Nota: Este documento contiene imágenes en mal estado.

CHAPTER 3

Disaster terminology and phases

The terminology of disaster management has already been introduced in this module. A brief glossary follows to highlight some of these working definitions.

This glossary lists the disaster management terms as used in this text and in the UNDP/UNDRO Disaster Manual. However, consensus does not exist among all disaster management practitioners or academicians regarding these definitions. A standardized and universally accepted glossary would obviously be desirable, but is not likely to exist within the next few years. Consequently, the following definitions represent one effort toward developing a consensus. Users of the DMTP training materials are encouraged to adopt these working definitions for the sake of uniformity and to be tolerant of other groups' definitions.

Disaster management A collective term encompassing all aspects of planning for and responding to disasters, including both pre- and post-disaster activities. It may refer to the management of both the risks and consequences of disasters.

Human-made disasters Disasters or emergency situations where the principal, direct cause(s) are identifiable human actions, deliberate or otherwise. Apart from "technological" and "ecological" disasters, this mainly involves situations in which civilian populations suffer casualties, losses of property, basic services and means of livelihood as a result of war or civil strife, for example. Human-made disasters/emergencies can be of the rapid or slow onset types, and in the case of internal conflict, can lead to "complex emergencies" as well.

An even broader definition of human-made disaster acknowledges that *all* disasters are caused by humans because they have chosen, for whatever reason, to dwell where natural phenomena occurs that result in adverse impacts on people.

Risk The expected losses (lives lost, persons injured, damage to property and disruption of economic activity) due to a particular phenomenon - a function of the probability of particular occurrences and the losses each would cause.

Vulnerability An expression of the extent to which communities, structures, services or geographic area are likely to be damaged or disrupted by the impact of a particular disaster hazard, due to their nature or construction and location (in a disaster-prone area).

The following terms are key to understanding slow onset disasters and their impact on populations.

Population displacements Usually associated with crisis-induced mass migration in which large numbers of people are forced to leave their homes to seek alternative means of survival. Such mass movements normally result from the effects of conflict, severe food shortages or collapse of economic support systems.

Complex emergencies A form of human-made emergency in which the cause of the emergency as well as the assistance to the afflicted are bound by intense levels of political considerations. This sort of emergency is normally associated with the problems of displaced people during times of civil conflict or with people in need caught in areas of conflict.

Phases of a disaster

Disasters can be viewed as a series of phases on a time continuum. Identifying and understanding these phases helps to describe disaster related needs and to conceptualize appropriate disaster management activities.

Rapid onset disasters

The definitions below correspond to the time sequence following the occurrence of a rapid onset disaster. See Figure 3.1.

Relief Phase The period immediately following the occurrence of a sudden disaster (or the late discovery of a neglected/deteriorated slow-onset situation) when exceptional measures have to be taken to meet the survivors' basic needs for shelter, water, food and medical care.

Rehabilitation Actions taken in the aftermath of a disaster to enable basic services to resume functioning, to restore infrastructure, assist victims' self-help efforts to repair dwellings and community facilities, and to facilitate the revival of economic activities (including agriculture).

Reconstruction The permanent reconstruction or replacement of severely damaged physical structures, the full restoration of all services and local infrastructure, and the revitalization of the economy (including agriculture).

Mitigation A collective term used to encompass all actions taken prior to the occurrence of a disaster (pre-disaster measures) including preparedness and long-term risk reduction measures. In practice the most effective time frame to implement mitigation is in the post-disaster stages. (Mitigation has been used by some institutions or authors in a narrower sense, excluding preparedness.)

Preparedness Measures to ensure the readiness and ability of a society to forecast and take precautionary measures in advance of an imminent threat (in cases where advance warnings are possible), and to respond to and cope with the effects of a disaster occurrence by organizing and facilitating timely and effective rescue, relief and other appropriate post-disaster assistance.

