

Part III

# Annexes

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## Annex 1

# Developing an Environmental Health Emergency Operations Plan

### Step 1: Identifying Organizational Resources

The first step in developing an environmental health emergency operations plan is to make an inventory of the organizations that will participate in the emergency activities and to assign members of these organizations to particular staffs and teams. Professionals, each working with an advisory committee, should be responsible for developing the plan and training the individuals who will participate in the relief effort. Contact should be made with civil defense, military, and other groups to learn about local contingency plans, to ask for help in planning for disaster, and to establish channels of liaison. The responsibilities of organizational staff members and teams and channels of command should be specified. In assigning individuals to the groups, alternates also should be designated. A list of names, addresses, and phone numbers should be made, including both regular and alternate members.

### Step 2: Vulnerability Analysis

Assessing vulnerability is the second step in developing the plan. To assess the vulnerability of areas that may be stricken by disaster, it is necessary first to identify and describe the components of entire environmental health service systems and then to chart the characteristics of those natural disasters that might occur (floods, earthquakes, windstorms, and so forth). The effects of each type of disaster on each component of services can then be estimated. (If 50 percent of the water treatment plants serving a particular area might be damaged when disaster strikes, for example, the result might be that safe water can be

provided to only 15 percent of the affected population.) After these estimates have been obtained, the service requirements and the capacities of services to meet these requirements should be estimated. This estimation reveals the balance between the capacity of a service affected by disaster and the minimum estimated need for it in the population. If the capacity exceeds the estimated need, there is a margin of safety, and priority placed on that service can be relaxed. But if requirements exceed the estimated capacity of the service, this indicates a need to improve the service. Finally, the critical components of services should be identified.

### **Step 3: Allocating Resources**

The third step is to specify priorities and establish the best program for using resources. Baseline environmental health levels should be determined. Needs and their priorities can then be established by allocating services under assumed postdisaster conditions, preparing guidelines for service allowances, rationing and deciding upon the timing of estimated needs, and selecting procedures for dealing with the conditions caused by disasters.

### **Step 4: Protecting Personnel**

The fourth step is to make provisions for protecting personnel. A plan should be developed to test personnel with exercises to familiarize them with emergency procedures. The program for providing shelter should guarantee shelter to essential personnel.

### **Step 5: Inventory of Supplies and Equipment**

In the fifth step, the equipment, supplies, and other materials necessary for the emergency are assessed. It is necessary to make inventories of those needs that will be essential for recovery, to plan to dispense them as necessary, and to provide security for them. Multiple copies should be made of the following records that will facilitate recovery:

1. maps and engineering plans
  2. lists of regular and auxiliary personnel
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3. lists of emergency supplies, including description of their availability and how to use them
4. inventories of items in stock
5. descriptions of emergency methods of operation and procedure

These records must be readily accessible to persons employed at all levels of environmental health services. Plans must be made for updating them and for keeping mutual aid parties informed of their contents and location.

### **Step 6: Coordination Agreements**

In the sixth step, mutual aid agreements and other cooperative arrangements are initiated. Agreements with related services and civil defense agencies encompass the exchange or assignment of personnel, equipment, and supplies of the various cooperating groups. The coordination of reconnaissance and assessment, taking inventories, standardizing, training, and so forth also are covered in the agreements. Responsibilities should be defined and assigned, and legal limitations of cooperation should be considered.

### **Step 7: Specifying Emergency Measures**

Once mutual aid agreements have been established, the seventh step follows: determining the actions to be taken during the emergency phase. The longer the period of warning, the greater the number of disaster readiness measures that can be accomplished. Disaster readiness measures include the following:

1. alerting and assigning personnel
2. undertaking abbreviated training
3. disseminating information to the public
4. increasing the protection of personnel
5. increasing the protection of structures and equipment
6. receiving emergency plans and procedures

The concerns of the warning period are personnel, plants and equipment, community action liaison, and public information. Con-

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cerns of the period of impact are public information and, as limited by conditions, operations.

