young men to ply three Tifa foggers. He himself by dint of strict overseeing of this tremendous job during the whole of July and August ensured its complete success. In our climate when the wind speed is less than 8 miles per hour the best fogging time is between 7 p.m. and 7 a.m. This involves considerable loss of sleep in bed for the field manager who had the human element to direct, the remedying of machinery defects, and the care of much bookkeeping. Carelessness in directing fogging in relation to trees, shrubs, vegetables, flowers, bees and fish must be avoided, and on occasion the irascible type of citizen, male or female, must be met and pacified. All these our field manager handled with unfailing good temper and judgment. Nor was he satisfied with land operations but assumed a naval role by mounting a Tifa on a suitable power boat from which he successfully fogged some 24 miles of trees and bush-lined banks of the Red and Assiniboine Rivers.

Hence it came to pass that universal approval and satisfaction was widely expressed for the complete victory over the winged barbarians. With regard to the common fly we had certain areas associated with industrial plants, certain lanes and stables which required vigorous DDT application to rid them of flies.

Outside Greater Winnipeg six small riverside towns were visited by John McLintock who advised the use of a Tifa fogger for residential districts and hand sprayers for breeding areas. DDT in oil solution was supplied for the purpose by the campaign. Excluding these towns the total area covered by the Greater Winnipeg Campaign included ten suburban municipalities and parts of three others, a coverage of approximately 250 square miles. During the past 24 years we have always maintained that just such a campaign would secure freedom from the mosquito pest. This has been achieved by adequate finance and the use of mechanical sprayers manned by intelligent operators in the 1950 campaign.

A NEW TYPE OF LARVICIDE FOR SPECIALIZED MOSQUITO PROBLEMS

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We, in mosquito control work, are always searching for better methods of control. Sometimes a new and better larvicide is discovered in the course of trying to solve a particularly stubborn problem. These problems present a challenge leading to experiments which often go beyond the demands of routine operations.

Such a problem has existed in Nassau County in connection with the use of abandoned sand pits as public dumps. One of the most troublesome of these is located adjacent to a large housing development. Children use the pit as a swimming hole and several have drowned. Authorities were forced to fence in this area to prevent trespassing. They have been trying to reclaim the pit by filling it with refuse that is not incinerated such as grass cuttings, brush, trash, ashes, discarded building materials, etc.

This particular pit comprises an area of about 11 acres and has banks which slope steeply some thirty feet to the surface of the water. The water in the pit covers an area of five acres and varies in depth from 45 to 50 feet. More than 10,000

truck loads of refuse are dumped annually along the banks of the pit and pushed into the water by a bulldozer. Consequently, two very favorable conditions for breeding exist. The water is covered with flotage which restricts wave action, and the decomposition of organic matter contained in the refuse provides ample food supply for the mosquito larvae.

During past breeding seasons the larvicides used were ineffective. In the season of 1949, from May to September, a total of 153 gallons of 30 per cent DDT-oil concentrate (382 lbs. of technical DDT), 2,600 gallons of fuel oil and 45 gallons of 25 per cent DDT emulsion concentrate (95 lbs. of technical DDT), were applied at the rate of 0.05 ppm in weekly treatments. These larvicides were sprayed from a scow, equipped with a motor-driven high-pressure spray pump, having a discharge rate of approximately 50 gal. per hour. Despite the weekly applications, a high percentage of *Culex pipiens* larvae was found five to six days after the application, and the emergence of adults continued all during the season, infesting the heavily populated residential area for at least a two-mile radius. The use of aerosol adulticides, dispersed twice weekly during the summer months within the infested area, gave only temporary relief lasting a few hours.

It was evident then that the most likely means of controlling this source of *Culex* breeding was to find a stable larvicide. The DDT emulsions used were unstable, and the oil solutions were dissipated too rapidly to remain effective. Many inquiries were made in trying to secure a stable larvicide. Finally one was located which proved to be most effective. This larvicide is manufactured by the Chemical Insecticide Corporation, Brooklyn 15, N. Y.