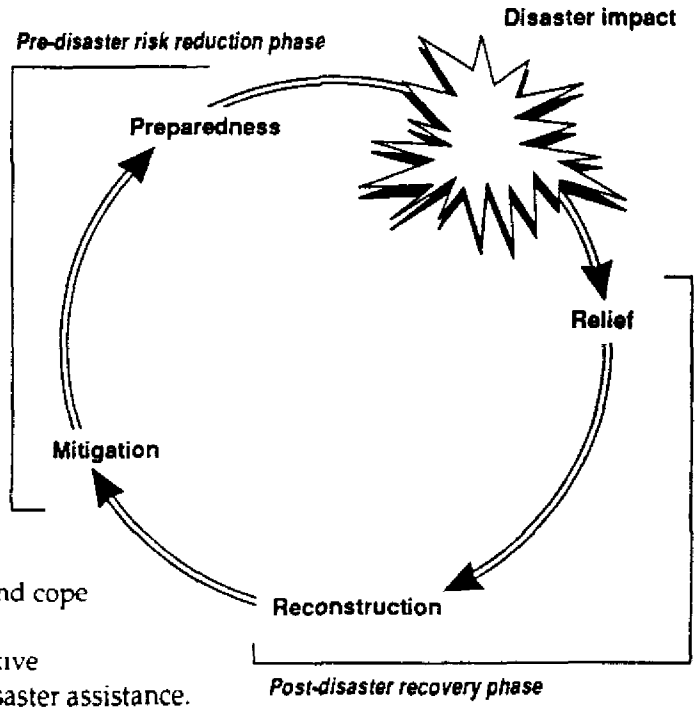


Fig. 3.1.
Rapid onset disaster management continuum

Slow onset disasters

The sequence of a disaster continuum for slow onset disasters is similar in framework but has important distinctions. The following terms and definitions reflect those additions or modifications. See Figure 3.2.

Early Warning The process of monitoring situations in communities or areas known to be vulnerable to slow onset hazards. For example, famine early warning may be reflected in such indicators as drought, livestock sales, or changes in economic conditions. The purpose of early warning is to enable remedial measures to be initiated

Emergency Phase The period during which extraordinary, emergency measures have to be taken. Special emergency procedures and authorities may be applied to support human needs, to sustain livelihoods, and to protect property to avoid the onset of disaster. This phase can, therefore, encompass pre-disaster, disaster alert, disaster relief and recovery periods. An emergency phase may be quite extensive, as in a slow onset disaster such as a famine. It can also be relatively short-lived, such as after an earthquake.

Rehabilitation After a slow onset disaster, attention must also be given to the issues of resettlement or returnee programmes, particularly for people who have been displaced for reasons arising out of conflict or economic collapse.

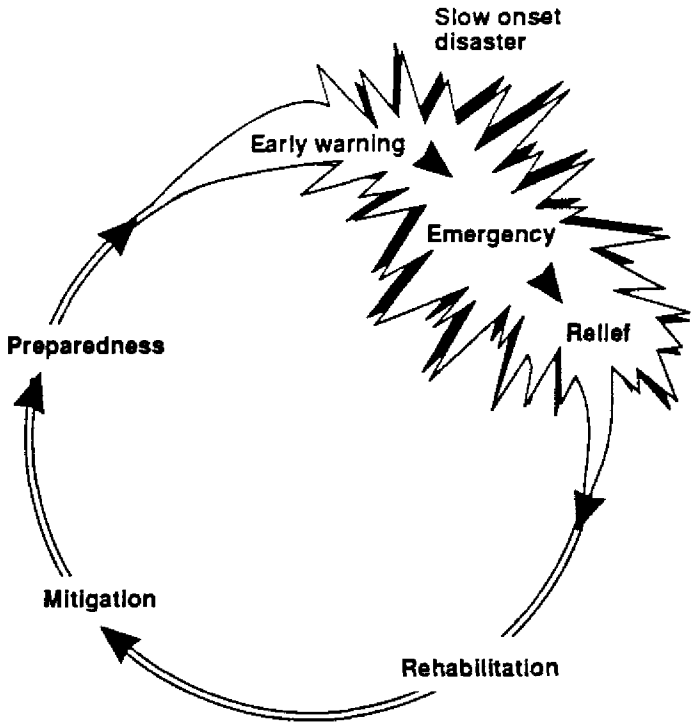


Fig 3.2.
Slow onset disaster management continuum

CHAPTER 4

Overview of hazard and disaster types

In earlier chapters, the discussion about disasters and emergencies resulting from natural and human-made hazards has been developed in general terms. However, each hazard has its own characteristics. To understand the significance and implications of a particular type of disaster we must have a basic understanding about the nature, causes and effects of each hazard type.