### **Step 8: Specifying Recovery Measures**

The eighth step is to plan the postdisaster recovery. First, command must be assumed, and these actions must be taken:

1. activation of the disaster organization
2. mobilization of regular and auxiliary disaster relief staff members
3. the implementation of procedures for protecting personnel

Following this, the plan for maintaining or initiating liaison with members of relief services and mutual aid agencies should be developed. Procedures must be provided in time phases for the following:

1. reconnaissance
2. assessment of damage
3. determination of priorities
4. cleaning and decontaminating
5. initiating the operation of surviving facilities

The least of these measures consists of conserving water and food; isolating and repairing damaged facilities; monitoring environmental health factors, such as water supply; and advising the public.

### **Step 9: Improving Capabilities**

The final step is to improve the capabilities of services if deficiencies are indicated. This is accomplished by increasing stocks of materials and supplies, developing auxiliary power sources and providing supplies of fuel, acquiring additional repair equipment, and recruiting and training personnel—volunteers, retired individuals, and other similar workers. The emergency plan must be improved and updated as a result of new additions. Finally, private benefactors who can augment local capabilities during emergencies should be identified, and a list of local consultants who can be called upon in emergencies should be compiled. All of these measures should be repeated at least once a year.

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Annex 2

## **Guidelines for the Use of Tablet, Powder, and Liquid Disinfectants in Emergency Situations**

Providing tablet, powder, or liquid disinfectants to individual users should be considered only when distribution can be coupled with:

1. a strong health education campaign in which people are instructed about how to use them
2. the distribution of containers for water storage
3. the assistance of public health or auxiliary personnel in providing the follow-up needed to ensure proper and continued use of the tablets
4. a network for distribution of additional supplies needed throughout the emergency phase and into the rehabilitation phase

In general, these disinfectants should be considered during an emergency for disinfecting small quantities of drinking water in limited and controlled populations, on an individual basis, and only for the limited time period of one to two weeks. Every effort should be made to restore normal chlorination facilities and to guarantee that water sources are protected.

Whenever disinfection is considered during an emergency, careful attention must be given to the initial condition of the water. Turbidity and color should be reduced as much as possible by allowing the water

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Adapted from "The Pan American Health Organization Interoffice Memorandum: Provisional Guidelines on the Use of Water Disinfection Tablets following Natural Disasters" (Washington, D.C., 1979).

to settle or by straining it through layers of cloth. Once disinfected, the water should be stored in clear, covered, and noncorrodible containers. Before any form of disinfectant is provided to individual users for emergency treatment, public health personnel must be sure that the available sources of water to be used are not and have not been chlorinated. The chlorine residual should be determined before any disinfectant is distributed to individual users.

The most common agents that can be used to disinfect small quantities of drinking water under emergency conditions are chlorine, iodine, and potassium permanganate. Detailed discussion of each follows.

### Chlorine Compounds

#### *Tablets*

The most common chlorine compound in use is known as Halazone tablets. Instructions for use of Halazone tablets are usually present on the bottle. If not, one tablet (4mg) should be used in each liter (approximately 1 quart) of water. If the water is turbid or highly colored the dosage should be doubled. The water should be stirred and left to stand for ten minutes before it is consumed.

Halazone tablets lose strength quickly once the wax seal on the bottle is broken. They should, therefore, be used as soon as possible, and the bottle should be capped between uses.

Higher strength tablets (160mg) are available in larger tablet size. Halazone (160mg) can be used to disinfect 40 liters of clear water or 20 liters of turbid or highly colored water. Care must be taken to not utilize Halazone (160mg) in the same tablet-to-water ratio as that prescribed for Halazone (4mg) tablets. Personnel involved in distribution should be aware of this precaution and should educate users.

#### *Granular Calcium Hypochlorite*

This dry powder, called HTH or Perchloron, contains 60 to 70 percent available chlorine. It remains quite stable when stored in tightly sealed containers in dark, dry, cool places. Once the container has been opened, it loses 5 percent of its initial available chlorine in forty days.

