

## MOSQUITO CONTROL AT DEPARTMENT OF THE ARMY INSTALLATIONS

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Mosquito control is of vital importance at Department of the Army installations. The post engineer on the staff of the installation commander is responsible for the supervision and execution of control measures. These operations include application of larvicides, control of adult mosquitoes in buildings and on grounds, and the necessary drainage to remove potential breeding areas. Mosquitoes adversely affect Army operations by transmitting malaria, dengue, encephalitis, and other diseases. The pest species, if not controlled, will reduce efficiency and morale of military personnel.

*Permanent Control.* These methods include camp site location, control of potential breeding in streams, ponds, and other surface water on and around the reservation, filling and grading, ditching and the use of subsurface drains. These measures require considerable costs for labor and equipment. High initial costs are weighed against the cost of applying temporary measures such as larviciding and adulticiding with DDT and other insecticides during the contemplated occupancy of the post. Permanent programs are not recommended or approved until adequate surveys are made by personnel specially trained in entomology.

*Temporary Control Methods.* In post engineer operations emphasis is placed on the following temporary measures for mosquito control: application of larvicides in infested waters; applications of residual sprays in housing and training areas; and control of adult mosquitoes in outdoor areas with fog, mist, and hydraulic sprays.

*Dispersal Apparatus for Ground Operations.* Prior to the discovery and development of DDT, sprayers and dusters used by the Army were primarily commercial models purchased on the open market.

Due to the urgent need for improved apparatus, research and development by the Army and by public and private agencies have produced marked improvements in the following types of apparatus: cylinder type compressed air sprayers; portable power sprayers; aerosol generators; mist blowers; and rotary hand operated and power dusters.

The most satisfactory compressed air sprayer available to the Army for applying insecticides in mosquito control consists of a steel cylindrical tank with a capacity of about 3 gallons. Accessories include spray gun and suitable nozzle and about 5 feet of oil resistant  $\frac{3}{8}$ -inch spray hose. Weight of the sprayer containing 2 gallons of liquid does not exceed 27 pounds. The hand pump, filler opening, outlet tube, and pressure gauge are mounted in the head of the tank. The pump cylinder is 2 inches in diameter and about 16 inches long. Spring valves, flapper valves, and seats of the pump valve assembly are made of stainless steel.

A portable power sprayer issued to installations is a skid-mounted piston pump type gasoline engine driven unit. It consists essentially of a one cylinder gasoline engine, four stroke cycle, air cooled, capable of developing  $1\frac{3}{4}$  h.p. at a governed speed of 2240 r.p.m. A V-belt drive transmits power to the pump. The unit mounted in a tubular frame is 34 inches in length, 17 inches wide, and 17 inches high. The net weight is about 195 pounds. Delivered capacities are affected by the operating pressure, size of nozzle opening, and spray used. The spray gun is made of corrosion resistant materials and equipped with satisfactory cut-off valves. The following nozzles are most satisfactory for use with spray gun:  $1/16$  inch,  $5/64$  inch,  $3/32$  inch, and  $7/64$  inch diameter holes.

The spray hose is  $\frac{3}{8}$  inch in diameter and oil resistant. With a pressure around 300 pounds per square inch and suitable adaptation of the spraying head, the spray droplets are finely broken up, and under favorable atmospheric conditions remain air-borne long enough to provide swath widths of about 600 feet. A high degree of adult mosquito control is obtained with this sprayer. Research and development work is under way on improved fog, mist and hydraulic type sprayer for large scale ground operations in mosquito control.

Dusts containing DDT are effective against *Anopheles* mosquitoes but the effects of treatments in the control of other species are in general disappointing. In breeding areas covered with vegetative growth, dusts are more effective than in areas relatively free of plant growth. A hand operated duster of the rotary blower type is used by post engineers. This duster has a cylindrical hopper with a rotary-type blower fan operated through a gear box by a hand operated crank. Accessories include carrying straps, discharge tubes, and nozzles. Net weight of the duster is about 12 pounds. The filler opening is  $4\frac{1}{2}$  inches square and constant agitation is provided to insure a uniform flow of dust from the hopper into the fan.

Evaluation and field tests of the commercially available fog spray equipment are being conducted prior to standardization of this type of equipment for issue. Operations to date show that the most effective fog spray for the control of adult mosquitoes has a droplet size ranging from about 16 to 60 microns. This type of fog applied with a machine moving at a speed of about 5 miles per hour has not injured foliage, and produces the minimum of spotting on automobiles, buildings, and clothing. Applications are most effective when made during early morning or late afternoon and with wind movement not exceeding about 7 miles per hour. Housing and training areas are best treated by travelling passable terrain, roads, and streets at a speed ranging from

5 to 10 miles per hour with a swath width of about 300 feet.

Mist blowers are also being evaluated at Army installations prior to standardization and procurement for general issue. The most effective mist blower for mosquito control produces an atomized spray with the droplets having a mass average diameter of about 50 to 100 microns. Mist sprays will rise and spread best on calm, warm, and dry days with some upward air currents present. With wind movement ranging from 5 to 10 miles per hour, effective swath widths of 800 feet have been obtained in the application of mosquito larvicides. The dosage rate per acre does not exceed .3 pound of DDT or .1 pound of lindane.

*Frequency of Application of Control Measures.* Surface waters that contain mosquito breeding receive an application of mosquito larvicide at intervals of 7 to 21 days as determined by records of mosquito traps and larval dips. Control of mosquito adults in living quarters and other permanent buildings is accomplished with residual sprays applied for household pests. The residual spray is usually 5% DDT in kerosene applied at intervals of 30 to 60 days during warm weather with a dosage rate of about one quart of the spray to 250 square feet of the inside surfaces covered. Adult mosquitoes in training and recreational areas are controlled with fog sprays applied at intervals of 7 to 14 days and mist sprays applied every 14 to 21 days as determined by mosquito densities, during the breeding season.

*Coordination with Other Government Departments.* Coordination is maintained with other departments of the Government, especially the United States Department of Agriculture, Bureau of Entomology and Plant Quarantine, and the United States Public Health Service (for results of research on mosquito control). This cooperation includes exchange of information, and joint participation in the development of equipment and field operations for mosquito control.