The list of hazard types is very long. Many occur infrequently or impact a very small population. Other hazards, such as severe snowstorms, often occur in areas that are prepared to deal with them and seldom become disasters. However, from the perspective of a disaster victim it is not particularly useful to distinguish between minor and major disasters. Some disasters are now of limited interest to the international community. These include avalanches, fog, frost, hail, lightning, snowstorms, and tornadoes. The international interest is less for these hazards because their impacts affect relatively few people and the countries in which they normally occur have sufficient resources and systems in place to respond without external assistance.

There are several hazard types for which there is widespread concern. They can be categorized as follows:

Sudden onset disasters — earthquakes, tsunamis, floods, tropical storms, volcanic eruptions, landslides

Slow onset disasters — drought, famine, environmental degradation, desertification, deforestation, pest infestation, (floods can also be slow onset)

Industrial/technological — system failures/accidents, spillages, explosions, fires

Wars and civil strife — armed agression, insurgency, terrorism, and other actions leading to displaced persons and refugees

Epidemics — water and/or food-borne diseases, person-to-person diseases (contact and respiratory spread), vector-borne diseases and complications from wounds

These hazard types are highlighted in this training material. The international community has an interest in them because they frequently affect large populations and the need for outside assistance is evident. Many disasters are themselves international events and have an impact on entire regions.

A brief description of each hazard type is presented below. It will be your responsibility to determine which hazards are of concern to your country and then to read the material about them.

Q. *Which hazards are of concern to your country?*

A. List the four hazards in order of their severity of impact.

1. _____

2. _____

3. _____

4. _____

Comments: _____

_____

_____

_____

_____

Now learn more about each of these hazards in the material that follows.

Earthquakes and tsunamis

Volcanic eruptions

Landslides

Tropical storms

Floods and storm surges

Droughts

War and civil conflicts causing population displacements

Characteristics of particular hazards and disasters[1]

This section provides, for each of the hazard or disaster types listed, an indication of their general characteristics and the kinds of counter-disaster measures which may be required. You should also note that disasters have collateral or direct effects that may endure even after a particular type of disaster has been directly addressed. The problem of displaced people after a sudden onset disaster, such as a cyclone, may continue well after immediate relief, recovery and even rehabilitation programmes have been implemented. Such collateral impact can turn a seemingly rapid onset disaster into a continuing emergency situation.

A further issue that must be borne in mind concerns the consequence of a sudden onset disaster when relief assistance is stymied because civil conflict makes access impossible. In other words, the perverse permutations are many. Nevertheless, the basic characteristics of certain types of disasters and emergencies and appropriate response measures can be structured as follows:

- **Causal phenomena**
- **General characteristics**
- **Predictability**
- **Factors contributing to vulnerability**
- **Typical effects**
- **Possible risk reduction measures**
- **Specific preparedness measures**
- **Typical post-disaster needs**

Different types of disasters have characteristic effects while retaining unique aspects. Risk reduction and preparedness measures, and emergency and post-disaster response can all be facilitated by some "rules of thumb" — as outlined in this section — but must also be tailored to the specificity of local conditions.

Remember that:

(a) where different types of disaster occur in combination — e.g. floods accompanying tropical storms - the combined effects must be considered; and where one disaster leads to another (for example a famine leading to civil strife) the compound effects must be anticipated

(b) the severity of the actual impact on the society depends on human and organizational factors as well as natural and topographical ones.

[1] The following material on hazards and population displacements is drawn from the **UNDP/UNDRO Disaster Manual.**

Kakhk, Iran

The results of a 7.1 Richter Scale Earthquake which killed 12,100 people.

From *Forces of Nature*, Sir Vivian Fuchs.

