CHAPTER TWENTY

PUBLIC HEALTH

THE ROLE OF PUBLIC HEALTH

20.01 In this Chapter the public health objectives of disaster management can be stated as follows (Foege, 1986)

a To prevent unnecessary morbidity, mortality and economic loss resulting directly from a disaster

b. To eliminate morbidity, mortality and economic loss directly attributable to mismanagement of disaster relief efforts.

INFORMATION

20 02 NATURE OF DISASTER

The first priority is to determine the nature of the disaster which will then indicate likely public health problems This will require immediate access to previously collected baseline data for the affected area, such as demographic and health characteristics

PRINCIPLE

Collection, collation, interpretation and dissemination of accurate, objective and timely data is mandatory to efficiently and effectively manage the public health response to the disaster and to mitigate the effect of future disasters.

20.03 IMMEDIATE ASSESSMENT

The next priority is immediate assessment which must include:

a. the geographical extent of the disaster,

b. climate conditions;

c. major public health problems;

d an estimate of the number of people affected;

e. what further information is needed immediately, and

f. the presence of continuing hazards.

20.04 DETAILED ASSESSMENT

This should then be followed by detailed assessment as the disaster unfolds, including:

a. the number of persons dead;

b. the estimated number of homes destroyed;

c. the condition and viability of essential services,

d the availability of shelter;

e the anticipated number of persons requiring evacuation or temporary shelter, and

f. the presence of continuing hazards

20.05 RELIEF PRIORITIES

The information from this assessment will then dictate relief priorities Public Health issues which may need to be addressed are·

a. provision of safe and adequate water;

b. shelter;

c. food and food related concerns;

d. provision of emergency ablution facilities,

e. sanitation;

f. refuse disposal collection,

g vermin and vector control;

h. infectious disease control;

i. personal hygiene;

j. disposal of dead stock and animals;

k. disinfection;

l. hazardous materials, and

m. siting and layout of emergency camp sites.

PRINCIPLE

The evaluation of public health disaster management is extremely important and must be an integral part of the procedure. Without such evaluation, it is impossible to learn from experience. Thus errors have often been duplicated in subsequent disasters.

MANAGEMENT

20.06 Usually, the management of public health problems in Australia is delegated to local environmental health officers.

WATER

20.07 This section on water deals with the aspect of **quality, supply, sources, treatment, storage** and **transport.**

20.08 QUALITY

a **Safety and Control** - Provision for a safe and adequate supply of water is essential. The bacteriological, chemical, and physical condition of water for human consumption should comply with established standards Consideration must be given to rationing and/or controlling the use of water.

b **Aesthetics** - It is essential to remember to ignore the quality of water in terms of aesthetics, colour or even turbidity, providing there are no detrimental effects to the consumer through any chemical, toxins or bacterial contamination.

c. **Testing** - In major natural disasters the ability to test water supplies especially for bacterial contamination is likely to be a long involved affair and should not be relied on in these situations

d. **Judgement Parameters** - It is necessary to attempt to make a value judgement on simple parameters, such as the source of the water, method of conveyance, removal of organic material, potential pollution sources, available methods of treatment.

e. **Bacteria** - If the population is accustomed to certain bacterial counts and physical conditions (sediment) in their water supply, providing the same conditions exist with replacement supplies to that found in the normal water supply this may be acceptable during an emergency for that particular community.

20.09 SUPPLY

a. **Water Must be Safe to Drink** - If possible it must also be pleasant to drink. It must also be readily available in adequate quantities. People can exist for days without food, but they cannot live for long without water, especially in Australian summer temperatures. The very young, the sick, and the very old are most at risk.

b. **Minimum Requirements for all Purposes** - The minimum quantities of water for all purposes per person per day are as follows:

CATEGORY	LITRES
Person	20
Feeding units per person	30
Medical unit per casualty	60

c. **Drinking Allowance** - Remember the drinking water part of this allowance (4 litres) must be increased in hot conditions or where heavy work is being done. To conserve available potable water for drinking and food preparation, other sources of water should be used, where risk to health is least likely.

PRINCIPLE

Water must be safe to drink, and readily available in adequate quantities.

20.10 SOURCES

It may be necessary to find new sources of water and arrange for emergency sterilisation and distribution. In an emergency situation, all water for drinking or food preparation should be considered to be contaminated and to require purification. It is unlikely that laboratory services will be useful or even available.

a. **Water Authority Reticulations** - These may be adequate to supply the volume required, but they must be checked to ensure that the:

(1) catchment is not polluted;

(2) treatment plant is working correctly; and

(3) reticulation system has not been broken.

b. **Private Systems** - These may belong to dairies, food plants, soft drink manufacturers, or private premises. Whatever the source, they must be checked as above

c. **Springs and Wells** - Ground water is less subject to gross contamination than surface water and may need no treatment except disinfection. If a well is established for the people drawing water, provide a raised curb and slope paving to drain surface water away from the well. If possible, place a dependable supervisor in charge.

d. **Surface Waters** - All surface waters must be treated as contaminated. Choose a spot for the water point as far away from potential pollution as possible, and protect the water and catchment area from contamination by humans or animals.

20.11 WATER TREATMENT

a **Raw Water** - This must be.

(1) clarified, then

(2) disinfected.

b. **Clarification** - This may be achieved by one of the following processes:

(1) Allow sedimentation to take place (a very slow process),

(2) Add a coagulation agent eg. aluminium sulphate (alum) and allow water to settle. A simple jar floc test can assist in estimating quantity. If the water is acidic the addition of lime, sodium bicarbonate, baking soda, soda ash beforehand so that the pH is 7 - 7.5 may assist in coagulation; or by

(3) Filter, either through sand (also a slow process) or through a finely woven cloth. If a storage is available, a sidestream filtration loop using a swimming pool filter powered by a diesel or electric pump will do a fair to excellent job.

c **Disinfection** - This may be carried out by boiling or by the addition of chemicals, such as chlorine, as detailed below:

(1) CHLORINATION - Add in enough chlorine to give a concentration of 1mg/L (ppm) after 30 minutes contact time. It is recommended that an initial dose to give a concentration of 5mg/L (ppm) be added and maintain not less then 1mg/L (ppm) residual in the water after initial treatment The quantities for 5mg/L (ppm) are as follows for 1000 litres are:

4% - available chlorine 125ml

12 5% - available chlorine 40ml

65% - available chlorine 8mg

Sources of available chlorine (read label on container)

(a) White King or similar household bleach 4% approx

(b) Liquid swimming pool or dairy factory chlorine (sodium hypochloride) 12.5% approx

(c) Granular pool chlorine (calcium hypochloride) 65% approx

The chlorine level can be checked after thirty minutes using a comparitor (there may be one at the local swimming pool) If none is available, make sure there is a strong smell of chlorine from the water.

(2) WATER STERILISING TABLETS (containing iodine) - These should not be used continuously for more than a week because of the danger of iodine overdose. The addition of two drips of Tincture of Iodine (available from pharmacies) to 600ml of water, which is allowed to stand for 30 minutes, may be useful on a short term basis

(3) BOILING - a 'rolling boil' for three minutes.

d. **Disinfection of Water Systems** - Where the water reticulation system has been contaminated, it will be necessary to flush and disinfect all water pipes, including domestic systems. and empty all hot water tanks, and maybe normal external water tanks (both above and below ground)

PRINCIPLE

Water of doubtful purity should be treated before being consumed.

20.12 STORAGE OF TREATED WATER

Storage vessels for treated water should·

a. be clean,

b. have covers,

c be above ground level,

d. be in a cool position,

e. be cleaned periodically; and

f. be mosquito proof.

20.13 TRANSPORT OF TREATED WATER

It may be necessary to advise on the transport of treated water into a disaster area eg. bush fire area with all tanks destroyed. Care must be taken to ensure that.

a. water to be transported is potable; and

b containers for the water (jerricans, tankers) are clean and unlikely to taint the water. Beware of railway tank cars, fire tankers, trade waste tankers and road construction tankers, which may have had chemicals added to their tanks when used in their normal role. If necessary flush and disinfect all water tankers before using

SHELTER

20.14 COMMUNITY MOTIVATION

The primary resource in the provision of post-disaster shelter is the motivation and resourcefulness of disaster-affected persons.

