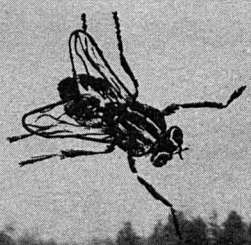
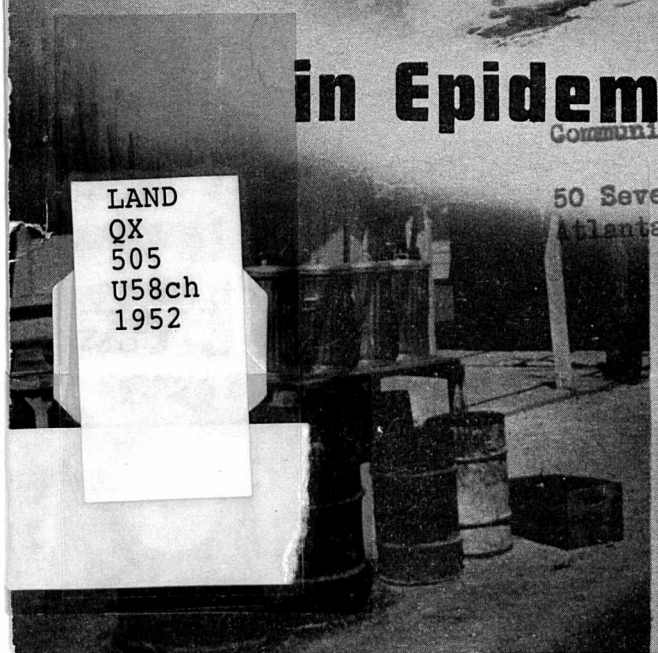
HEALTH and SANITATION

FLY CONTROL



in Epidemics and Disasters



FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA

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HEALTH AND SANITATION

FLY CONTROL
IN EPIDEMICS OR DISASTERS
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I. CONDITIONS WARRANTING FLY CONTROL OPERATIONS

The need for fly control activities during or following a disaster or epidemic hinges on several factors. The most important of these are:

1. Type of epidemic or disaster
2. Season of the year (climate)
3. Geographic location
4. Availability of manpower not required for more urgent health activities

Although flies are suspect in the transmission of several diseases, it is only in the transmission of diarrheal diseases that fly control has been demonstrated to actually reduce disease incidence. (Watt & Lindsay, Public Health Reports, 63:1319-1334, 1948). Emergency fly control programs are warranted then as a health measure when potential transmission of diarrheal diseases by flies becomes a serious threat. This could occur where adult flies can develop in large numbers, and fecal material or other possible sources of contamination are available to the flies.

A second condition wherein fly control operations is justified is when the disaster leaves in its wake such volume of organic matter that flies can develop in extreme quantities and, by their sheer numbers, disrupt the normal and rehabilitation activities of the community.

Both the climate and season of the year should be considered in evaluating the fly breeding potential. Unless breeding conditions are especially favorable, adult fly populations will not increase rapidly when temperatures do not rise above 60° to 70° F. The geographic location also may affect the evaluation. The potential danger of the disaster or epidemic may have passed

before fly development assumes significant proportions. This latter factor must also be considered in certain parts of the country, particularly cattle raising areas, because flies causing myiasis may be a potential hazard.

In most disasters, the immediate and urgent health needs of a community are the provision of safe water, food, and milk, and the bulk of the available man-power should rightfully be concentrated on these activities during the early stages of the disaster and rehabilitation period. Since time is a factor in the development of large fly populations, it should be put to advantageous use in the planning of an orderly, effective approach to the latent fly control problem. Surveys should be made to locate the major potential breeding sites, the selection and operation of dumping grounds should be guided, inspectors should be on the watch for the first signs of large-scale fly development, maps should be prepared, equipment and materials stockpiled, and initial crew men trained. Such preparation, if started at once, can be made by a relatively small group of men and the costly, and sometimes flustrating, attempts to control flies after they are on the wing will be averted.

The summary of conditions under which fly control would be required:

1. During an epidemic of diarrheal disease in an area which has a large fly population or where seasonal breeding will soon begin.
2. Following a disaster which occurs during or just before the fly breeding season and which has disrupted the sanitary facilities for disposal of fecal matter and organic wastes.
3. Under particular conditions related to myiasis or other diseases where transmission by flies is possible.

