

August 1, 1944

FEDERAL SECURITY AGENCY
U. S. PUBLIC HEALTH SERVICE
U. S. MALARIA CONTROL IN WAR AREAS
605 VOLUNTEER BUILDING
ATLANTA, GEORGIA

RESTRICTED

BRIEF DIGEST OF INFORMATION ON DDT

Although an enormous amount of laboratory work has been done on the use of DDT as an insecticide the final recommendations for its field use against mosquitoes and other insects of military importance have yet to be written. We include below the best information available to us at the present moment.

GENERAL:

DDT is known chemically as dichloro-diphenyl-trichlorethane. The supplies we have on hand are of the micronized pure drug. In this form it is primarily designed for mixing with talc, pyrophyllite, or other diluent for use as a dust. It can also be used as a spray when dissolved in a liquid. Later we may have available a form, known as "powdered dissolving," designed primarily for preparing sprays. This form consists of much larger crystals and is slightly moist.

The toxicity of this product to human beings is relatively slight. It is harmless to handle in the powdered form but in solution, particularly in oily diluents, it may be absorbed through the skin, consequently care should be taken to avoid gross soiling. Absorption through the respiratory tract is apparently harmless but as a safety measure men who are working with it and subjected to inhalation of fogs or mists of the material should doubtless wear respirators or moistened gauze strips. Based on experimentation with dogs a toxic dose when it is administered by mouth ranges between .1 and .2 grams per kilo of body weight. This is many times the amount that could possibly be ingested under ordinary circumstances in sprayed or dusted food or drink and would only become of importance in case of accidental ingestion through gross errors in food preparation or similar accidents.

DDT is apparently a true contact insecticide (perhaps the only one now in use). There is some evidence that it is absorbed by insects through the sensory pores. It apparently has no repellent action whatever. After an insect has rested on the material for a few moments it develops a high degree of irritability and makes every effort to leave the immediate vicinity. After this stage is reached a paresis of the limbs develops first and this is followed by a complete paresis including wings after which death ensues. Due to the first effects of excitability in which the insect attempts to get away from it all, only a small percentage of the insects actually killed are found in the immediate vicinity providing means of escape are available. In treating barns for house flies it is common experience to find more dead flies twenty-five to thirty yards from the barn than in the structure itself. In houses treated for mosquitoes where the windows are open the greatest accumulation of dead insects often occurs in the vicinity of the open windows toward which the doomed insects were making efforts to escape.

DDT is insoluble in water. The following table indicates its range of solubilities at normal temperatures with some of the common solvents:

Communicable Disease Center
Library

50 Seventh Street, N. E.
Atlanta 5, Georgia

| | |
|---------------------|-----------------------------|
| Cyclohexanone | 100 to 120 gms. per 100 cc. |
| Xylene | 56 gms. per 100 cc. |
| Ether | 29 gms. per 100 cc. |
| Fuel Oil #2 | 10 gms. per 100 cc. |
| Kerosene (Crude) | 5 to 8 gms. per 100 cc. |
| Kerosene (Purified) | 2 to 4 gms. per 100 cc. |
| Ethyl alcohol | 1.5 gms. per 100 cc. |

INTERIOR RESIDUAL SPRAYING:

DDT dissolved in purified kerosene at one to two per cent concentration makes a very adequate space spray comparable to the better commercial fly sprays. However, a single application has little lasting effect and for this reason it is recommended that it be applied to the walls in sufficient concentration to remain of lasting benefit over a period of weeks and possibly months.

Kerosene spraying: DDT may be dissolved in kerosene up to seven or eight grams per 100 cc. However, a five per cent solution (for practical purposes two pounds to five gallons) makes a very convenient mixture for use with hand sprayers. In order to apply 200 milligrams per square foot, which is considered an adequate residual application, the spraying of this material should be so regulated that approximately 4 cc are applied per square foot. This can easily be done on rough wood, papered surfaces and composition boards, but on painted surfaces considerable run-off and streaking will follow.

Water emulsions: A very satisfactory emulsion can be made by dissolving DDT three pounds, in Triton X-100 six ounces, and Xylol three quarts. This makes approximately one gallon of concentrate and when diluted with three gallons of water the concentration of DDT is such that 2 cc of the emulsion per square foot will deposit an approximation of the required 200 milligrams. If power sprayers are utilized it is probably advisable to add six gallons of water instead of three and figure on depositing 4 cc of the emulsion per square foot instead of 2. There is some intimation that the water emulsion produces a more effective deposit of chemical than the pure oil sprays. Varnished surfaces on highly polished furniture should be covered during the spraying operations as some spotting may result.