Camera Press (photo: Delaney/Hacken)

Earthquakes and Tsunami

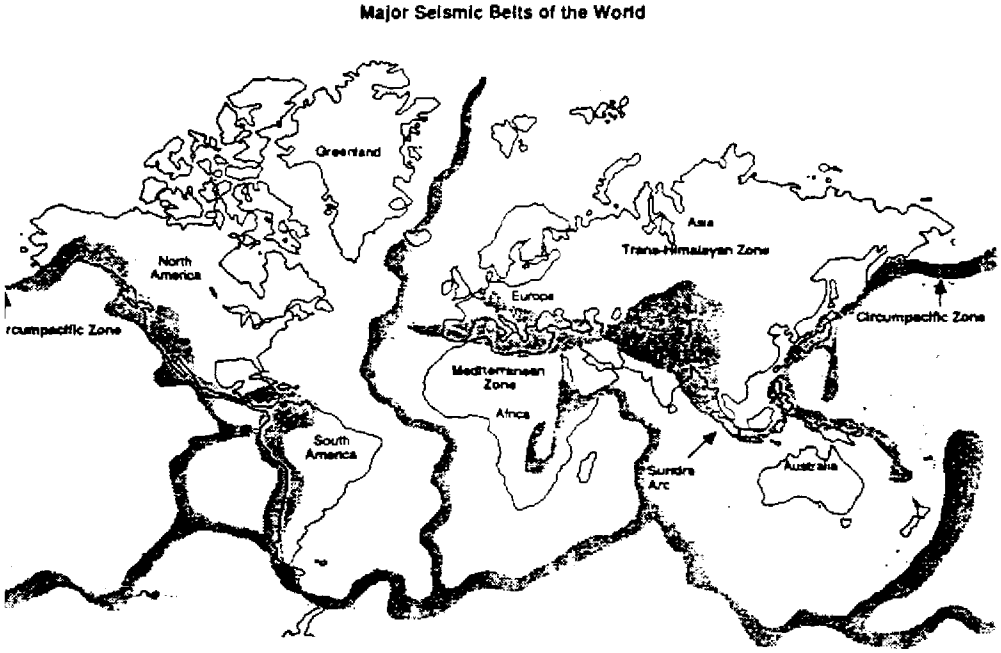
Causal phenomena

Movements in the earth's crust resulting, on the surface, in tremors (ground shaking), liquefaction (upward movement of moisture creating quicksand-like soil condition), ground failure, ground rupture (cracks and horizontal displacement). Earthquakes tend to recur in areas where stresses build up due to the movement of tectonic plates. They occur most frequently in zones around the Pacific Ocean and through the Mediterranean-Himalayan belt, but can occur in some other areas as well.

Earthquakes (and volcanic eruptions) occurring on or below the ocean floor can cause seismic sea waves called tsunami (also popularly known as tidal waves).

Predictability

EARTHQUAKES The areas in which earthquakes are likely to occur are fairly well known, but there has been little success in predicting when they will take place. It is possible to predict the areas where damage would be greatest, should an earthquake occur.



Major seismic belts of the world.
Source: U.S.G.S.

TSUNAMIS If there is a system to monitor and communicate seismic and tidal information quickly it is possible to predict which coastal areas will be hit, and when. This can be done rapidly after an earthquake has been detected, and depending on its distance to a a coast, allow for several hours of warning. In the Pacific, where tsunamis are most common, a Pacific Warning Centre (in Honolulu) and a network of regional warning centres has been established.

General characteristics

EARTHQUAKES Sudden, with the likelihood of after-shocks continuing over a period of some hours (or even days) for large earthquakes occurring at depths less than 15 km. Earthquakes in inhabited areas cause damage by ground vibration (the most prevalent and damaging), surface faulting, tectonic uplifts and subsidence, liquefaction, and landslides.

TSUNAMI can displace a large mass of water, creating a wave which, in deep ocean, may travel at speeds of up to 800 km/hour over large distances. In shallow water the speed decreases, and a steep front as high as 30m can be created. Nearshore bottom topography and coastal configurations greatly affect the characteristics of the tsunami from place to place. On low lying coasts there will often be a train of up to 10 waves at intervals of 20-30 minutes.