II. FLY CONTROL BY SANITATION

Because the health menace from flies results from the lack or failure of sanitation facilities, the augmentation or restoration of these facilities

is of primary importance. To this end, vehicles and manpower should be made available at the earliest opportunity for the sanitary storage, collection, and disposal of human excrement and organic wastes which may be present or may have accumulated as the result of the disaster. In cases where the season and temperature indicate the need for action, a quick reconnaissance survey should be made to determine the extent and nature of fly-feeding and fly-breeding factors within and adjacent to the disaster area.

If on-premises storage of garbage, pending collection, and its disposal are defective, immediate steps should be taken to improve these conditions. Action by citizens in covering garbage containers, burial of garbage on the premises, or applying commercial insecticides weekly may be effected through press and radio appeals, distribution of leaflets, or by the inspection of the premises. Collection and disposal practices might be improved by appealing to the municipal department or private collectors responsible. Collections should be at least weekly, and preferably twice-weekly. Existing dumps within fly range of the populated area should be converted to sanitary landfills, covered and abandoned in favor of sanitary landfill operations in a different area, or covered and abandoned in favor of a dumping area well beyond the normal flight range of flies. When it is impracticable to convert a dump to a sanitary landfill or to abandon and cover it, insecticides should be applied to control fly breeding.

Fly-feeding and fly-breeding wastes which accumulate or become exposed as a result of a disaster should be collected and disposed of in a sanitary manner. If incineration or sanitary landfill disposal cannot be effected, these wastes should be dumped at least five miles from the populated area.

If domestic animals (horses, cows, pigs, and other animals) are present in the disaster area, frequent inspection of the animal yards and shelters is

warranted to assure sanitary conditions. Prodigious numbers of flies may breed in animal excrement and stock feeds which have been soaked by flood-water or rain. Animal excrement should be placed in flyproof bins, spread thinly over the ground, or buried under from 12 to 24 inches of earth. Stock feed should be dried for subsequent use or buried. Proper disposal of manure and waste feeds should be effected at least once, and preferably twice a week. Food-packing houses, grain elevators, abattoirs, and stock yards, may have stocks on hand or accumulated wastes which have been neglected or partially destroyed during the disaster period. Such materials provide ideal breeding material for flies and must be disposed of at once. Disposal by burial, that is, sanitary landfill, is recommended.

For the control of diarrheal diseases, the prevention of contact of human excrement and human food by flies is of primary importance. Human excrement in privies should be in flyproof pits to prevent contact by flies as well as to prevent breeding. Leakage to the surface of the ground from septic tanks and sewers which have been broken during a disaster should be eliminated or treated chemically until lasting correction can be effected. In cases where temporary fecal disposal must be provided, all latrines should be made flyproof. Temporary as well as permanent food-handling establishments should be adequately screened.

Despite the efficacy of improvised methods to restore sanitation facilities, it is probable that the use of chemicals will be required to (a) supplement the sanitation effort, or (b) abate fly populations until adequate sanitation is restored.

III. FLY CONTROL BY CHEMICAL TREATMENT

Depending on the nature of the disaster and the availability of equipment and materials, it may be best to apply chemicals by hand equipment,

by ground-operated power equipment, or by airplanes.

(A) Hand Equipment Plan:

Many types of disaster involve major disruptions in transportation facilities, i.e., roads blocked by floodwaters, fallen trees, and other obstructions. Under such conditions, men on foot would be far more effective than stalled or mired mechanized units.

The basic unit then becomes the one-man area in which one man equipped with a hand-pumped compressed air sprayer and a supply of insecticides would be responsible for conducting inspections and spraying in his designated area. Depending on the terrain, degree of congestion, and accessibility of properties, one man could take care of approximately 25 city blocks. His duties would be to scout his area and locate all significant breeding areas, recommend appropriate sanitation measures, apply larvicides to active breeding materials, and apply residual treatment to favored fly resting surfaces. Equipment, supplies, and supervision should be provided from a headquarters unit.

The following estimates are based on a city unit of 10,000 population.

