EDITOR'S NOTE:

MOSQUITO NEWS is happy to publish in its entirety the script of a radio talk by Professor Victor K. LaMer of Columbia University on the subject "Insect Control with DDT." This script deals with aerosols and their practical use in mosquito control. Some of the fundamental work in this field of aerosols is here presented in nontechnical language by one of the world's leading authorities on the subject.

"INSECT CONTROL WITH DDT"

Script of radio talk by Professor Victor K. LaMer of Columbia University over Station WNYC, New York City, on January 30, 1947, presented as a joint public service of the American Chemical Society News Service and Station WNYC.

ANNOUNCER: In co-operation with the American Chemical Society, we now bring you an interview with Professor Victor K. LaMer of Columbia University. Professor LaMer's topic will be "Insect Control With DDT." He will be interviewed by George Boehm of the American Chemical Society News Service.

MR. BOEHM: We are told that insects are man's most deadly enemies in his struggle to dominate the earth. In fact, it has been said that insects will eventually take over, unless man takes adequate steps to control them. Despite our much-heralded programs of insect control, such pests as the bean beetle and Hessian fly destroy at least 10 per cent of the food crop in the United States—that is two billion dollars' worth of food. Mosquitoes, ticks, and others spread deadly diseases among man and his domestic animals. Would you say, Professor LaMer, that DDT and the other powerful new insecticides are the weapons that will enable man to conquer his insect foes?

PROF. LAMER: Yes, Mr. Boehm, DDT and its cousins should solve many of our problems of insect control, but only if they are used wisely. Much careful study is needed to find out just how each insecticide can best be used to control each species of insect pest.

MR. BOEHM: During the war, Professor LaMer, you helped solve the problem of controlling mosquitoes with DDT. Your work led to control of the dreaded anopheline mosquito in the South Pacific, where early in the war malaria spread by that insect was causing more casualties among our troops than bombs and bullets combined. Could you tell us how you went about your work, and give us a rough idea of what you discovered?

PROF. LAMER: I would be glad to. The Department of Agriculture made an important contribution to insect control by developing the so-called freon-insecticide "bomb," which is about the size of a milk bottle. When the valve is opened, a fine spray of insecticide is released. It is effective within a room but carries only a few feet outdoors. A way of treating large areas with insecticides was urgently needed. The Department of Agriculture turned for help to the National Defense Research Committee, which then assigned the problem to our staff at the Central Aerosol Laboratories of Columbia University.

MR. BOEHM: Isn't an aerosol simply a fog made up of droplets so small that they float in the air, Professor LaMer?

PROF. LAMER: That's right, Mr. Boehm. We planned to generate fogs of oil, in which DDT had been dissolved. We hoped that these aerosol fogs would roll over the ground for long distances, killing all mosquitoes in their path.

MR. BOEHM: Why didn't you use ordinary mechanical sprayers?

PROF. LAMER: Mechanical sprayers had already been tried and found ineffective

for long distances. You see, the large droplets in the spray quickly fell to the ground where they had little chance of doing harm to mosquitoes. With aerosols we hoped to hit the mosquitoes on the wing.

MR. BOEHM: Did you find that the size of the aerosol droplets was important, Professor LaMer?

PROF. LAMER: It certainly was, Mr. Boehm. A theoretical study of particles floating in air and laboratory experiments on fruit flies and mosquitoes indicated that best results could be expected if all the aerosol droplets were about ten microns in diameter, that is, about four ten-thousandths of an inch. Fortunately, we already knew how to regulate the size of aerosol droplets.

MR. BOEHM: Just why was ten microns the best size?

PROF. LAMER: If the droplets were much larger, like spray droplets, they would fall to the ground too quickly. On the other hand, if they were too small, they would be caught in the tiny air currents that surround each mosquito, and would flow around the insect without depositing on it. The mosquito would be protected by its streamlined figure. To do its work, the aerosol droplet containing DDT must actually be deposited upon the insect's body.

MR. BOEHM: Did you check your calculations with large-scale outdoor experiments?

PROF. LAMER: Yes, in co-operation with the Department of Agriculture we did extensive field testing at Cocoa, Florida, on the salt marsh mosquito and in the T.V.A. territory on the malaria-carrying anopheline mosquito. We soon found that in the hot sunshine, the aerosol fog quickly swirled upward from the ground and was no more effective than the sprays. But at night or on cloudy days the fog hugged the ground and killed virtually all mosquitoes for a mile downwind.

MR. BOEHM: Wasn't this an expensive way to distribute DDT, Professor LaMer?

PROF. LAMER: Not at all, Mr. Boehm. We found that we needed only about a tenth of a pound of DDT to rid an acre of open country of all mosquito life, and even less for the larvae which breed in stagnant pools. In forest areas, about twice as much aerosol is necessary, because some is deposited on the trunks, leaves, and branches of the trees. In the case of the mechanical sprayer, a great deal of the insecticide is filtered out by deposition on the leaves.

MR. BOEHM: Was the aerosol effective on mosquitoes hiding in long grass?

PROF. LAMER: Yes. In fact we found that it followed small eddy currents in the air and penetrated into such hiding places as hollow logs and even in cracks in the bark of trees. We made sure of its penetrating power by placing cages of live mosquitoes in holes in the trees in the path of the drifting fog. Practically all the caged mosquitoes were killed.