Factors contributing to vulnerability

EARTHQUAKES Siting of human settlements, industrial plants, dams and infrastructure in seismic areas, and especially on poorly consolidated soils (which amplify ground vibrations), on ground prone to slide, or along fault lines. The resistance of individual structures (buildings, bridges, dams, etc.) to ground motion depends on the design and quality of construction, type of materials, etc.

TSUNAMI Siting of settlements and economic assets in low-lying coastal areas likely to be affected by tsunamis.

Typical adverse effects

Physical damage

EARTHQUAKES Damage and destruction of human settlements, buildings, structures, and infrastructure especially bridges, elevated roads, railways, water-towers, water treatment facilities, utility lines, pipelines, electrical generating facilities and transformer stations. After-shocks can cause much damage to already weakened edifices.

Buildings are not only vulnerable to ground shaking due to "near-field" earthquakes, but also to low frequency resonance caused by distant earthquakes when these are sufficiently strong.

Significant secondary effects: fires; dam failure; landslides which by blocking waterways can also cause flooding; damage to facilities using/manufacturing dangerous materials; breakdown of communications facilities.

TSUNAMI Tsunami-induced currents, including the "drag" of water returning to the sea, have led to the erosion of foundations, the displacement of structures, the collapse of bridges and sea walls. Tsunami wave forces demolish frame buildings and damage shipping and port facilities. Tsunamis can cause heavy loss of life among exposed coastal populations. Heavy floating debris (cars, boats, etc.) cause further damage.

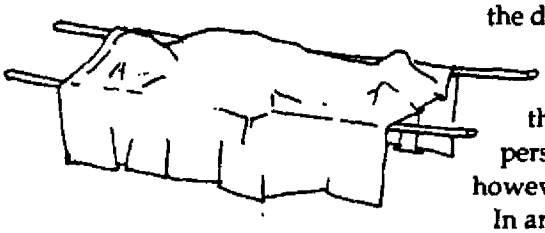
Casualties

The casualty rate is often high, especially when earthquakes occur in areas:

(a) Of high population density and particularly when streets between buildings are narrow, buildings themselves not quake-proof, and/or the ground is sloping and unstable; or

(b) Where adobe or dry-stone construction is common with heavy upper floors and roofs.

Casualty rates are, in general, higher when quakes occur at night than during the day. They generally decrease with distance from the epicenter.



As a very rough rule of thumb, there are three times as many injured survivors as persons killed. The proportion of dead may, however, be higher if there are major landslides, etc. In areas where houses are of light-weight construction, especially with wood frames, casualties are generally very much lower and quakes may occur regularly with no serious, direct effects on human populations.

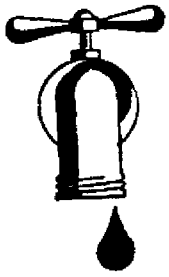
Public health

Probably few problems, apart from fracture injuries, ***unless***:

- there is secondary flooding (see under floods);
- water supplies are disrupted and contaminated water is used (although no significant outbreaks of water-borne diseases have apparently been documented following an earthquake); or
- people are concentrated into high density camps.

An earthquake in itself is unlikely to cause any new outbreaks, but endemic diseases will persist and may become virulent if control measures break down and insanitary conditions develop.

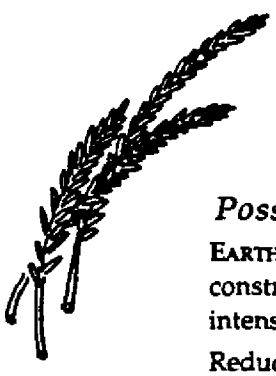
Water supply



Severe problems are likely because:

- Piped (municipal) water systems may be severely damaged and/or become contaminated — the latter especially if sewerage systems have also been damaged.
- Reservoir dams may be broken.
- Open wells may be blocked by debris.
- Earthquakes can cause changes in level in the water table with the possible drying up of wells and surface springs.