20.15 URGENCY AND RESOURCE FACTORS

The urgency and type of shelter provided will depend on:

a. the availability of shelter;

b. the type of disaster;

c. the climatic conditions;

d the availability of water, toilets, latrines, showers, power, food; and

e. the number of disaster victims

PRINCIPLE

Groups providing assistance must always be co-ordinated.

20.16 INDIVIDUAL'S HOMES

In most instances, disaster victims will want to return to their own homes. This should be encouraged as soon as possible but only if basic needs are available, and the site is cleared of any potential hazard.

20.17 SITES IDENTIFICATION

Communities exposed to the risk of disaster (and those that propose to give shelter to disaster victims) should identify sites for temporary shelter in their preparedness plans.

PRINCIPLE

Communities exposed to the risk of a disaster should identify sites for temporary shelter before disaster strikes.

20.18 EMERGENCY SHELTER

When the disaster has made houses uninhabitable and there has been no evacuation of the area, temporary shelter must be arranged for those affected, who generally prefer to remain near their property. It may happen that the population settles all over the place, using anything that comes to hand. If so, the sanitary situation may then rapidly deteriorate and it becomes very difficult to assess requirements.

PRINCIPLE

Every effort must be made to provide disaster affected persons with the most suitable accommodation available, eg motels, established accommodation venues.

20.19 USE OF TENTS

Should it be necessary to house people in tents, the following considerations must be taken into account in choosing a location:

a. The site should be within reasonable distance of a safe and ample source of water, and downstream from sources of drinking water.

b. The site should be away from mosquito breeding places and garbage dumps. It should have good access to roads.

c. The topography of the land should permit easy drainage: the subsoil and ground water conditions should also be studied; and the site should be at a higher level than sullage and refuse disposal areas. Land covered with grass will prevent dust, but bushes and excessive vegetation that can harbour insects, rodents, reptiles, should be avoided or cleared.

d. Wherever possible, the area should be naturally protected from adverse weather conditions eg. prevailing winds. Narrow valleys and ravines subject to floods should be avoided.

e. The site should be flood-proof, above high water level. If possible avoid areas with shallow water tables, otherwise the ground could become marshy in the rainy season.

f. The site should be protected against landslides.

g. The site should be easily accessible, not far from the centre of population.

h. Areas adjacent to commercial and industrials zones, exposed to noise, odours, air pollution, traffic jams, and other nuisances, should also be avoided.

i. There should be ample space for the people to be sheltered and for all the necessary public facilities. Generally, this means 3-4 hectares for every 1000 people (30-40 sq. metres per person).

j. The tents should be arranged in rows on both sides of a roadway at least 10 metres wide to permit easy traffic. Between the edge of the road and the tent pegs there should be at least 2 metres.

k. Inside tents there should be a minimum floor area of 3 sq. metres per person.

l. There should be a minimum distance of 8 metres between tents, so that people can pass freely without being obstructed by pegs and ropes. This spacing also provides a safety measure against the spread of fire.

m. Small tents for a small number of occupants are preferable. This point should be taken into consideration when planning for emergencies.

n. In cold weather some heating appliances should be provided, and people should be instructed in their use and every precaution should be taken to prevent fires and explosions. Natural ventilation is adequate for tents.

o. Suitable lighting should be provided for tents and roads.

p. Garbage collection facilities should be provided.

q. Showers, toilets, latrines and laundries should be located away from residential and food areas and handwashing facilities should be provided in conjunction with latrines.

r. The siting of these blocks must be carefully considered in relation to the kitchen, accommodation, weather conditions and access.

s. Sanitation regulations should be laid down according to what is feasible in the particular situation and should be strictly observed.

t. Drainage ditches should be dug around the tents and along the sides of roads. Water supply points should also have adequate drainage to avoid mud and sludge.

u. When camp sites are in use for long periods, the surface of roads should be treated to keep dust down.

v. The camp should be divided into two separate areas: a residential area; and a community service area (mass feeding centre, field hospital, recreation).

w. For better management and control of communicable diseases, large camps should be avoided, or subdivided into independent units of no more than 1000 people.

x. The camp site should be cleaned regularly according to a pre-arranged schedule.

FOOD AND RELATED CONCERNS

20.20 This section covers the subjects of food management **food poisoning, emergency food production/preparation, supervision of food handlers, mass feeding, examination of damaged food, examination of donated food, personal hygiene and disinfection .**

PRINCIPLE

In disaster prone areas the population should be encouraged to maintain a supply of 'long-life' basic food rations sufficient for a family for 4 to 7 days.

20.21 FOOD MANAGEMENT

a. **General** - Unless proper sanitary measures are applied to the storage, preparation and distribution of food under disaster conditions, mass feeding will be a constant danger to health. Food is easily contaminated especially when being prepared and distributed in conditions which may prevail during and after a disaster

b. **Temporary Kitchen Facilities** - In certain situations it may be necessary to set up temporary kitchens Siting and construction should be in accordance with the guidelines of this section

20.22 FOOD POISONING

a. **Protection Aspects** - Special attention must be paid to the services associated with the protection of food namely

   (1) water supply;

   (2) waste disposal; and

   (3) vector control.

b. **Sanitation Requirements** - These services may have to be carried out in an improvised manner. Failure to maintain proper sanitary conditions in the area of food preparation and distribution could lead to a secondary disaster with response personnel and disaster affected people having food poisoning.

c. **Disease Risk** - In disasters, conditions favour the outbreak of food-borne diseases, and the consequences of such an outbreak could be overwhelming. The medical and health services, which might already be short staffed and fully focused on urgent situations, might not be able to cope These considerations show clearly the necessity for the proper planning and operation of food sanitation programs in disasters including

   (1) quantities and types of food,

   (2) lines of supply,

   (3) premises and preparation, and

   (4) means of distribution.

d. **Food and Feeding Plan** - Initial survey and planning is essential with all relevant personnel involved in the provision of food in order to develop a plan for the supervision of food and feeding centres.

PRINCIPLE

Proper sanitary conditions in food preparation and distribution areas are essential.

20.23 EMERGENCY FOOD PRODUCTION/PREPARATION

Measures that can be applied to ensure safe emergency food production include the following:

a. Quality control of incoming food in order to detect spoilage and contamination including a knowledge of the source and type of food.

b. Knowledge of the water supply to ensure its safety or if necessary its treatment.

c. Control of insects and rodents in stores, kitchens and feeding centres.

d. Provisions for the proper storage of food eg. freezers, refrigerators, dry store.

e. Provision for the proper disposal of solid and liquid food wastes eg. grease traps, burial, cartage, incineration.

f. Provision of the proper washing and sanitising of utensils eg. cutting boards.

g. Supervision of food preparation areas.

h. Supervision of food servicing eg. appropriate cooking methods.

i. Supervision of food handling personnel including:

   (1) health;

   (2) training;

   (3) adequate numbers; and

   (4) provision of separate toilet and hand washing facilities for food handlers where possible, to prevent cross-infection.

j. When possible, food should come from a reliable source eg. supermarket.

20.24 SPECIAL FOOD SURVEILLANCE

Areas that need special attention and supervision include:

a. the method for transporting food (eg. trucks, cars, aircraft);

b. examination of donated food (eg. wholesomeness);

c. examination of disaster affected food;

d. conditions under which food has been stored and transported (eg. temperature);

e. regular supervision of feeding areas, particularly during the early stage of a disaster when personnel are operating 24 hours a day, usually in shifts of six hours; and

f. examination of food suppliers (eg. food warehouses and supermarkets).

20.25 SUPERVISION OF FOOD HANDLERS

a. **Screening and Selection** - The kitchen supervisor will probably have to use whatever workforce is available eg. volunteers or organised responders. Medical screening of food handlers is never a particularly effective exercise and will be impossible under these conditions. The most that can usually be done is to exclude anyone with diarrhoea, vomiting, infectious lesions or exposed areas of infected skin, or a recent history of illness.

b. **Food Handling Rules** - Certain rules, as set out briefly below, must be followed:

(1) Only those with a job to do should be allowed in the kitchen.

(2) Only those who are healthy and clean should be chosen to work in the kitchen.

(3) The kitchen staff should have a 'dirty job' group (cleaners) whose duties do not include food handling.