MR. BOEHM: For how long is such an aerosol treatment effective, Professor LaMer?

PROF. LAMER: That depends, Mr. Boehm, upon how wide an area is treated. We found that salt marsh mosquitoes migrate twice a day. In the early evening, they leave the swamps and woods and wander toward open places. At dawn they return to the swamps and woods where they find shelter from the sun. The anopheline mosquito, the malaria carrier, fortunately travels less than his salt marsh cousin and is more easily controlled. Due to their migrating habits, it is almost impossible to rid an area of mosquitoes permanently, for they continue to blow in from neighboring breeding areas.

MR. BOEHM: Wouldn't this migrating habit make it especially important to attack the mosquito at its source, the pools in which the larvae breed?

PROF. LAMER: Yes, and the aerosol takes care of the larvae too. Some of the droplets are deposited on the surface of every pool. The larvae, as they swim around, pick up more and more droplets on their bodies, until finally they have collected a fatal dose of DDT.

MR. BOEHM: Does DDT injure fish?

PROF. LAMER: Yes, it can. But we are certain that the concentration of DDT that we recommend for kill-on-the-wing or larva control will not harm fish. Indiscriminate use of DDT or other insecticides will kill fish, as well as birds, bees, spiders, and other small animals.

MR. BOEHM: What effect does wind have on aerosol distribution, Professor LaMer?

PROF. LAMER: In our work we found that wind speed had considerable effect. The aerosol spread more widely when a gentle breeze was blowing, and also it seemed that we might be able to use larger droplets if there was enough wind to carry them. This problem seemed so important, that we returned to the laboratory where we could have our wind made to order.

MR. BOEHM: That sounds interesting, Professor LaMer, could you give us the details?

PROF. LAMER: To the scientist, Mr. Boehm, this phase of our work was the most interesting. At Beltsville, Maryland, the staff of the Central Aerosol Laboratories of Columbia University worked hand-in-hand with scientists of the Department of Agriculture's Bureau of Entomology and Plant Quarantine. To supply the wind, they built a wind tunnel.

MR. BOEHM: Was it like the wind tunnels used for testing airplane models?

PROF. LAMER: Yes, it worked on the same principle. It was a narrow tunnel, thirty-two feet long. At one end a fan sucked air through the tunnel. At the other end was an aerosol generator which produced droplets all of the same size. A door was cut in the middle of the tunnel so that we could insert wire cages of live mosquitoes, and glass panes around that section let us observe what went on inside the cages.

MR. BOEHM: You could regulate both the speed of the wind and the size of the aerosol droplets?

PROF. LAMER: On different cages of mosquitoes we varied the wind from two to sixteen miles an hour. We tried droplet sizes from one to twenty microns diameter, that is, about four hundred-thousandths of an inch to about a thousandth of an inch. Our figures showed that the effectiveness of the DDT aerosol depended jointly upon the wind speed and the volume of the droplets, as long as the droplets were small enough to be carried by the wind.

MR. BOEHM: In other words, by doubling the particle volume or wind speed, you could approximately double the effectiveness of the aerosol. Did you also find out how much DDT is a fatal dose for a single mosquito?

PROF. LAMER: Theoretically, only one fifteen-billionth of a pound of DDT is needed to kill the average healthy female mosquito. The males are even more vulnerable. DDT, however, does not do its work immediately. Many mosquitoes carry a fatal dose on their bodies for several hours before they die.

MR. BOEHM: It would seem, Professor LaMer, that your laboratory technique could be adapted to the problem of controlling almost any insect with almost any insecticide.

PROF. LAMER: Yes, Mr. Boehm, we hope that we have supplied a model for future studies of insect control. Different insects and different insecticides will call for different doses. But the aerosol, or fog, method of distributing the poison should work well in many cases. We hope that our general conclusions about the effect of windspeed and droplet size will in all cases hold true. At any rate, we have determined

the fundamental laws by which aerosol particles are deposited on insects.

MR. BOEHM: Do you think that with aerosols we will be able to control grasshoppers, locusts, gnats, black flies, and hundreds of other insects that plague us?

PROF. LAMER: Undoubtedly, most of them will succumb to the aerosol treatment. But once again, let me emphasize, powerful insecticides can work against us as well as for us, if we do not use them wisely. For example, DDT has been dumped from airplanes in large quantities. While it is true that this procedure rids an area of mosquitoes for a long time, the high concentration kills fish and birds, man's natural allies in his war on insects. The kill-on-the-wing aerosol method, which we have described, requires just enough DDT to kill the mosquitoes and cannot harm our allies. In other words, our aerosol method is as selective in its action as a well-aimed rifle bullet.

MR. BOEHM: Thank you, Professor LaMer.

ANNOUNCER: You have just heard an interview with Professor Victor K. LaMer of Columbia University. This program has been brought to you with the cooperation of the American Chemical Society. If you would like a copy of Professor LaMer's talk, you may obtain one by sending your name and address in a letter or on a postcard to the American Chemical Society News Service, the Lincoln Building, New York City. I repeat. The American Chemical Society News Service, the Lincoln Building, or to the station to which you are now listening.