on concrete vaults, but we don't have the fluctuations in water levels which occur in risers on concrete pipe lines.

Question: Are light traps of any value in a well-organized program? If so, what is the value?

Dr. Bradley: They are extremely valuable to give an index and for comparison from season to season. They are, of course, much more indicative in some places than in others. In one locality we had quite a few out to measure the density of quadrimaculatus.

We only got one or two or maybe three quads per night. Our small catch didn't mean they were not there, but only that they were not coming to the traps. For pest mosquitoes, light traps are often of great value in obtaining an index and in making comparisons.

Prof. Herms: The light reaction varies to the species. We know very little about these reactions but we know there is a great difference between species and light traps do serve as an index.

Question: Which is best to organize for control -- A Pest Control or a Mosquito Abatement District?

Mr. Gray: I would say that a Mosquito Abatement District is best from the standpoint that you are free from any interference by the Board of Supervisors in regard to the amount of money you levy provided you stay within the limit set by law -- 15% normally, but it may be as much as 40% with the permission of the Board of Supervisors. The pest abatement law states that the supervisors shall levy a tax sufficient to raise the amount of money necessary for control. The mosquito abatement act says that the Board of Supervisors shall levy a tax

sufficient to raise the amount of money certified by the Board of Trustees of the District. This is an appreciable difference if one has a hostile Board of Supervisors. Aside from this difference, I would say that the mosquito abatement act is more specific in its field, but in practice there is not too much actual difference.

The mosquito abatement law is to be found in Sections 2200 to 2398 of the Health and Safety Code. The law governing pest abatement districts is in Sections 2800 to 2922.

Mosquito abatement districts are governed by a board of trustees. The city council of each city included in the district appoints a member. The board of supervisors appoints at least one member to represent the county at large. A board of trustees must consist of at least five members. It is the responsibility of this board of trustees to determine the policy of the district, employ the personnel, prepare the budget and control the finances. Pest abatement districts have practically the same powers as mosquito abatement districts but are at a disadvantage financially if they happen to have an unfriendly board of supervisors. The board of supervisors can, if they so desire, cut the appropriation for a pest control district to practically nothing.

Question: Under the new law, what is the best procedure to follow in setting up a new county wide district? How long will it take before a district can be organized and set in operation?

Mr. Gray: If the Board of Supervisors will initiate proceedings by a resolution, publication and hearing, it should not take more than approximately a month to organize a new district now that the District Investigations Act is eliminated. If proceedings are initiated by a petition of the electorate, I doubt that a district can be organized under about two months' time, even with no opposition. You will find it is going to take quite a little time to persuade people that a district is necessary and should be formed. You won't get these things over unless you have prepared the minds of the people. In some cases you will find it has taken several years of education to get to where you can organize.

A Member: I know one district where it took seventeen years.

Question: Does DDT have an accumulative poisoning effect on live stock?

Dr. Stewart: In oil, it is absorbed through the skin and apparently is accumulative. It is secreted in the milk of animals. It is very difficult to interpret the information now available. Perhaps DDT is similar to lead in its poisonous effects. Lead is stored up without apparent harm until it reaches a toxic level. Whether the storage of DDT is comparable is not yet known. Those most concerned with this problem are connected with the department of agriculture, and they are urging caution and yet greater caution.

Mr. Gargas: There has been some work done on that by Neil. He definitely claims there is an accumulation.

Question: How long will DDT be effective on vegetation along irrigation canals?

Mr. Robinson: It is difficult to determine the lasting effect, if any. Possibly the use of DDT enabled us to go three days longer than with straight diesel oil. In clover fields which are irrigated every 8 to 12 days we found that with DDT we could skip every other spraying.

The meeting then adjourned.

The meeting re-convened at 9:15 a.m., Tuesday, February 26, 1946, President Robinson presiding.

Mr. Robinson: The first paper today is concerned with the special training course conducted at the University of California in December, 1944. It will be presented by Harold Gray.

THE SPECIAL TRAINING COURSE ON CONTROL OF
MOSQUITOES AND MOSQUITO-TRANSMITTED DISEASES
GIVEN AT THE UNIVERSITY OF CALIFORNIA
DECEMBER, 1944

By
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During the period December 4-16, 1944 the School of Public Health at the University of California, in cooperation with the Division of Entomology and Parasitology, College of Agriculture, conducted an intensive short course of instruction on the control of mosquitoes and mosquito-transmitted diseases. Twenty-four men, coming from mosquito abatement districts and from various health departments, attended the course. Twenty-two were from California, with one each from Washington and Utah. Fifteen were employed by mosquito abatement districts, eight by state health departments, and one by a city health department. Twenty-two received certificates of satisfactory attendance while two failed.

The teaching staff was obtained from the University faculty, the State Department of Public Health, the Hooper Foundation for Medical Research, and various other agencies.

Instruction was grouped under four main headings:

(1) Administration and Management, 18 hours; (2) Entomology and Parasitology, 25 hours, nine of which were in the laboratory; (3) Mosquito-transmitted Diseases, 6 hours; (4) Techniques of Control, 46 hours. In addition to the laboratory work, the instruction consisted of lectures, demonstrations, seminars and motion pictures.

Our experience with this course indicated that it was too intensive and too short for the best results, and we are of the opinion that if such a course should be given again it should be either expanded to at least a four weeks' course, with ample time for directed reading and study, plus several days of field demonstrations, or if it is