(4) Adequate hand washing facilities must be available and their use enforced.

(5) The kitchen, surrounds and utensils must be kept clean.

(6) Keep animals out of kitchen and surrounds.

(7) Keep all kitchen refuse in sealed and cleaned bins, and remove as often as is necessary

(8) The use of garbage bags is recommended

(9) Separate ablution, latrine and toilet facilities for the exclusive use of kitchen staff should be provided where possible.

(10) Personal hygiene is of the **utmost** importance

c. **Personal Versus General Hygiene** - Food handlers with dirty hands and clothing, unhygienic and careless habits and active or latent communicable diseases are just as often responsible for food contamination as are flies, spoiled utensils and other unsanitary conditions in kitchens and eating areas.

d. **Untrained Personnel** - If there are not enough suitably trained workers for the supervision of feeding centres, any suitable persons can be trained to assist with the inspection of food premises and reporting any deficiency or fault.

PRINCIPLE

Personal hygiene in handling food in disaster situations is of the utmost importance.

20.26 MASS FEEDING

It may be necessary to provide food for disaster-affected persons who have left a disaster area or to take catering services to survivors still in the area. These numbers can be small or large depending on the size of the disaster, type of disaster and the duration of the disaster.

a. **Disaster Planning** - This should include nominated buildings which are suitable for mass catering, that is:

(1) premises with cooking areas;

(2) premises with toilets;

(3) adequate supplies of safe potable water, and as far as possible, centrally located and well known to the public; and

(4) schools and community centres are two buildings which may meet these criteria, these should be incorporated in the local or municipal Disaster Plan

b. **Emergency Food Supplies** - Another item to be taken into consideration is a list of after hours telephone numbers and addresses of owners of food manufacturing plants and large retail food stores. This would assist in cases where emergency food supplies are required urgently; also if premises are close at hand (provided they have not been affected by the disaster). **Where possible utilise local business as much as possible.**

c **Organising Feeding Centres** - Some important points for the organisation of mass feeding centres are as follows:

(1) The location and layout of mass feeding centres should be identified to ensure reasonable sanitary safeguards

(2) Whenever possible use should be made of existing buildings such as restaurants, hotel dining rooms, schools, public assembly halls and churches, which may offer suitable conditions eg water, toilets, kitchen, power for maintaining a satisfactory standard of cleanliness, and protection against the invasion of rodents and insects.

(3) Only safe potable water may be used for drinking in feeding centres, where there is no piped supply, water must be transported, stored and handled in a sanitary manner.

(4) The source of the water must be known, as well as the means of conveyance of the water to the disaster site.

(5) A sufficient number of basins, each with soap, nail brush and clean disposable towelling must be provided exclusively for the use of food handlers

(6) Separate basins should be provided for washing and rinsing eating and cooking utensils.

(7) Before washing, any grease or food scraps on the eating and cooking utensils should be scraped into a refuse bin.

(8) Serving of raw vegetables and soft skinned foods should be avoided unless for dietary reasons: in such cases the vegetables and fruits must be thoroughly washed.

(9) Separate toilet and latrine installations for the food handlers should be provided (if possible) close to the mass feeding centres: it being assumed that people eating at the feeding centres can make use of the general facilities; toilets (and where applicable latrines) must be kept in the best possible state of cleanliness at all times.

(10) Solid wastes from kitchens must be deposited immediately into refuse bins (garbage cans); no filled bins may remain in the preparation and cooking areas, bins must be tidily covered and removed outside for collection and disposal **(the use of garbage bags is recommended).**

(11) A refuse removal service must be promptly started as proper collection and disposal obviates many problems, particularly fly breeding, rodent invasion and fire risk. Attempts should be made to separate refuse into categories of:

(a) dry refuse - papers, cartons, cardboard,

(b) putrescible - food scraps, fruit, vegetables. and

(c) indestructible - tins, bottles and plastics.

(12) Where refrigeration facilities are non-existent or inadequate, perishable foods should only be bought on a daily basis and cooked and served as soon as possible.

(13) The slaughtering of animals (cattle, sheep, pigs) for consumption on the same day could be considered If possible advice from a veterinarian or a qualified meat inspector should be sought

(14) Condensed or powdered milk must be reconstituted with safe potable water only, and under the best possible sanitary conditions. If fresh milk is available for infants and hospital patients it must be boiled before use.

(15) An adequate cleaning supply of detergents, disinfectants, brushes, clean cloths, brooms and other cleaning necessities must be provided

(16) Disposable plates, cups should be used in mass feeding centres

d. **Sanitary Conditions** - The measures applied to maintain a sanitary environment in the feeding centres and to protect food from contact with contaminated matter will be more effective if the cleanliness and health of the personnel working in the these centres are of a high standard.

20.27 EXAMINATION OF DAMAGED FOOD

a **Checking and Sorting** - Damaged food can be checked and often it will be safe if it is used quickly and handled properly Perishable foods can be sorted out and used first In the event of power loss of more than 36 hours, all frozen food will have to be consumed or destroyed. If power is cut off or even rationed, refrigerators will have to be kept for essentials.

b. **Care In Use** - The use of damaged food and the priority for its order of consumption must receive careful consideration.

c **Risk of Contamination** - Damaged food which is potentially contaminated (bottled food affected by flood waters) will have to be replaced Take no chances, **destroy it** but if food is scarce, judgement may be difficult.

20 28 EXAMINATION OF DONATED FOOD

a. **Inspection and Storage** - When a disaster occurs donations of all forms are bought into the disaster area, including food. It is essential that all such foods are brought to a central inspection area where they can be examined by a trained person and correctly stored pending distribution.

b. **Acceptance and Disposal** - It is better to accept all food donations, even if it is obvious that they are unsuitable and to dispose of the food after the donor has left the site. This overcomes the problems of:

(1) unauthorised food distribution, and

(2) embarrassment to the donor who, in good faith, may have travelled a long distance to donate the food not knowing its suitability

PRINCIPLE

Food donations should be discouraged unless essential.

20.29 PERSONAL HYGIENE

a **Limiting Disease** - Personal hygiene may be neglected in times of emergency, especially in densely populated areas, such as settlements for displaced persons In these circumstances, the risk of spreading disease is increased Personal hygiene is the responsibility of the individual This promotes health and limits the spread of infectious disease, especially those transmitted by direct contact

PRINCIPLE

All disaster affected persons need to be informed about and encouraged to practice personal hygiene

b **Advice to Workers** - All relief workers and affected persons should be advised to.

(1) wash hands in soap and water immediately after going to the toilet and always before handling and/or eating food,

(2) avoid the use of common or unclean eating utensils, toothbrushes, razors, drinking cups, towels, handkerchiefs, combs, and hairbrushes;

(3) avoid coughing and sneezing on others; and

(4) wash hands thoroughly after handling a patient or his/her belongings.

c. **Basic Facilities** - Providing displaced persons with cleaning and bathing facilities will encourage attention to hygiene. Overcrowding in sleeping quarters should be avoided.

20 30 DISINFECTION

Where equipment or materials require disinfection to prevent the spread of disease the following methods are recommended.

a. All equipment and surfaces must be cleaned before disinfection.

b Choose heat for disinfection where possible

c If the application of heat is not possible use a chemical disinfectant such as a hypochlorite solution using a concentration giving 100 to 200ppm of available chlorine for a scrupulously clean surface. Where absolute cleanliness cannot be assured, a concentration giving 1000ppm or more of available chlorine will be required

d. Chemical disinfection solutions are to be prepared fresh daily, in clean, dry and preferably heat treated containers

e The effectiveness of a chemical disinfectant depends on preparation, application methods and the users

SANITATION

20.31 This section deals with emergency ablution facilities, refuse disposal, disposal of dead animals, vermin and vector control.