Food Supplies



Except where earthquakes give rise to flooding or tidal waves, there is usually little loss of either food stocks or standing crops. Distribution and marketing systems may, however, be disrupted and irrigation works be damaged.

Possible risk reduction measures

EARTHQUAKE Land use and building regulations specifying the permitted types of construction in a specific location. For each zone with a specified earthquake intensity, certain types of buildings can be prohibited or encouraged.

Reduction of structural vulnerability may be achieved through building configuration and design, uniform distribution of rigidity, reinforcement at points of stress and in foundations, and assured quality of construction materials and workmanship. Structural vulnerability can be reduced even when cheap traditional materials, such as adobe, are used.

TSUNAMI The force of a tsunami is difficult, if not impossible to control. Hazardous areas, usually limited to no more than two kilometers inland, can be delineated, and certain types of structures sited in consequence. Breakwaters, docks, shore facilities, etc., can be designed to deflect and up to certain levels resist the force of a tsunami.

Specific preparedness measures

EARTHQUAKES Community education on the causes and characteristics of earthquakes, and actions to be taken if there is one.

Contingency plans for logistics, communications, search and rescue, medical care, emergency food (for short-term feeding) and shelter materials.

Flood preparedness plans should be drawn up in seismic areas where there are dams, or waterways susceptible to being blocked.

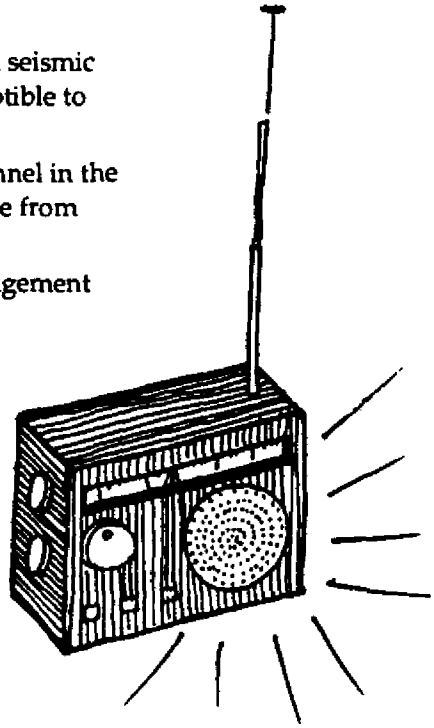
Training of search and rescue and medical personnel in the specific problems of finding and extracting people from under collapsed buildings.

Ensuring the rapid availability (possibly by arrangement with sources of international assistance) of detection equipment and search dogs.

TSUNAMI Community education on the causes and characteristics of Tsunami, and of the action to be taken on warning.

Tsunami warning system for coastal populations including fishermen, ships docked and at anchor, etc.

Evacuation plans.