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Care must be taken not to contaminate the powder with oil or combustible organic materials when it is mixed, because to do so may cause fire. To use HTH, add and dissolve one heaping teaspoon (approximately 1/4 ounce or 7 grams) per 2 gallons (8 liters) of water, thus producing a stock solution of 500 milligrams/liter. Add the stock solution to the water to be disinfected in the proportion of 1 part solution to 100 parts water. Let this stand for thirty minutes. If the taste of chlorine is too strong, allow it to aerate by standing another few hours or by pouring it several times from one clean container to another. The stock solution should be used within two weeks after it is prepared.

### ***Sodium Hypochlorite Bleach or "Javel Water"***

Common household bleach contains a compound that can, in emergencies, be used to disinfect water. The content of available chlorine (usually 3 to 10 percent) should be determined. It should be added to the water according to the following table:

Available chlorine	Drops/liter of clear water	Drops/liter of turbid or colored water
1%	10	20
4-6%	2	4
7-10%	1	2

If the strength of available chlorine in the bleach is unknown, ten drops of bleach should be added. After mixing the treated water, allow it to stand for thirty minutes. There should be a slight odor of chlorine. If not, repeat the dosage and allow the water to stand for fifteen minutes.

## **Iodine**

### ***Tablets***

The most convenient and reliable iodine tablet forms are those that contain approximately 20 milligrams of tetraglycine hydroperiodine, 90 milligrams of disodium dihydrogen pyrophosphate, and 5 milligrams of talc. These tablets will dissolve in less than one minute at

about 20°C, liberating 8 milligrams of elemental iodine per tablet. This amount will be adequate to treat 1 liter of most natural waters within ten minutes.

### **Solutions**

Common household tincture of iodine from a medicine chest or first aid kit (2 percent tincture of iodine) can be used to disinfect water. Five drops of tincture of iodine will be sufficient to disinfect 1 liter of clear water. For turbid water, however, add ten drops. Let the water stand for at least thirty minutes.

### **Potassium Permanganate (KMnO<sub>4</sub>)**

Potassium permanganate is seldom used because of its long contact time. It is usually considered as a disinfectant for large quantities of water in wells, springs, or storage tanks. Potassium permanganate is of doubtful efficacy against pathogenic organisms, with the possible exception of *Vibrio cholerae*.

To use the chemical, prepare a solution by dissolving 40 milligrams of KMnO<sub>4</sub> in 1 liter of warm water. The solution will disinfect approximately 1 cubic meter of water after twenty-four hours of contact time.

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Annex 3

# **Technical Guide to Environmental Health Measures Taken in Response to Natural Disaster**

This annex consists of a summary of recommendations. These are to be carried out during evacuation and relief operations.

## **Evacuation**

During evacuation, water from suspicious sources must be boiled for one minute before it is cooled or it must be disinfected with chlorine, iodine, or potassium permanganate in either tablet, crystal, powder, or liquid form. The minimum amounts of water to be provided are:

- 3 liters/person/day in cold and temperate climates;
- 6 liters/person/day in hot climates.

Food must be nonperishable and should not require cooking.

Waste disposal should be in a shallow, all-purpose trench of the following dimensions:

- 10 centimeters deep x 45 centimeters wide x 3 meters long/1000 persons.

## **Relief Operations: Tent Camps**

During relief operations, sites for tent camps should be chosen where the slope of the land and the nature of the soil favor easy drainage and where there is protection from adverse weather. Sites must be away from mosquito breeding places, refuse dumps, and commercial and industrial zones. The layout of the site should meet the following specifications:

1. 3–4 hectares of land/1000 persons
2. roads of 10 meters width
3. minimum distance between edge of roads and tents of 2 meters
4. minimum distance between tents of 8 meters
5. minimum floor area/tent of 3 square meters

Water distribution in campsites should consist of:

1. minimum capacity of tanks of 200 liters
2. minimum capacity/capita of 15 liters/day
3. maximum distance of tanks from farthest tent of 100 meters

Solid waste disposal containers in tent camps should be waterproof, insect-proof, and rodent-proof; the waste should be covered tightly with a plastic or metallic lid. The final disposal should be by incineration or by burial. The capacities of solid waste units should be:

- 1 liter/4–8 tents; or
- 50–100 liters/25–50 persons.