20.32 EMERGENCY ABLUTION FACILITIES AND LATRINES

a. **General** - The provision of temporary ablution facilities may be required where existing facilities are damaged or additional facilities are required Temporary facilities will also be required where temporary camp sites, either short term or long term, have been established. Ablution facilities will be located in accordance with the Shelter Section, Paragraph 20.14 of this Chapter. The efficient disposal of waste matter of all kinds is important to health for:

(1) prevention of contamination of drinking water;

(2) prevention of contamination of food;

(3) eradication of fly and vector breeding places; and

(4) control of rats and mice.

b. **Temporary Camps (up to three days)** - In temporary camps of up to three days duration the normal facilities used are:

(1) shallow trench latrines and urinals for disposal of human waste; and

(2) soakage pits with soap and grease trap for the disposal of sullage water.

c **Shallow Trench Latrine** (See Figure 20:1) - This type of latrine requires very careful supervision by hygiene personnel to ensure correct usage and that the following rules are observed:

(1) Fouling of the surface of the ground and sides of the trench with faeces and urine must be avoided Paper must be deposited in the trench and not allowed to blow about.

(2) All excreta and paper must be covered immediately with earth by the user, using a scoop provided for the purposes. Boots and hands must not be used for this purpose.

(3) Facilities for washing of hands within the vicinity of the latrines are provided.

(4) Five trenches are constructed for the first 100 persons and five trenches for each additional 100 persons

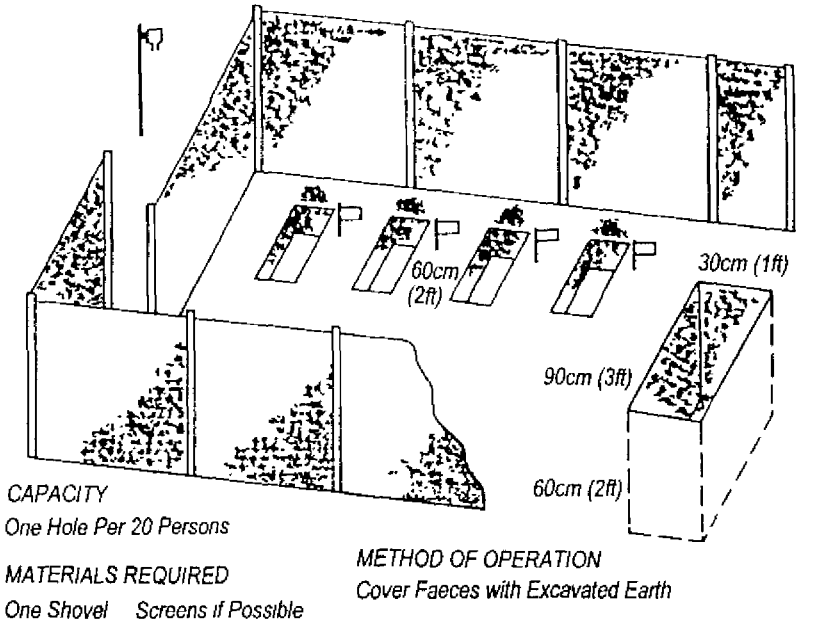

Figure 20:1
Shallow Trench Latrine

d. **Shallow Trench Urinal** - A shallow trench urinal consists of a trench 3 meters long, 1 metre wide and 750mm deep. The soil in the bottom is then loosened for a further 150mm but is left in the trench. The excavated earth should be heaped on three sides of the trench and used to cover it when it is full One such trench should be ample for 250 men.

e. **Temporary Camps (exceeding three days)** - Shallow trench latrines and urinals are unsatisfactory in a camp of **more than** three days duration. Something of a more permanent nature is therefore needed It is usual to provide:

(1) deep trench latrines or bored hole latrines for disposal of faeces;

(2) funnel or trough urinals for disposal of urine; and

(3) cold water grease traps with soakage pits for final disposal of sullage wastes.

f. **Deep Trench Latrine** (See Figure 20·2)

(1) GENERAL - Deep trench latrines will be required at a rate of one seat for every 20 persons The facility should be constructed so that they are fly and vermin proof. It is essential that they are provided with pedestal support ie heavy timber or star pickets. To prevent fly access or breeding in the latrine or at the base of the pedestal, oil sacking can be put in place, or alternatively by applying lime to the ground surface. This is the best method for camps of duration longer than a few days

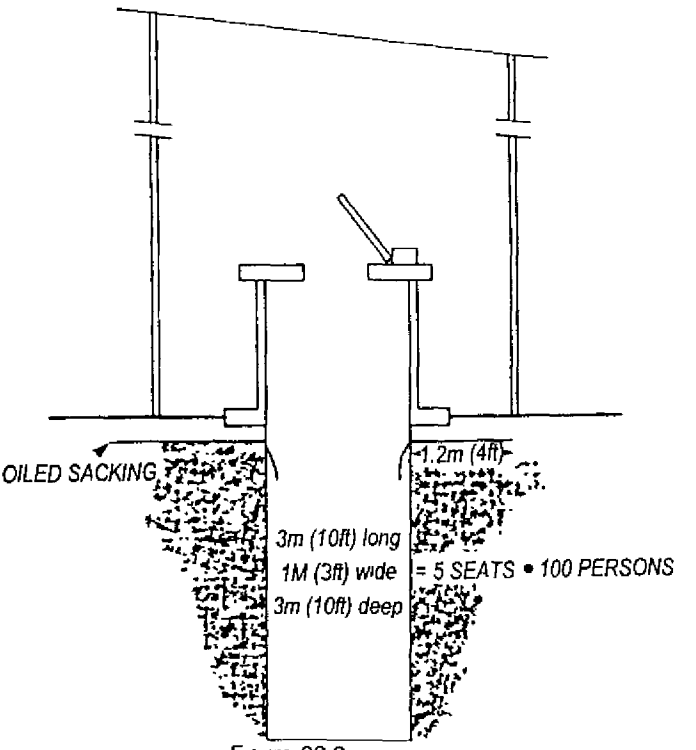

Figure 20·2
Deep Trench Latrine

(2) CONSTRUCTION - The following guidelines apply:

(a) A trench **5 metres long by 750mm** wide is excavated to a depth of at least 2.5 metres. The soil is placed not closer than 1 5 metres from the edge of the trench. **In cases where this depth cannot be excavated, the trench must be built up to obtain the required depth** If there is any danger of the sides collapsing. they should be strengthened with **sand bags,** timber, or other means

(b) The ground all round the trench should be dug to a depth of 150mm for a distance of 1 5 metres outwards from the trench and the soil removed. Strips of oiled sacking, 1 5 metres wide, should be spread over this area with the edge turned down over the side of the trench for a depth of 750mm. It is then fastened to the wall of the trench with small wooden pegs

(c) A flyproof wooden structure is then placed in position, being supported by two heavy wooden beams along the front and back of the trench and extending beyond it, at each end, for a distance of 600mm.

(d) After being mixed with some **heavy oil** the loose soil which was removed is replaced on top of the sacking and rammed tight. This ensures that any fly larvae hatching out in the trench will be trapped under the **sacking** on attempting to reach the surface of the ground. The superstructure should be of **well seasoned tongue and grooved timber** and have sides built vertically and with the back sloped.

(e) The openings in the seats should have **close fitting lids** attached in such away that they will close automatically when not supported. This can be effected by a bar at the back which arrests the lid before it reaches a vertical position. The openings must be arranged above the centre of the trench and a sheet metal deflector placed to the front under each opening to deflect urine and so prevent fouling of the sides of the trench. Protection from the weather should be afforded with screening Where a roof is provided the lower edge should project well clear of the trench.

(f) When the trench becomes filled to within 600mm of the ground level, the superstructure, screening should be removed to another trench prepared previously, the contents of the old one being then covered with oiled sacking, and the trench filled with earth, rammed hard and the site prominently marked.

g. **Bored Hole Latrine** - This consists of a 5 to 6 metre deep by 300mm diameter hole and is prepared by a mobile auger. The top 1 to 2 metres is usually reinforced and fly proofing is carried out in a simular manner to that used for Deep Trench Latrines. A fly-proof structure should also be built over the top of these fixtures.

h. **Funnel and Trough Urinals**

(1) GENERAL - Where field latrines are in use, separate arrangements are necessary for the disposal of urine. The best methods are those by which the urine is disposed of directly into the ground as described below and shown in Figures 20·3 and 20.4.

(2) CONSTRUCTION

(a) *Funnel Urinals* - Four conical metal funnels are built into a soakage pit, one funnel in each corner The tops of the funnels are expanded and detachable strainers are inserted inside, about 75mm from the top, or wide end, to trap cigarette ends and other debris The **soakage pit** is a 1.2 metre cube filled to within 150mm of the top with stone, rubble, perforated tins or similar material. These are covered with a layer of oiled sacking and the earth is replaced to ground level. The funnels may be constructed of sheet metal and are tapered from 300mm diameter at the top to 50mm diameter at the bottom.