Spraying suggestions: The ordinary cylindrical sprayer of three-gallon capacity provides a very effective method of application, if care is taken to select one on which the cover can be screwed down tightly and preferably with tight fitting rubber gaskets and tightening lugs which fit under the rim of the tank. Two or three feet of additional hose length is a decided aid. A stick which can be easily attached to the spray wand to lift the nozzle to high places in the room is a helpful accessory. The ordinary circular disc nozzle with an aperture in the center is satisfactory for general spraying. Care should be taken to select an aperture that will produce a medium spray as both coarse sprays and atomized sprays are very wasteful of the material. With the nozzle properly adjusted a spraying distance of six to eight inches from the surface to be treated gives excellent results and keeps the spray well under control.

LARVICIDAL USE:

DDT as a dust appears to have no more beneficial effect than Paris green and with a price differential at the present moment of well over \$1.00 per pound it would seem inadvisable to even conduct experiments for its utilization as a dust larvicide. As a spray its chief value is that it may be applied in extremely small quantities and yet be as effective as the application of fuel oil. A five per cent dilution in kerosene or diesel oil forms an effective material for use. The ideal treatment recommended for this dilution is one to two quarts per acre as contrasted with the eighteen to twenty gallons per acre of fuel oil dispersal. This will give some idea as to the minute quantity that should be used. However, DDT has no magic power of spreading itself over water surfaces and in dispersing this small amount of material great care must be taken to see that it is introduced onto the entire surface particularly where there are rafts and booms of floatage that will cut its access to sheltered areas where breeding may be intense. In dispersing the five per cent kerosene mixture a suggested method is to apply the material from the windward side and allow it to be drifted over the breeding area. In order to increase the coverage and cut down the care that must be used in the application of the minute amounts when kerosene is used alone as a carrier considerable work has been done with emulsions. If a quick breaking emulsion such as that produced by standard mixtures of B-1956 is used it is possible to apply the material on the acre basis figuring at the rate of about one-tenth of a pound of DDT per acre. If, however, a tight emulsion is produced with an emulsifier such as Triton X-100, it is advisable to figure the dosage roughly on a volumetric basis so that the DDT will not exceed one part in ten million. Concentrations in excess of this will most certainly be detrimental to fish and we are always subject to claims from the possibility of injuring domesticated animals. Trials involving the addition of DDT to irrigation water at its source have not been particularly successful.

Should we experience difficulty in obtaining oil for larvicidal purposes it is probable that we might be able to turn to the application of DDT as an oil saving substitute. It has great possibilities along this line for an intelligent operator, but with our present labor set-up there is no anticipation that its application could be placed in the hands of our present crews with any saving either of manpower or materials. One intriguing approach to its use along these lines might be the development of a method of application that could be used by inspectors to treat the small breeding areas they discover in the course of their rounds thus obviating a visit by an operations crew. A primary requisite would be its freedom from weight and bulkiness.

Although this material is supplied strictly for your use in malaria mosquito control, the following is included for your general information.

OTHER INSECTS:

House and stable flies: Apply exactly as for residual spraying for mosquitoes. In addition, the spraying of resting places such as the outer portion of manure piles, the walls behind them, and the other most obvious resting places in the stables where flies congregate will destroy numerous flies before they

leave the breeding grounds for other areas. For household control give particular emphasis to screens, door and window frames and the edges of pillars, shelves and other areas which fly "specks" indicate as habitual resting places of flies.

Fleas: A ten per cent dust in talc or pyrophyllite rubbed into the fur of pets constitutes a very satisfactory primary source of control. Five per cent kerosene spray applied to floors, chicken houses and yards, dog kennels, and stable floors is extremely effective.

Roaches: All the household roaches except the German roaches are easily controlled. A ten per cent dust applied along the areas generally traversed by roaches or a five per cent kerosene spray heavily applied is the most effective method of control. Twenty-five per cent dust and repeated applications of the five per cent kerosene spray will eventually make some inroads on the German roach.

Bed bugs: Five per cent kerosene spray is remarkably effective against bed bugs. Mattresses, pillows, springs, and bed frames should be lightly sprayed so that the surface is just slightly moistened. If the beds are placed upright against the wall the spraying of this furniture incidentally treats the wall behind the bed. A cursory spraying along the baseboards facilitates the control, but even though no other part of the room is treated the bugs in nocturnal search for food will come in contact with sufficient poison on the bed and mattress to kill them eventually. The advantage of this treatment as contrasted with fumigation is that re-infestations are eliminated over a period of several weeks or even months, whereas fumigation kills only those bugs which happen to be present at the moment.

Body lice: Application of a ten per cent dust in talc applied to the inside of the clothing at the rate of about $1\frac{1}{2}$ ounces per individual is adequate control for all body lice.