Insect and Rodent Control In Epidemics and Disasters

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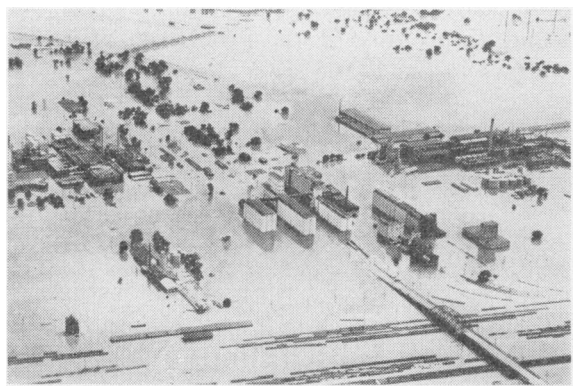
VECTOR-BORNE diseases are an added hazard to humans when, in the wake of floods, storms, earthquakes, fires, and wartime destruction, insects and rodents increase in number. The public health officer should, immediately after a disaster, or when an outbreak is or may be imminent, evaluate potential hazards from insects and rodents and prepare a plan for controlling them. The danger of disease may not be confined to areas in which there has been a history of malaria, typhus, plague, dengue, or yellow fever. Fly-borne diarrheal diseases, mosquito-borne virus encephalitis, and such rodent-borne diseases as leptospirosis (Weil's disease), rickettsialpox, and lymphocytic choriomeningitis may also occur.



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Disasters often disrupt normal sanitation and public utility services and result in temporary relocation of displaced persons. Evacuation of personnel to save lives, application of first aid and medical care, and provision of shelter, safe water, and food are of first importance. Rehabilitation is next in importance to restore normal life to the community. Concerted efforts are required to remove debris and repair buildings and utilities, and to prevent the development of pests, the insects and rodents which carry diseases and seriously affect community activity.

Flies, mosquitoes, and rats, present in most parts of the United States, are hosts and carriers of many diseases in aftermaths of disasters. Especially as flood waters recede, these insects and rodents may multiply in unprecedented numbers.

A number of vector-borne diseases may occur in epidemic proportions, particularly after a build-up of the vector populations following a disaster (see table).

The potential build-up of the insect and

Collapsed building and debris resulting from floodwater.

Disposal of flood damaged meat.

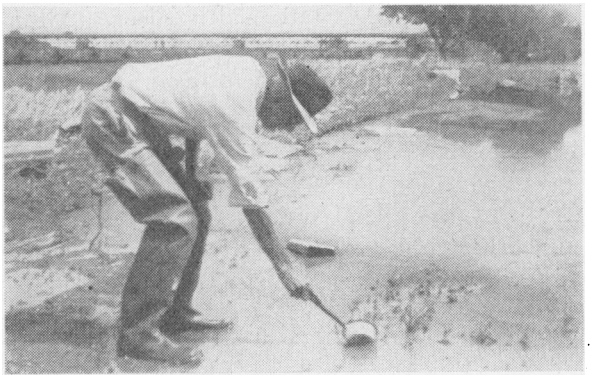
rodent vectors depends upon a number of factors: the type and magnitude of the disaster; its geographic location; the season of the year; and existing control measures or the timing of emergency measures for combating the pests.

Fires, floods, and other disasters may temporarily reduce rather than increase the numbers of vectors and pests by killing them or destroying their breeding and harborage areas. However, disasters generally increase the breeding potentials by creating larger breeding and harborage areas. Midwest floods in the summer of 1951 and in the spring of 1952 created extensive water areas suitable for mosquito breeding and left volumes of organic matter in which flies and rats could develop in large numbers.

The geographic location of the disaster area is, of course, a factor determining the danger from specific vector-borne diseases. Malaria, typhus, dengue, and yellow fever would not be expected to develop to epidemic proportions in northern sections of the United States. This may be due to a lack of host or vector, to the absence of infection among inhabitants, or to other conditions which prevent these diseases from spreading. *Anopheles* mosquitoes, *X. cheopis* fleas, and rats all exist in these sections of the country, but their presence would not be expected to result in an epidemic threat of the tropical or semitropical diseases. In southern areas, however, malaria and typhus would be real threats. If a source of infection were introduced, plague, yellow fever, and dengue could break out. Pestiferous insects and rodents may develop in large numbers following a disaster in almost any part of the United States.

The season of the year greatly affects the ex-

Entomologist surveying residual floodwater for mosquito production.



Space spraying of insecticides for fly control.

tent to which vectors and pests develop. Certain fly and mosquito species have short breeding seasons, particularly in the North where normally they do not develop intensively. However, myriads of insects may develop following a disaster during the breeding season, no matter how short it may be.

Whether insect or rodent control measures are warranted, following disasters or during epidemics, depends upon the factors discussed. The period of development may be from 7 to 10 days in the case of mosquitoes and flies. It is therefore essential that entomological surveys and plans should be made as soon as possible after a disaster in order to have personnel, equipment, and materials available as the problem develops.

