# 4. Soil pollution

## 4.1 Solid waste

Solid waste refers here to all non-liquid wastes. In general, Solid waste is all rotting and non-rotting waste in solid or semi-solid form, including but not limited, trash, unwanted compounds, ash or incinerator residues, street waste, dead animals, demolition and construction waste, sanitation, solid or semi-solid commercial and industrial waste. Solid waste can create significant health problems and a very unpleasant living environment if not disposed of safely and appropriately. If not correctly disposed of, waste may provide breeding sites for insect-vectors, pests, snakes and vermin (rats) that increase the likelihood of disease transmission. It may also pollute water sources and the environment.

## 4.2 Associated risks

### 4.2.1 Disease transmission

Decomposing organic waste attracts animals, vermin and flies. Flies may play a major role in the transmission of faecal-oral diseases, particularly where domestic waste contains faeces (often those of children). Rodents may increase the transmission of diseases such as leptospirosis and salmonella, and attract snakes to waste heaps. Solid waste may also provide breeding sites for mosquitoes.

Mosquitoes of the Aedes genus lay eggs in water stored in discarded items such as tins and drums; these are responsible for the spread of dengue and yellow fevers. Such conditions may also attract mosquitoes of the Anopheles genus, which transmit malaria. Mosquitoes of the Culex genus breed in stagnant water with high organic content and transmit micro filariases (Médecins Sans Frontières, 1994), appropriate conditions are likely to arise where leachate from waste enters pooling water. In times of famine or food scarcity, members of the affected population may be attracted to waste heaps to scavenge for food; this is likely to increase the risk of gastro-enteritis, dysentery and other illnesses.

### 4.2.2 Pollution

Poor management of the collection and disposal of solid waste may lead to leachate pollution of surface water or groundwater. This may cause significant problems if the waste contains toxic substances, or if nearby water sources are used for water supplies.

Where large quantities of dry waste are stored in hot climates this may create a fire hazard. Related hazards include smoke pollution and fire threat to buildings and people.

### 4.2.3 Effect on morale

The effect of living in an unhygienic and untidy environment may lead people to become demoralised and less motivated to improve conditions around them. Waste attracts more waste and leads to less hygienic behavior in general.

## 4.3 Sources and types of solid waste

### 4.3.1 Sources of solid waste

In most emergency situations the main sources of solid waste are:

1. Medical centers.
2. Food stores.
3. Feeding centers.
4. Food distribution points.
5. Slaughter areas.
6. Warehouses.
7. Agency premises.
8. Markets.
9. Domestic areas.

Appropriate solid waste management strategies may vary for institutional, communal and domestic sources, depending on types and volumes of waste.

### 4.3.2 Type and quantity of waste

The type and quantity of waste generated in emergency situations varies greatly. The main factors affecting these are:

1. The geographical region (developed or less-developed country or region).
2. Socio-cultural practices and material levels among affected population.
3. Seasonal variations (affecting types of food available).
4. The stage of emergency (volume and composition of waste may change over time).
5. The packaging of food rations.

In general, the volume of waste generated is likely to be small and largely degradable where the population is of rural origin and the food rations supplied are unpackaged dry foodstuffs. Displaced urban populations are more likely to generate larger volumes of non-degradable

waste, especially where packaged food rations are provided.

Guideline values suggest that each person is likely to produce 0.5-1.0 liters of refuse per day with an organic content of 25 to 35 per cent and a moisture content between 10 and 60 per