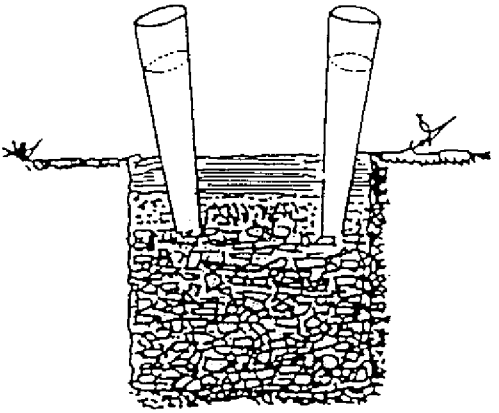

Figure 20:3
Funnel Urinal

(b) *Trough Urinals* - These need to be properly constructed if they are to be kept clean and odourless (see Figure 20:4).

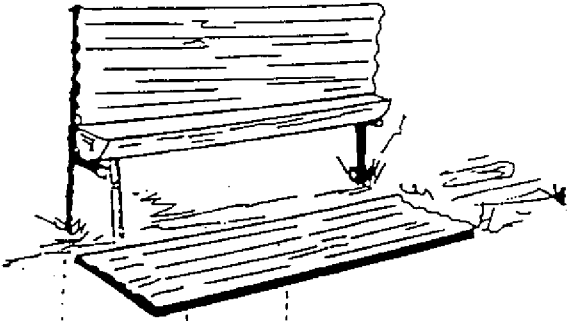

Figure 20:4
Trough Urinal

i. **Use of Existing Septic Tank Systems** - Following a disaster, it may be possible that existing septic tank systems could be used either when relocating people back onto their property or, when utilising a community hall. However, before this can be done, it will be necessary to find out whether the tank is still usable ie damage to tank, disposal area, plumbing fixtures. Existing septic tank systems will not work if the water reticulation system is not operating. However, if water supply is not a problem and the septic system is working the use of a bucket to clear waste from the toilet and into a septic system is to be encouraged. If demolition machinery is to be used on properties, septic tank systems can be identified, marked and isolated if usable. In relation to community halls, where large numbers of people may be using the facilities, it will be necessary to regularly de-sludge the septic tank and to isolate the disposal area to prevent damage or prevent locating facilities such as food storage areas over disposal areas.

Disposal of Sullage Wastes - In the prolonged occupation of any site for camp purposes, the disposal of sullage water (kitchen, shower/ablution and laundry waste) is a problem of great importance, as between 30 to 150 litres per person may be produced daily. Waste water from kitchens contains a considerable amount of fat in the form of grease, while water from ablution places, baths and laundries, contains a large quantity of soap. These factors, if not considered will ultimately lead to failure of the soil to absorb the wastes discharged onto it, or into it. Soaps and greases may be removed from waste water prior to disposal to soakage pits to prolong the life of the pit or absorption qualities of the soil. The simplest are either strainer traps or cold water grease traps A simple strainer through which the cold water passes may be used either alone or in conjunction with a cold water grease trap Construction and use of both methods is detailed below.

(1) STRAINER TRAPS

(a) *General* - A suitable strainer is easily improvised. with grass, straw or similar material which will keep back some of the grease, soap or other suspended matter. The weight of a few large stones pressing down on the straining material will greatly increase its efficiency. The straining medium, together with the solids retained, can be disposed of by incineration or burial each day - more often if clogging occurs.

(b) *Construction* - A strainer trap, suitable for temporary camps, consists of a perforated tin containing the straining material and fitted into another tin, which is connected to a soakage pit by means of a channel which also contains straining material

(2) GREASE TRAPS

(a) *Principle* - Grease in sullage is in suspension. If the hot water containing the grease is run into an adequate amount of cold water, the grease solidifies, rises to the top of the water and can then be skimmed off. This is the principle on which the cold water grease trap is constructed.

(b) *Capacity* - It is important to note that the effective capacity of the grease trap must be sufficient to ensure that, water passing through it at one time - peak loads - will be cooled to a temperature at which ordinary cookhouse grease is solidified.

(c) *Improvisation* - In instances where grease traps are not available one can be improvised quite simply by using a 200 litre drum or even a packing case.

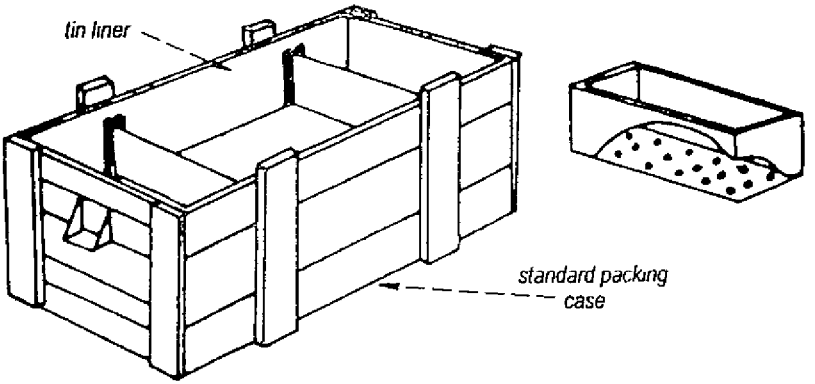

Figure 20:5
Cold Water Grease Trap

(3) FINAL DISPOSAL OF WASTE WATER

(a) *Soakage Pits* - Final disposal of waste water is, by preference, to a soakage pit which is of great value in field sanitation. Their purpose is to receive sullage water in quantities and to act as reservoirs from which the water can be absorbed continuously into the surrounding ground. The size of a soakage pit is 1.2 metres cube. If more soakage area is required, further soakage pits may be dug. The pit is filled up to within 150mm of ground level with stones, as previously described when considering Funnel urinals.

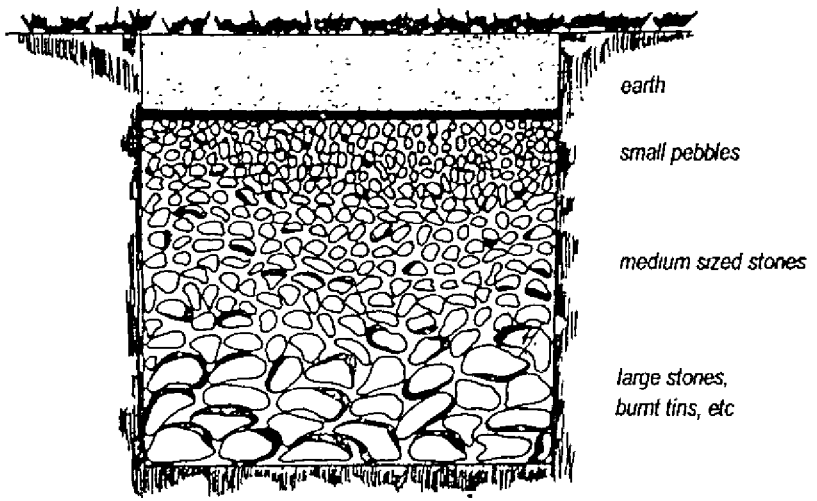

Figure 20:6
Sullage Soakage Pit

(b) *Reserve Pits* - The small amount of soap or grease which will remain in the water after attempts to remove them will ultimately form a coating on the sides and floor of the soakage pit and so prevent any further absorption of water. It is wise therefore, to have reserve pits available, particularly in clay soils where the absorption rate is slow. Soakage pits should be provided at each cookhouse, ablution, bathing place and laundry.

k. **Shower and Laundry Facilities** - These can be provided by locating prefabricated facilities or by improvising. Refer to Figures 20:7 and 20:8