In a public health insect or rodent control emergency program following a disaster, whether it be to control an epidemic or to prevent disease and discomfort, the State health officer or his designated representative functions as coordinator of all health activities within the State. If the assistance of the Public Health Service is desired, it should be requested of the appropriate Public Health Service regional office by the State health officer. All insect and rodent control measures should be coordinated to secure efficient program supervision. Chemical control measures may vary for each insect or rodent group. Control by sanitation is equally as important as chemical control and may effectively and simultaneously reduce the number of types of vectors. The entire activity should be supervised by a single individual competent in this field of work.

Three brochures have recently been issued by the Communicable Disease Center of the Public Health Service on fly, mosquito, and rodent control in epidemics and disasters (*1–3*). They deal in some detail with the various recommended control measures which in this article are considered only in a general way.

Fly Control

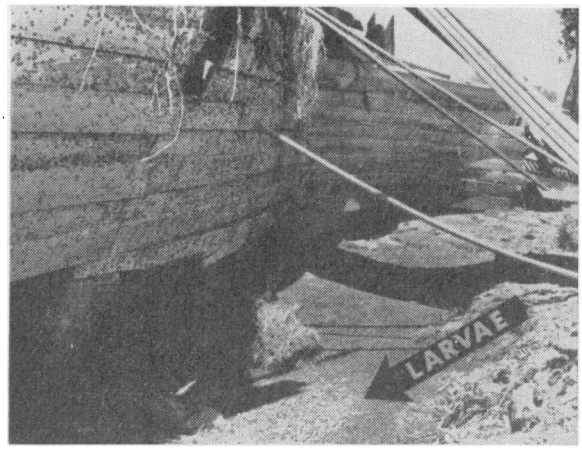
Required conditions for fly control may be summarized as: (*a*) during an epidemic of diarrheal disease in an area which has a large fly population or where seasonal breeding will soon begin; (*b*) following a disaster which occurs during or just at the beginning of the fly-breeding season and which has disrupted the sanitation facilities for disposal of fecal matter and other organic wastes; and (*c*) under particular conditions related to diseases where transmission by flies is possible.

The health menace and discomfort from flies result from lack or failure of sanitation facilities; therefore, augmentation of these facilities is of primary importance. Vehicles and manpower should be made available at the earliest opportunity for sanitary storage, collection, and disposal of accumulated human excrement and other organic wastes resulting from a disaster. For the control of diarrheal diseases, flies should be excluded from excreta and from human food, which indicates the need for fly-proof disposal pits and for screening of temporary and per-

Disease	*Source of infection*	*Vector*
Malaria	Man	*Anopheles quadrimaculatus.* *Anopheles freeborni* *Anopheles albimanus.*
Dengue	Man	*Aedes aegypti.*
Yellow fever	Man	*A. aegypti.*
Virus encephalitis	Bird, possibly horse	*Culex tarsalis* and other mosquitoes.
Diarrhea and dysentery	Man	Domestic flies and rats.[1]
Murine typhus fever	Rats	*Xenopsylla cheopis* (fleas).
Plague	Rodents, man	*X. cheopis* and other fleas.[2]
Lymphocytic choriomeningitis	House mouse	Possibly arthropods occasionally.[1]
Rickettsialpox	House mouse	*Allodermanyssus sanguineus* (mite).
Leptospirosis	Rats, less often dogs	([3]).

[1] Transmission also through contaminated food or dust. [2] Also transmissible from man to man. [3] Transmitted through the skin, or water contaminated with rat urine or feces.

Adult and larval stage flies produced from animals drowned by flood.



Mixing poison bait for rodent control

manent food-handling establishments. 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.

Mosquito Control

In mosquito-borne disease transmission, initial control measures should be directed against adult mosquitoes as the quickest means of intercepting the course of the epidemic. Residual spraying with a DDT formulation on interior surfaces of occupied dwellings, and sometimes of outbuildings, will effectively destroy the house-frequenting species of recognized disease vectors. Space spray measures may be indicated in certain instances. Larviciding may be necessary to prevent the development of further broods following a disaster.

The current epidemic of mosquito-borne encephalitis in the Central Valley of California furnishes a striking example of the importance of emergency mosquito control measures.

Rodent Control

In the event of a rodent-borne disease transmitted by arthropods, control of the fleas or mites is of first importance. DDT dust applied to rat runs and harborages will effectively reduce the ectoparasites. Rat poisoning is applied to control the rats after the DDT has had an opportunity to kill the ectoparasites. With warfarin, the poison and DDT may be applied concurrently. In the case of diseases transmitted from rat to man without vectors, rat poisoning is instituted immediately without previous insecticide application. If rodents already heavily infest the area, it is important that a relatively quick-acting poison be used before attempting to clean up and restore sanitation. If rats have migrated or concentrated in the disaster area, it may be necessary to move the people to a rat-free area. Finally, the removal of rubbish and debris, and the proper storage and disposal of garbage will deprive remaining rats of food and shelter.

REFERENCES

(*1*) Health and sanitation. Fly control in epidemics or disasters. Revised January 1952. Atlanta, Ga., Communicable Disease Center, 12 pp. Mimeographed.

(*2*) Health and sanitation. Mosquito control in epidemics or disasters. Revised January 1952. Atlanta, Ga., Communicable Disease Center, 13 pp. Mimeographed.

(*3*) Health and sanitation. Rodent control in epidemics and disasters. Revised January 1952. Atlanta, Ga., Communicable Disease Center. 11 pp. Mimeographed.