Assumptions and pertinent data:

Basic insecticide to be 5 per cent DDT in fuel oil (approximately 40 lb. DDT per 100 gal. fuel oil).

One man can inspect and apply residual spray or larvicide to attractants and adjacent surfaces at the rate of from one to two blocks per man-day.

A complete round of a designated 25-block area would be made one or two times per month, allowing for weekly or even daily treatment of special problem areas.

Assuming 100 persons per block, there would be $\frac{10,000}{100 \times 25}$ or four one-man areas in a city unit of 10,000 population.

Materials consumption would be approximately 20 gals. of insecticide per block per application.

Equipment: (Assuming four one-man areas per 10,000 population)

10 - Compressed air spray cans (4 gal.).

Miscellaneous spare parts, wrenches, pliers, and other tools.

1 - Truck for transportation of materials, and supervisory personnel.

Personnel:

4 - Sprayer-inspectors

1 - Supervisor

Materials:

20 gal. of basic insecticide per block per application on a once-a-month application requires:

20 x 25 = 500 gal. per one-man area per month

4 x 500 = 2,000 gal. per 10,000 population per month

2,000 gal. of 5 per cent DDT in fuel oil requires 2,000 gal. fuel oil and 800 lb. DDT (per 10,000 population per month).

(Under conditions where the application of larvicides is the predominant chemical control measure, or in areas where flies have become resistant to DDT, a $2\frac{1}{2}$ per cent chlordane emulsion is recommended instead of DDT).

(B) Power Equipment Plan:

Today, many communities possess power-driven space-spray equipment for tree spraying programs. Should such equipment be available in the area under consideration or in one of the nearby communities, and should the streets of the city be free from obstructions, the use of space-spray machines would be feasible.

Assumptions and pertinent data:

Basic insecticide to be 5 per cent DDT in fuel oil.

Application rate: 1 gal. insecticide per acre per application.

Applications to be made once each week.

Space-spray machine can cover from 20 to 30 blocks per day.

Hand-pumped compressed air sprayers (4 gal.) to apply larvicides and to reach locations inaccessible to the space-spray machine.

Inspectors must guide spray operations and check their effectiveness by scouting the area and reporting estimated fly densities on a block-by-block basis.

Inspectors should also locate sites of major fly breeding in order that larvicidal application may be made before the flies are on the wing.

Equipment:

1 - Space-spray machine

1 - Truck (1½ ton stake)

1 - Truck (pick-up) for inspector

4 - Compressed air-spray cans (4 gal.)

Miscellaneous small tools

Personnel:

1 - Space-spray operator

1 - Truck driver

1 - Supervisor-inspector

Materials:

On the basis of 4 acres per block, an application rate of 1 gal. per acre, and a coverage of 30 blocks per day, the space-spray machine would require 120 gal. per day, or 600 gal. per 5-day week.

(C) Airplane Spray:

Unless immediate reduction of existing fly population is necessary, as in the case of a fly-borne dysentary and diarrhea outbreak, the use of

airplanes is not recommended because of the hazards involved in low flying over populated areas. Should the fly populations increase at an accelerated rate, however, airplane applications of chemicals afford a means for rapid control. This method must be supplemented by ground crews to treat problem areas, gaps in the airplane application, and focal breeding centers.

With crop dusting so well-established throughout the country, there should be little difficulty in making contact with one of the commercial companies to secure aerial equipment.

Assumptions and pertinent data:

A small airplane, commonly used by crop dusters, can treat as much as 1,200 acres (approximately 2 sq. miles) per day. In addition to weather conditions, pilot fatigue and equipment maintenance are controlling factors in airplane operations so that, at the above rate, applications should be scheduled for only 3 days per week for any given pilot or airplane.

A city unit of 10,000 population will range from 1 to 4 sq. miles in area depending on the degree of congestion.

Application rate: 0.4 lb. DDT per acre.

Recommended formulation: 30 per cent DDT in Velsicol (AR-60), (1/6 gal./acre).

Alternate formulation: 5 per cent DDT in fuel oil (1 gal./acre).

Frequency of applications: once a week.

Equipment:

Airplane and spraying equipment to be supplied by crop-dusting contractor

1 - Pick-up truck

2 - Compressed air-spray cans (4 gal.)