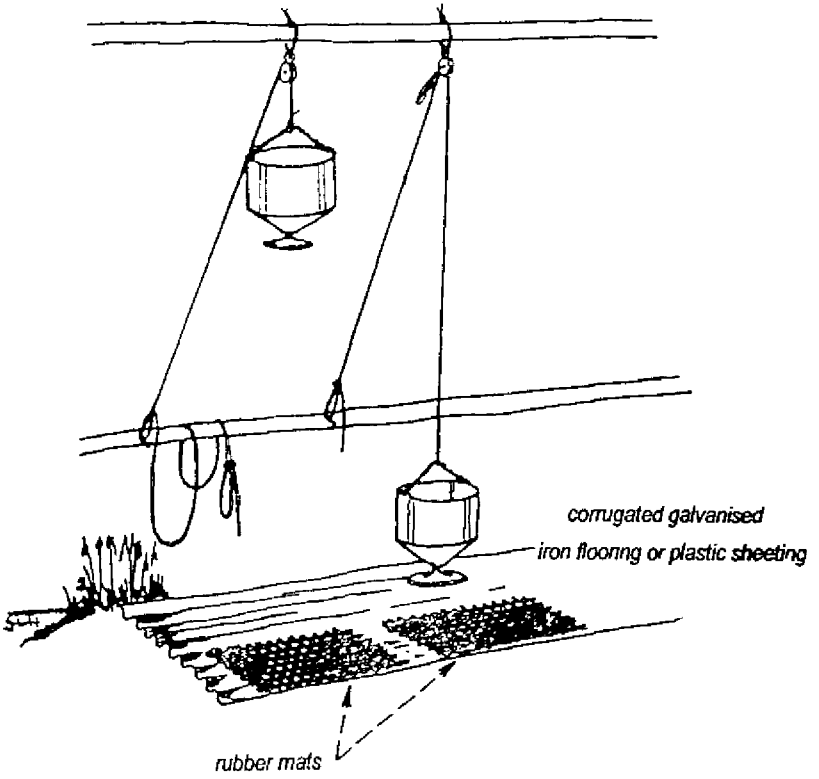

Figure 20:7
Improvised Showers

l. **Hot Water** - A simple method is through use of a 'put and take' heater which works on the principle that cold water must be put into the heater before hot water can be taken out. (See Figure 20:8) A 200 litre drum is prepared as illustrated. It is filled with cold water and then heated. If cold water is poured down the funnel an equal amount of hot water will run from the pipe.

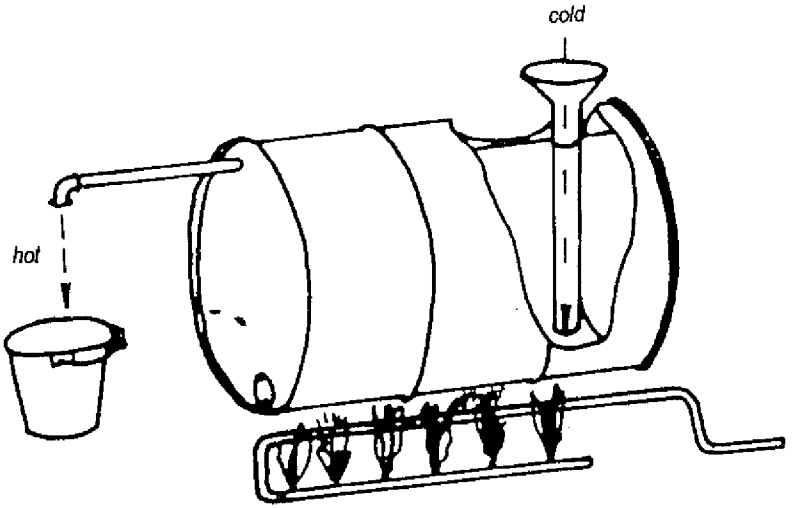

Figure 20:8
Put and Take Hot Water Heater

m. **Maintenance of Ablution Facilities**

(1) TEMPORARY LATRINES - These should be maintained on a daily basis. Lime should be spread around the ground external to the pedestal in deep hole and bore hole latrines to prevent possible fly breeding areas. Lime should not be put into the pits as this will adversely affect the bacterial operation within the pit. A bucket of water poured in the deep trench and bore hole latrines daily will assist in sludge breakdown.

(2) HANDWASHING AND DRYING - Hand washing and drying facilities should be checked daily to ensure an adequate supply of soap and clean water. Toilet paper should be protected from the elements.

(3) INSECTICIDES - The limited application of residual insecticides may be required for the treatment of ablution facilities. In areas where the population is barefooted, the use of insecticides in lieu of lime, for fly breeding control, must be considered.

20.33 REFUSE DISPOSAL

a. **General** - Disaster conditions will overwhelm normal tip facilities and planning for the utilisation of emergency methods of disposal may be necessary. In a disaster, the control of public health problems such as vector/vermin control depends a lot on the efficiency which all refuse is collected and removed.

PRINCIPLE

The primary aim of disposing waste material is to prevent the transmission of disease and make areas safe and accessible.

b. **Refuse Categories** - Refuse can be categorised for removal as follows:

(1) Putrescible garbage (wet garbage) such as food scraps, discarded fruit, kitchen waste, vegetables.

(2) Dry refuse/non-putrescible garbage - ashes, cinders, papers, old iron, tins, bottles, rags, cardboard.

(3) Indestructible rubbish such as used building material.

c. **Bashing and Burning** - In a disaster it will be necessary to 'save space' due to the lack of sufficient bulk refuse receptacles or the lack of special vehicles required to move the same. The 'Bash and Burn' technique may have to be employed in disaster situations in spite of the undesirable effects of burning refuse. (This would apply to dry material only). 'Bashing' or compressing metal containers reduces bulk, thereby giving more space in the refuse bin.

d. **Storage** - Plastic garbage bags are an asset for the temporary storage of putrescible material and should be used if available. However, care should be taken to ensure that these containers are not damaged in any way and that dogs, cats and other animals are not likely to have access to them. Where plastic garbage bags are used, it is essential that they are securely sealed at the top, and care taken to avoid putting jagged objects inside such as glass and tins.

e. **Selection of Tip Sites** - Should the usual garbage disposal site be either inaccessible or unusable for any reason, alternative facilities must be established. In selecting an alternative site the factors which must be considered are:

(1) suitability of terrain - soil quality;

(2) availability of surface coverage soil;

(3) likelihood of leaching;

(4) height of water table;

(5) accessibility - all weather road;

(6) proximity of rivers, streams and creeks; and

(7) likelihood of nuisances being caused eg. flies, vermin, breeding factors, environmental pollution.

f. **Sanitary Landfill** - This is one of two disposal methods likely to be employed in a disaster area. In this method the use of depressions, gullies or low lying lands is recommended and the following points should be applied:

(1) Only putrescible wastes should be transported to a sanitary landfill site. Putrescible waste should be covered with soil to a depth of 300mm for bulk sanitary land fill sites and to a depth of 150mm for small local burial sites.

(2) Bulky non-putrescible wastes should be stored at alternative sites away from the sanitary landfill site.

(3) It may be necessary to burn timber but sorting material out also puts a strain on resources.

(4) Other indestructible matter such as steel lintels, car bodies, heavy machinery, where possible should be separated, particularly gas cylinders, refrigerators or freezers.

g. **Incineration** - This is the second likely disposal method. By this process, refuse is reduced to about one quarter of its original weight. In addition, incineration will destroy all fly larvae and prevent the proliferation of vermin. In a disaster, large incinerators will probably not be available; however, small on site incinerators may be constructed in emergency situations as shown in Figure 20:9.

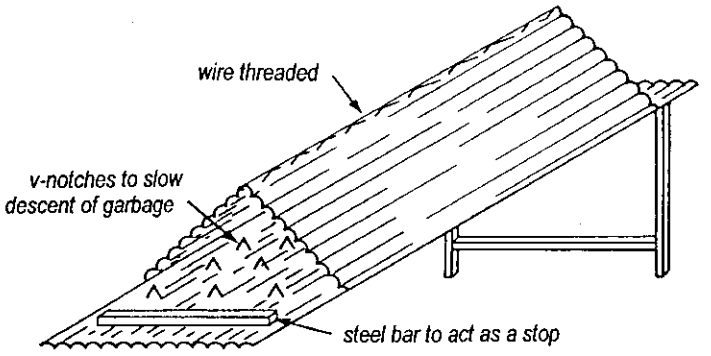

Figure 20:9
Inclined Plane Incinerator

In the construction and siting of incinerators for the final disposal of refuse it is essential to observe the following points:

(1) The incinerator should be located away and downwind from the camp or temporary shelters.