Excreta and liquid waste should be disposed in bore-holed or deep trench latrines in tent camps. Specifications for these are:

- 30–50 meters from tents;
- 1 seat provided/10 persons.

Modified soakage pits should be used for waste water by replacing layers of earth and small pebbles with layers of straw, grass, or small twigs. The straw needs to be removed on a daily basis and burned.

Washing should take place with an ablution bench that is:

- 3 meters in length;
- double-sided;
- 2/100 persons.

### **Relief Operations: Buildings**

Buildings used to accommodate victims during relief should provide the following:

- minimum floor area of 3.5 square meters/person;
- minimum air space of 10 square meters/person;
- minimum air circulation of 30 cubic meters/person/hour.

There should be separate washing blocks for men and women.

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Washing facilities to be provided are:

- 1 hand basin/10 persons; or
- 1 wash bench of 4–5 meters/100 persons and 1 shower head/50 persons in temperate climates;
- 1 shower head/30 persons in hot climates.

Toilet accommodations in buildings housing displaced persons should meet these requirements:

- 1 seat/25 women; and
- 1 seat plus 1 urinal/35 men;
- maximum distance from building of 50 meters.

Refuse containers are to be plastic or metallic and have closed lids.

To be provided are:

- 1 container of 50–100 liters capacity/25–50 persons.

### **Relief Operations: Water Supply**

Daily consumption of water should be:

- 40–60 liters/person in field hospitals;
- 20–30 liters/person in mass feeding centers;
- 15–20 liters/person in temporary shelters and camps;
- 35 liters/person in washing installations.

Prescriptions for disinfecting water are:

- for routine chlorine residual, 0.7–1.0 milligrams/1;
- for disinfection of pipes, 50 milligrams/1 available chlorine for 24 hours contact; or 100 milligrams/1 for 1 hour contact;
- for disinfection of wells and springs, 50–100 milligrams/1 for 12 hours.

For elimination of high chlorine concentration in disinfected water, use:

- 0.88 grams sodium thiosulfate/1000 milligrams chlorine.

To protect water, the distance between the water source and sources of pollution must be at least 30 meters. Wells can be protected by keeping the bottoms of cesspools and latrines 1.5–3 meters above the water table and with:

- impervious casing 30 centimeters above and 3 meters below ground surface;
  - concrete platform around well of 1 meter radius;
  - fenced area of 50 meters radius.
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### **Relief Operations: Latrines**

Shallow trenches should be:

90–150 centimeters deep x 30 centimeters wide (or as narrow as can be dug) x 3–3.5 meters/100 persons.

Deep trenches should be:

1.8–2.4 meters deep x 75–90 centimeters wide x 3–3.5 meters/100 persons.

Bore-holed trenches should be:

5–6 meters deep;  
40 centimeters in diameter;  
1/20 persons.

### **Relief Operations: Refuse Disposal**

Trenches used for disposing refuse should be:

2 meters deep x 1.5 meters wide x 1 meter long/200 persons; covered with compact earth 40 centimeters deep. With these dimensions trenches can be filled in one week. The time to allow for decomposition of the refuse is four to six months.

### **Relief Operations: Food Sanitation**

Eating utensils are to be disinfected with:

boiling water for 5 minutes or chlorine solution 100 mg/l for 30 seconds;

quaternary ammonium compounds: 200 mg/l for 2 minutes.

### **Relief Operations: Stocks**

The following are important items of equipment and supply to be stockpiled for emergency environmental health:

1. Millipore sanitarian kits
  2. comparators for chlorine residual or pH test kits
  3. Hach DR/EL field test kits
  4. pocket-type flashlights and spare batteries
  5. water pressure gauges with positive and negative pressure
  6. rapid phosphatase determination kits
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7. mobile chlorinators and/or hypochlorinators
8. mobile water purification units of capacity of 200–250 liters/minute
9. tank trucks for water of 7 cubic meters capacity
10. easy-to-assemble portable storage tanks





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## Annex 4

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