Personnel:

1 - Pilot (by contractor)

1 - Insector-sprayer

1 - Supervisor

Materials:

(a) One square mile at 0.4 lb. DDT per acre or 0.16 gal. 30 per cent concentrate per acre requires approximately 100 gal. 30 per cent DDT in Velsicol (AR-60) per application.

(b) If 5 per cent DDT in fuel oil is used, the application rate is 1 gal. per acre or 640 gal. per square mile.

From the foregoing lists, it can be seen that, with the exception of the quantity of DDT required (and the possible use of Velsicol), all essential equipment and supplies are normally available in the community. It would behoove a community to keep a thousand pounds of DDT on hand for emergency use; but of even more importance would be a community survey of its present sanitation practices with regard to refuse, animal shelters, privies, and putrescible industrial wastes. Without doubt, many improvements could be made now which would avent potentially dangerous situations from developing in the event of a disaster.

IV. PRECAUTIONS

It must be continually borne in mind that the chemicals used in killing flies can also kill man and other forms of animal life. They can kill by ingestion, inhalation, and skin contact.

Do's and Don'ts in chemical handling:

(Ingestion)

1. Don't spray in areas where chemicals may fall on food, utensils, or surfaces for preparing foods for human consumption.

2. Don't spray hay, grains, or other animal feeds.

3. Don't feed animals with grains or other materials that may have been treated with larvicides.

4. Don't permit animals to graze or forage in areas freshly treated with chemicals.

(Inhalation)

5. Do require good ventilation at chemical mixing plants. (Mix out of doors if possible.)

6. Do require mixing plant operators to wear respirator masks.

7. Do train spray men to avoid rebound of spray. (Spray down wind whenever possible.)

(Contact)

8. Do require spray operators to wear protective clothing (coveralls, broad-brimmed hats, rubber gloves).

9. Do require all spray men and mixing plant operators to bathe daily and launder protective clothing weekly.

10. Do require all operators to report for weekly health examination with special regard to dermatitis, unusual signs of nervousness, or weight loss in excess of 10% resulting from loss of appetite.

11. Do require immediate and thorough washing with soap and water in all cases where chemicals are accidentally spilled on the body, especially if chemicals are in the form of concentrated solutions.

V. ALTERNATE CHEMICALS AND FORMULATIONS

The list of chemicals and formulations is given in the event that DDT is not immediately available or that flies have developed sufficient resistance to DDT to materially reduce its effectiveness.

Benzine hexachloride (BHC) (See also Lindane)

Usually available as water-wettable powder, dust, or technical grade (12% gamma isomer). Use as 1% (BHC) dust for larvicide in privies, on garbage heaps, manure, or industrial wastes. Use as 3% (BHC) suspension (water-wettable powder) for either larvicide or residual sprays. Note: Has objectionable odor; highly toxic, do not use near animal shelters -- for outdoor use only. Imparts bad taste to eggs and meat of fowl even in minute quantities -- do not use as space spray except at dump areas.

Chlordane

Usually available as wettable powder, emulsion concentrate, or oil solution concentrate.

In any of its three forms, reduce to 2% or 2½% chlordane in finished spray and apply as a larvicide or residual spray.

Note: More toxic than DDT -- for outdoor use only.

Lindane (99% pure BHC)

Usually available as water-wettable powder, oil solution, or emulsifiable concentrate.

In any of the above three forms, reduce to 0.625% lindane and apply as a residual spray.

Note: Lindane is one of the few chemicals which are acceptable as residual sprays in dairy barns. It is too expensive to be considered for general usage on a fly control program.

Methoxychlor

Usually available as a (50%) water-wettable powder.

Reduce to 5% methoxychlor in finished spray and apply as residual.

Note: Usually not as effective as other chemicals listed, but can be used in dairy barns.

Pyrethrum

Usually available in an oil solution to be diluted "1 to 20" with deodorized kerosene to obtain finished spray containing 0.1% pyrethrins.

Use as interior space spray.

Note: Too expensive to be considered for general city-wide operations for larvicidal or exterior space sprays. Acceptable for use in dairy barns.

VI. REFERENCES TO KEEP ON HAND

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