(2) The incinerator should be built on an impervious base of concrete or hardened earth.

(3) The air inlet must be sufficiently large and it should be funnel-shaped, narrow end inwards to produce a blower effect.

(4) The fire bars should be placed loosely on their support to allow for expansion.

(5) The stocking gates should be suitably situated so that fresh material can be added from above.

(6) Whatever type of incinerator is used it is important to remember that:

(a) final disposal by burial may be necessary to prevent the accumulation of media for fly propagation and sources of food supply for rodents; and

(b) burning off might not be possible if a bushfire risk prevails.

h. **Dump Master Bins** - Where possible the use of Dump Master Bins in disaster areas should be encouraged, however, constant surveillance of the bins must be made to ensure that only appropriate household garbage is being deposited in them. In the event of Dump Master type bin not being available, other receptacles may be provided eg. 200 litre drums, together with properly fitted lids. Constant surveillance of these receptacles is required to ensure that only domestic rubbish is being placed in them and that they are cleaned and disinfected regularly.

i. **Transportation of Refuse** - Should conventional refuse removal not be available, any vehicle fitted with a tip-tray and high sides would be satisfactory. Care should be taken to ensure that any liquid or semi-liquid waste which may be present in the load, does not leak on to the road while being transported. To eliminate this possibility, it would be wise to line the tray with plastic membrane prior to loading. In all instances where 'unconventional' vehicles are employed, it is essential to ensure that the loads are also covered with a suitable tarpaulin or plastic sheet.

j. **Open Dumping** - Open dumps give off objectionable odours and are potential breeding grounds for flies and vermin. Some components of refuse are suitable for open dumping. These include debris such as bricks, concrete and roofing tiles. However, serious nuisances and hazards may result if garbage or mixed refuse is disposed of in this manner.

k. **Summary** - Sanitary landfill and incineration are the preferred methods of refuse disposal in a disaster situation.

20.34 DISPOSAL OF DEAD ANIMALS

a. **Objectives** - The basic objectives to be achieved in disposing of dead animal carcasses, products and waste materials are to ensure that no spread of disease occurs to either humans or to other animals, and that the carcasses are effectively removed from public view. The opportunity for vermin and flies to access carcasses is minimised and the cost of disposing of animals concerned is kept to a realistic minimum.

b. **Personal Hygiene** - Care must be taken at all times when handling dead animals, including wearing of rubber boots, gloves, proper protective clothing and adequate personal disinfection.

PRINCIPLE

Strict personal hygiene must be practised in the handling of all dead animals.

c. **Selection of Disposal and Destruction Sites** - A decision must first be made on burning versus burying of carcasses The method to be adopted will depend on the cause of death of the animals concerned, the availability of fuel, fire restrictions, location of the water table and availability of machinery Factors to be considered are

(1) availability of sites suitable for burial or burning adjacent to the destruction site;

(2) nature of soil/rock formation in the available area,

(3) level of water table,

(4) proximity to water catchment areas, bores and wells,

(5) presence of underground services eg. water, gas, electricity, telephone lines, drainage, sewerage, other improvements or structures;

(6) proximity to built up areas and dwellings (particularly in the case of burning),

(7) other weather conditions including prevailing winds (it may be easier to burn in excessively wet conditions),

(8) availability of supplies of suitable fuel for burning;

(9) presence of overhead structures such as power lines, these must be avoided when selecting both burial and burning sites,

(10) quantities of carcasses and other material for disposal, and

(11) subsequent plans for the use of the area, eg. soil may be unstable where burial pits are placed.

d. **Advantages of Burying** - Burial is the preferred method of disposal because it is·

(1) quicker;

(2) cheaper,

(3) environmentally cleaner, and

(4) easier to organise (less outside resources required)

e. **Burial Procedures**

(1) As a rule a 3m wide and 5m deep pit filled to within 2.5m of ground level will accommodate 5 adult cattle per linear metre. One adult cattle carcass is equivalent to 3-4 adult sheep or goats, or 2-4 pigs

(2) Carcasses and other material for disposal should be dumped on the side opposite the excavated soil. Portable yards in which sheep are destroyed, may be located at the side of the pit. The abdominal cavities of all animal carcasses must be opened prior to placement in the pit. Carcasses of horses and pigs should be slashed widely-open using long handled bill hooks or short barred chainsaws.

(3) The operation should be undertaken at the side of the pit to minimise contamination of the other areas. **Under no circumstances should personnel enter the pit**

20.35 VERMIN AND VECTOR CONTROL

a. **General** - Vermin and vectors (flies, fleas, lice, mites, mosquitoes, ticks) are disease carriers that develop rapidly in an uncontrolled environment

b **Increased Disease Transmission** - Disasters do not generate 'new' diseases but, by altering the environment, they may increase transmission of diseases that already exist in a region through.

(1) direct effect of the physical event itself, such as faecal contamination;

(2) indirect effects which may result in such conditions as overcrowding and poor sanitation;

(3) promoting or causing increase in the movement of populations;

(4) disrupting routine vector control programs, or

(5) altering the distribution of vector species

The increased risk of transmission of vector-borne diseases must be seriously considered after all natural disasters. Therefore, it is a matter of priority that, the potential of transmission of vector-borne disease is assessed early in the post-disaster period It is important to note that natural disasters do not necessarily lead to outbreaks of infectious diseases. This is particularly true of the mosquito-borne diseases, since the larval habitats and adult breeding sites of mosquitoes are often damaged As a result, diseases such as malaria, dengue fever, Ross River fever and encephalitis may not appear until several weeks after the disaster, if they appear at all.

c. **Vector and Vermin-Related Diseases**

CAUSE	MAIN DISEASES
mosquitoes	malaria, dengue fever, Ross River fever, viral encephalitis, filariasis
houseflies	diarrhoea, dysentery, salmonellosis
cockroaches	diarrhoea, dysentery, salmonellosis
lice	endemic typhus, pediculosis, relapsing fever, trench fever, skin irritation
bedbugs	severe skin inflammation
ticks	rickettsial fever, tularaemia, relapsing fever, viral encephalitis
rodent mites	rickettsial fever, scrub typhus
rodent fleas	endemic typhus, plague
rodents	rat-bite fever, leptospirosis, salmonellosis, melioidosis

d. **Assessment and Situation** - A significant control problem after different types of natural diasters is accurately assessing the potential of vector and vermin-related diseases and determining what resources are required. Also the time for which the problem remains may vary. Knowledge of the biology and ecology of pest organisms and their relevance to the current conditions is required when the effect of natural disaster damage on vector and vermin problems is being assessed. For example:

(1) Flooding usually flushes out or destroys mosquito breeding sites. It subsequently creates additional habitats that can eventually produce even greater mosquito densities.

(2) When water and sewerage systems are damaged, increased storage of potable water can provide additional breeding sites for Aedes aegypti while temporary pit latrines can provide habitats for flies and Culex mosquitoes.

(3) Inadequate food storage, poor sanitation and contamination by debris, animal carcasses and excreta may produce breeding areas for flies and an increase in rodent populations.

(4) Problems related to vectors and vermin may not be confined to the affected region. Human movement away from the region may contribute to crowding in peripheral areas and, as a result, provide opportunity for the proliferation of diseases associated with vectors and vermin. For example, following water-related disasters, these peripheral areas may harbour potential mosquito breeding habitats that are more conducive as immediate breeding sites than in the disaster area.

e. **Determining Action Priorities** - Types of vector-borne diseases in the area and the density of the human population are factors to consider when setting priorities. When these are known, action should be immediately directed towards the areas of high population density, especially slum areas and camps where migrant populations are received. Every attempt should be made to restore and strengthen routine vector control operations within the disaster area. Urban, suburban and rural areas of high priority of receiving control efforts should be determined by considering all relevant criteria, including:

(1) population at risk;

(2) number of confirmed or suspected disease outbreaks;

(3) recent history of disease transmission;

(4) relative density of potential disease vectors;

(5) significant increases in new breeding sites.;

(6) presence of potential disease reservoirs;

(7) seasonal accessibility by ground transport; and

(8) number and types of complaint calls regarding mosquito activity.

f. **Surveillance and Control**

(1) IMMEDIATE ACTION - The major activities in vector and vermin control should occur during the immediate post-disaster period. If initial surveys and other sources of information indicate a potential problem, the sooner that post-disaster programs are implemented to reduce disease potential, the less is the chance that epidemics will occur. Delaying action may be medically and economically disastrous.