Accordingly, in the season of 1950 a 50 per cent chlordane emulsion containing 5.25 lbs. of technical chlordane per gallon was used. The specifications of the manufacturer stated that a 2 per cent dilution of this emulsion with water would remain stable for a period of one year. This material acted differently from the other larvicides mentioned earlier. This special 50 per cent chlordane colloidal concentrate, when diluted with water to strengths as low as 1/10 ppm formed a mixture which because of its unusual stability, clarity and penetrating qualities was dispersed throughout all the water in the pond. The toxicant could not be distinguished from the main body of water, and unlike the ordinary larvicides did not fall to the bottom or float to the top upon standing. These characteristics enable us to control the breeding of mosquitoes throughout all parts of the pond where they were in contact with water.

The first treatment with this larvicide was made on May 22 at an application rate of 0.2 ppm, requiring 1,000 gallons of a 2 per cent dilution. Thereafter, routine inspection checks were made weekly. No mosquito breeding developed during the months of May, June and July.

On July 17, a second treatment was made as a precautionary measure due to the increase in refuse disposal during the summer and the accumulation of open receptacles among the flotage.

These two treatments were sufficient to prevent mosquito breeding during the season of 1950 from May to October, with one minor exception. On August 25th, after a heavy rainstorm, larvae of *Culex pipiens* were found in a small area of some 500 sq. ft., adjacent to a part of the pit bank where a considerable quantity of earth and broken concrete had been bulldozed into the water. This new crevice, holding water, naturally had not been treated. An interesting point in connection with this incident is that the area mentioned was treated with a 2 per cent DDT emulsion upon the discovery of the larvae as our stock of chlordane had become depleted. Larval breeding occurred again a week later. When our stock of chlordane was replenished, a 2 per cent emulsion was used and no larvae were found thereafter.

The chlordane used in 1950 cost only $11.00 more than the materials which had been used unsuccessfully in 1949. How-

ever, in 1949 it required three men to make 17 applications which produced no results. In 1950 it took the three men only four days to make the application of chlordane emulsion, this time with very favorable results.

In conclusion, chlordane has proved to be more effective than DDT in this particular control problem. The cost has been about the same as DDT but the labor costs have been considerably less. Because of the scarcity of DDT and its prohibitive cost, chlordane larvicide is being adopted in Nassau County for the coming year as the basic larvicide. It is planned to continue experimenting with it and to test its effectiveness in controlling *Mansonia perturbans.*

MOSQUITO CONTROL WORK IN PORTLAND, OREGON AND VICINITY IN 1950

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The first serious attempt at mosquito control in the Portland vicinity came in the middle 30's. In 1934, a study was made by the U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, with Entomologist H. H. Stage in charge. Results showed that the *Aedes,* or floodwater mosquitoes, were much more than a nuisance. Their presence caused losses running into thousands of dollars through decrease in milk production in dairy herds, inability to hire or keep labor in the truck crop area, and loss of tourist trade.

There are 34 species of mosquitoes known to occur in Oregon. They belong to 5 genera; *Aedes, Anopheles, Culiseta, Culex,* and *Mansonia.* Out of 34, we have nine species that are plentiful enough to warrant control. They are:

A. 1. *Aedes vexans* Meig
   2. *Aedes sticticus* Meig (formerly known in this area as *lateralis* Meig)
   3. *Aedes increpitus* Dyar
   4. *Aedes dorsalis* Meig.

These species are found in the overflow areas along the Columbia and Willamette Rivers.

B. 5. *Culex tarsalis* Coq.
   6. *Culex pipiens* Linn.
   7. *Culiseta incidens* Thompson.

These species are found in semi-permanent and impounded bodies of water.

C. 8. *Anopheles punctipennis* Say
   9. *Anopheles freeborni* Aitk.

These species are found in spring-fed lakes in both Multnomah and Clackamas County.

With Federal aid, extensive brush clearing of the mosquito breeding areas was done in 1935. When the floodwaters passed over these areas, oiling crews sprayed diesel oil on water where larvae were hatched. Since this work was done by rowboat or on foot, it was impossible to treat all the hatching areas. Indeed, only an estimated 25,000 out of a possible 80,000 acres were treated.

The work was continued until 1938, when Federal aid was withdrawn. By that time residents of Portland and Multnomah County had become aware of the advantages of mosquito control and protested its discontinuance. So the City of Portland and Multnomah County consulted to see what they could do, and be-