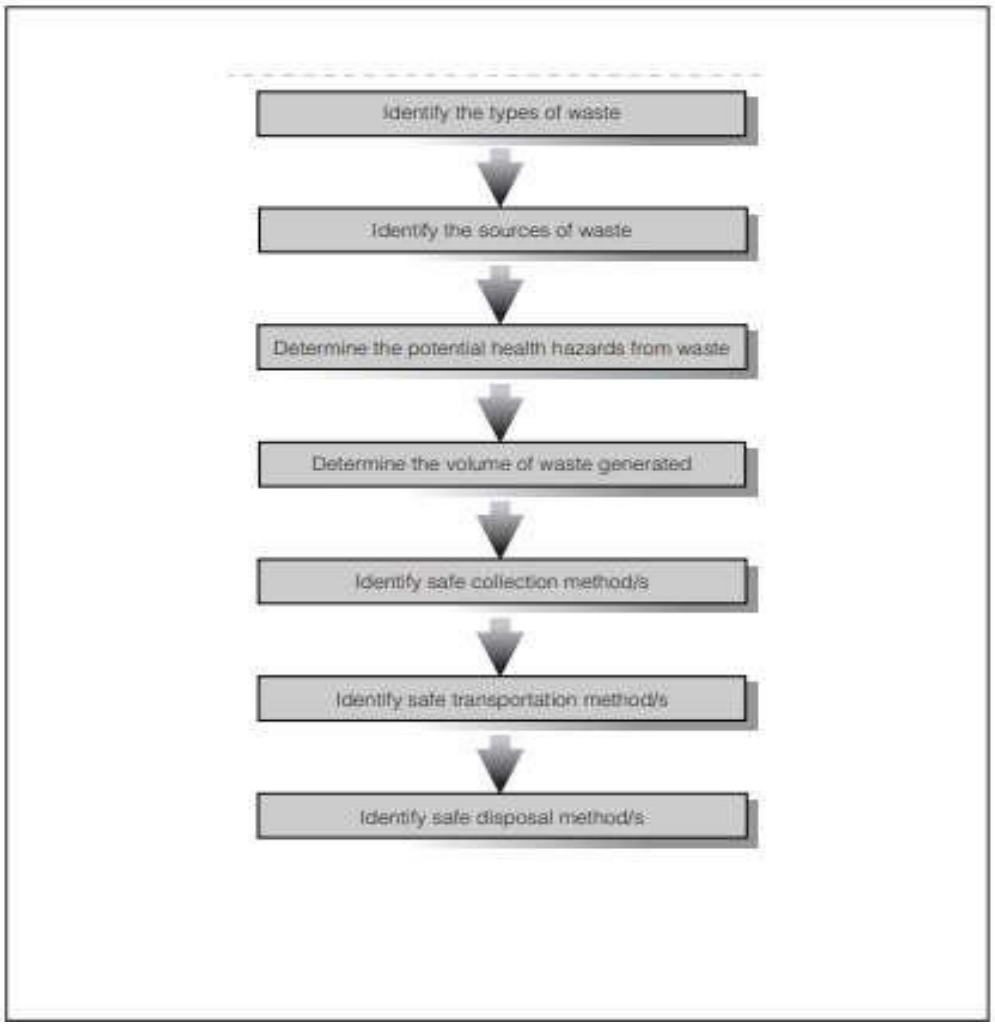
cent (Adams, 1999). However, this is likely to vary greatly and estimates should be made locally.

Different categories of solid waste include:

1. Organic waste: Waste from preparation of food, market places, etc.
2. Combustibles: Paper, wood, dried leaves, packaging for relief items, etc. (high organic and low moisture content).
3. Non-combustibles: Metal, tin cans, bottles, stones, etc.
4. Ashes/dust: Residue from fires used for cooking.
5. Bulky waste: Tree branches, tires, etc.
6. Dead animals: Carcasses of domestic animals and livestock.
7. Hazardous waste: Oil, battery acid, medical waste.
8. Construction waste: Roofing, rubble, broken concrete, etc.

## 4.4 Solid waste management

In order to establish effective solid waste management in the affected area the following process should be used:



## 4.5 Key components of solid waste management

Solid waste management can be divided into five key components:

1. Generation.
2. Storage.
3. Collection.
4. Transportation.
5. Disposal.

### 4.5.1 Generation

Generation of solid waste is the stage at which materials become valueless to the owner and since they have no use for them and require them no longer, they wish to get rid of them. Items which may be valueless to one individual may not necessarily be valueless to another. For example, waste items such as tins and cans may be highly sought after by young children.

### 4.5.2 Storage

Storage is a system for keeping materials after they have been discarded and prior to collection and final disposal. Where on-site disposal systems are implemented, such as where people discard items directly into family pits, storage may not be necessary. In emergency situations, especially in the early stages, it is likely that the affected population will discard domestic waste in poorly defined heaps close to dwelling areas. If this is the case, improved disposal or storage facilities should be provided fairly quickly and these should be located where people are able to use them easily. Improved storage facilities include:

1. Small containers: household containers, plastic bins, etc. Large containers: communal bins, oil drums, etc.
2. Shallow pits.
3. Communal depots: walled or fenced-in areas.

In determining the size, quantity and distribution of storage facilities the number of users, type of waste and maximum walking distance must be considered. The frequency of emptying must also be determined, and it should be ensured that all facilities are reasonably safe from theft or vandalism.

### 4.5.3 Collection

Collection simply refers to how waste is collected for transportation to the final disposal site. Any collection system should be carefully planned to ensure that storage facilities do not become overloaded. Collection intervals and volumes of collected waste must be estimated carefully.

### 4.5.4 Transportation

This is the stage when solid waste is transported to the final disposal site. There are various modes of transport which may be adopted and the chosen method depends upon local availability and the volume of waste to be transported. Types of transportation can be divided into three categories:

1. Human-powered: open hand-cart, hand-cart with bins, wheelbarrow, tricycle.
2. Animal-powered: donkey-drawn cart.
3. Motorized: tractor and trailer, standard truck, tipper-truck.

### 4.5.5 Disposal

The final stage of solid waste management is safe disposal where associated risks are minimized. There are four main methods for the disposal of solid waste:

1. Land application: burial or landfilling.
2. Composting.
3. Burning or incineration.
4. Recycling (resource recovery).

The most common of these is undoubtedly land application, although all four are commonly applied in emergency situations.