(2) ROUTINE OPERATIONS - Re-establishing and upgrading routine control operations, surveillance and training of staff will minimise the risk or impact of an arthropod-borne epidemic.

(3) RISK PERCEPTION - Very few mosquitoes are disease carriers, however, most people in a disaster environment will associate the presence of mosquitoes with disease even though their presence may be no more than a nuisance.

g. **Areas of Common Concern** - Whatever the disaster, certain areas are likely to need surveillance, to control vermin and vector proliferation. They include:

(1) food areas (preparation, storage and eating);

(2) refuse collection area and tips;

(3) sanitary depots;

(4) sewerage farms/depots;

(5) damaged food premises, food manufacturers, food warehouses, coolstores, commercial kitchens, food storage areas;

(6) damaged or destroyed poultry sheds, piggeries, stables;

(7) dead stock/animals;

(8) domestic kitchens (particularly box freezers or refrigeration which are buried under rubble);

(9) burst sewerage pipes;

(10) damaged septic tank systems or domestic treatment plants, in particular those made with fibreglass or connected to PVC piping;

(11) areas/properties reduced to rubble; and

(12) any area where people accumulate.

INFECTIOUS DISEASES

20.36 INTRODUCTION

Emergency health workers must be aware of the need for vigilance in a disaster to prevent or control an infectious disease epidemic. However, epidemics are rare following disasters in Australia, but can be common in less developed countries.

20.37 PUBLIC PERCEPTION

During the immediate aftermath of a disaster, unconfirmed stories of epidemics may be reported by the media. These may prompt the wasteful deployment of resources on emotive rather than scientific grounds.

20.38 RISK FACTORS

Certain diseases such as malaria and cholera pose a threat after a disaster in areas where they are endemic. However, even if conditions are ideal for transmission, a disease cannot occur as a result of a disaster unless the causative organism is present before the disaster or introduced to the area during the disaster. The chance of a disaster-related infectious disease occurring in an area depends on the variables of:

a. the existing pattern of disease; and

b. the nature of the disaster.

20.39 TRANSMISSION METHODS

Infectious disease can be transmitted by the following means:

a. **Airborne** - Micro-organisms spread through the air from a source to a person eg. influenza, Legionnaires' disease and Q fever.

b. **Direct or Indirect Contact with Source** - Micro-organisms are transmitted from source to person, including transmission by body fluids eg. hepatitis B, leptospirosis and scabies.

c. **Waterborne/foodborne** - Micro-organisms are carried in water or food and ingested eg. typhoid, cholera and hepatitis A.

d. **Vectorborne** - Micro-organisms are transmitted to a person by another host eg. Ross River virus, malaria and plague.

20.40 MITIGATING TRANSMISSION

Epidemic control measures should include:

a. reduction of population density to reduce person-to-person contact;

b. provision of appropriate sanitation and water;

c. awareness of existing disease prevalence in the disaster area and evacuation/relocation areas; and

d. adequate control of disease vectors.

20.41 CONTROL PRINCIPLES

One person should assume responsibility for the overall management of disaster-related infectious disease. The following principles apply:

a. Effective disease surveillance, through an awareness of probable infectious disease in the particular area, and vigilance in identifying all cases.

b. Prompt investigation of reported and rumoured outbreaks.

c. Timely feedback to appropriate authorities to facilitate the appropriation of adequate resources.

d. Institution of appropriate control measures for the defined infectious disease risk.

e. On-going surveillance beyond the declared disaster period.

20.42 SPECIFIC CONTROL MEASURES

Control measures for specific infectious diseases are documented in 'Control of Communicable Diseases in Man' (Benenson, 1991). These methods have been adapted and field-tested under Australian conditions (Infectious Diseases Section, NSW Health Department; Infectious Diseases Unit, Department of Health and Community Services Victoria). Information about immunisation is documented in 'Immunisation Procedures' (National Health and Medical Research Council, 1991).

PRINCIPLE

The chance of a disaster-related infectious disease occurring in an area depends on two variables, the existing pattern of disease, and the nature of the disaster.

HAZARDOUS WASTE DISPOSAL

20.43 DEFINITION

Hazardous waste is waste that has physical, chemical or biological characteristics, which require special handling and disposal procedures to avoid risk to health and/or other adverse environmental effects. When attempting to define hazardous waste, concern is essentially with wastes that present either of the following:

a. **Short-Term Acute Hazard** - These include acute toxicity by ingestion, inhalation, skin absorption, corrosion or other skin or eye contact hazards, or a risk of fire or explosion.

b. **Long-Term Environmental Hazards** - These include chronic toxicity upon repeated exposure, carcinogenicity, resistance to detoxification processes such as biodegradation, the potential to pollute underground or surface waters, or aesthetically objectionable properties, such as offensive odours. Wastes with these properties may arise as by-products, side-products, process residues, radioactive residues, contaminated plant or equipment from manufacturing operations and the discarding of manufactured products.

PRINCIPLE

Hazardous waste is waste that has physical, chemical or biological characteristics, which require special handling and disposal procedures to avoid risk to health and/or other adverse environmental effects.

20.44 CRITERIA FOR IDENTIFYING HAZARDOUS WASTE

a. **Characteristics** - Waste has the potential to be hazardous by virtue of:

(1) substances present in it, according to:

(a) the concentration of their chemical reactivity;

(b) the physical form in which they present;

(c) its quantity and latent heat generation;

(d) its mobility and persistence within the environment in which it is placed;

(e) targets available in its environment, and their vulnerability; and

(f) the possible requirement for remedial measures, and their cost.

Relevant hazard characteristics mentioned above can be defined by the following criteria. These are detailed below in sub-paragraphs b. to h.

b. **Composition** - The individual components of waste should be known before assessment of its hazard potential is made. This knowledge, however, is often very difficult (or even impossible in practical terms) to obtain, particularly for solid waste. Nevertheless, good information on waste composition is needed and in many cases, broad composition data will be adequate.

c. **Physical Form** - The physical nature of waste (solid, semi-solid, sludge, liquid) has the potential for acute or long-term environmental hazards. In general, liquid or sludge waste is more liable to cause water pollution problems than is solid waste. Where an inhalation hazard exists, as with asbestos, fibrous waste is inherently more dangerous than is matrix-bond waste, such as asbestos cement.

d. **Quantity** - The quantity of the waste and its recurrent rate of generation are important. The handling and disposal of a few hundred kilograms of a particular waste as an isolated case, may demand a totally different solution to the disposal of similar material generated regularly.

e. **Biological Hazards** - The movement and storage of infective biological materials may present an additional hazard in an emergency.

(1) If a container is broken during transportation;

(a) check label, which lists the contents and the consignor or consignee;

(b) notify consignor or consignee; and

(c) isolate container until expert assistance can be arranged.

(2) If damage occurs to laboratories handling biological hazards, isolate the area until expert assistance is arranged.

f. **Radioactive Hazards** - Radioactive sources are used in industry, medicine and research. The possibility of an accident exists in the workplace and during transport. Radioactive materials are stored and transported in containers designed to keep radiation within safe levels and undamaged containers present no radiation hazard.

g. **Damaged Containers and Spillages** - If there is damage to containers and there is a leak or spill:

(1) contact relevant authorities to arrange for expert assistance for advice, removal or repair;

(2) cordon off area;

(3) do not wash spillages down drains;

(4) Take action to prevent spread of spilled material, by using sand or earth when possible and safe to do so; and

(5) remove any injured person if possible but do not put yourself of others at risk.

h. **Environmental Demands of Disposal Techniques** - As a basic principle, waste should be disposed of so that adverse effects to the welfare of the community are minimised, and in particular, so that:

(1) human health is not threatened and human well-being is not impaired;

(2) livestock, game, other wildlife and fish are not threatened;

(3) water bodies, soil and useful plants are not harmed;

(4) the environment is not harmed by air pollution; and

(5) law and public order are not otherwise threatened or disturbed.

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