Typical post-disaster assistance needs

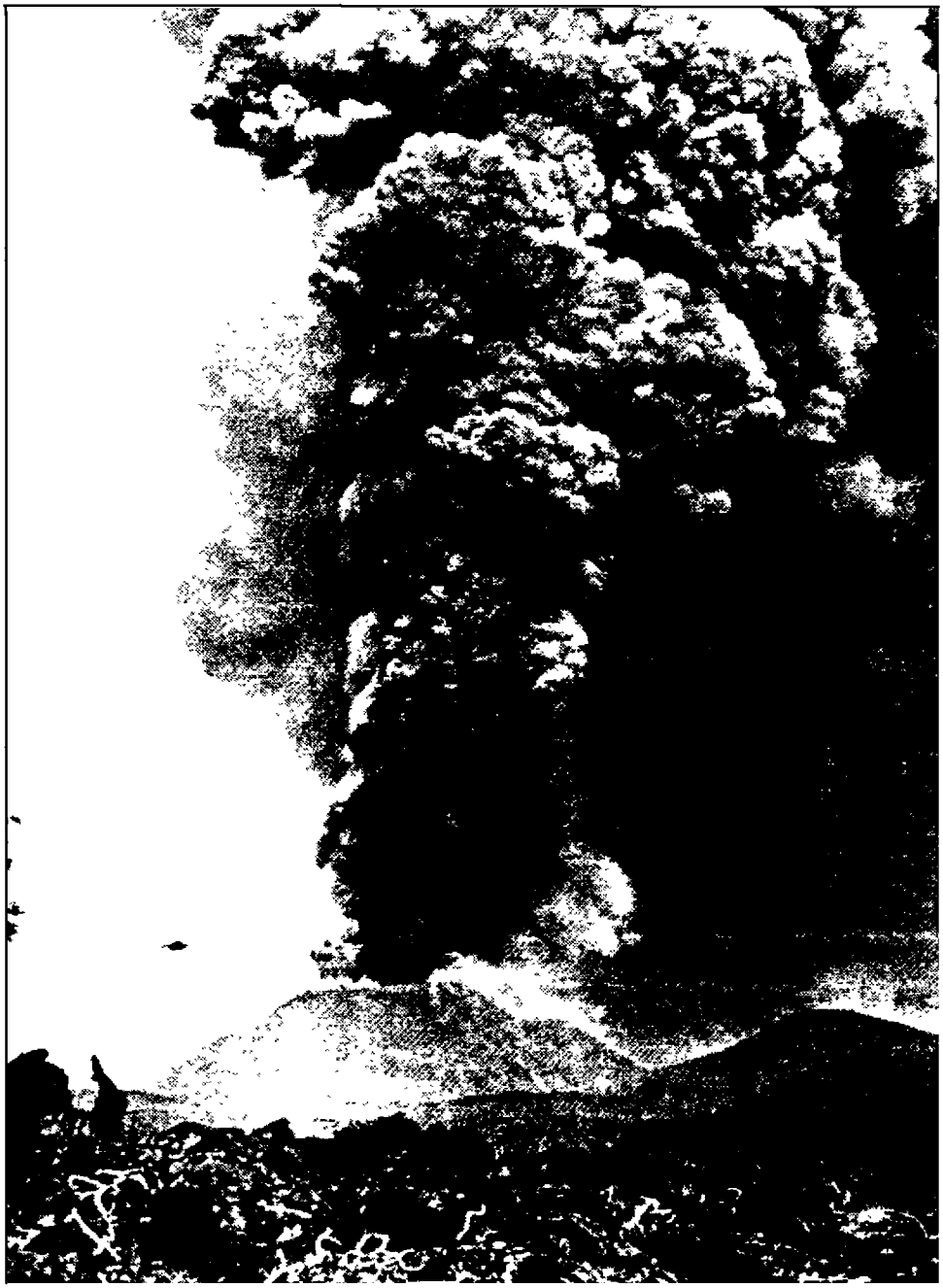
Search and rescue, possibly (especially in urban areas) requiring heavy and other special equipment and trained teams (in first 48 hours); traffic and crowd control; fire control; surgical medical care (in first 72 hours); transport for disaster assessment; reestablishment of communications; identification/provision of potable water; emergency shelter materials (such as plastic sheeting).

Resources typically *needed* from foreign sources

- Cash to finance local purchases (of food, utensils, shelter materials, etc.), the contracting of transport and other services, and providing credit for local reconstruction and economic rehabilitation efforts.
- Specialized search and rescue teams (provided they can be operational within first 48 hours).

Resources typically *not needed* from foreign sources

- Search and rescue teams and medical teams arriving more than 48 hours after the occurrence.
- Large quantities of food aid.



Kamchatka, U.S.S.R.
Great Tolbachik eruption in Kamchatka in 1975
From N P Smelov, Institute of Volcanology, Kamchatka, U S S R

Volcanic Eruptions

Causal Phenomena

The eruption onto the earth's surface of molten material (magma), ash and gas. The volume and rate of the eruption is determined mainly by the amount and rate of effervescence of gases, and the viscosity of the magma. Eruptions vary widely in magnitude and duration, not only from one volcano to the another, but even at the same volcano. The frequency of eruption also varies, from volcanoes which are in almost continual eruption to those which erupt only at intervals of hundreds, or even thousands of years.

General characteristics

The chief threats to life and property are due to: ash falls, pyroclastic flows (horizontal blasts of gas containing ash and larger fragments in suspension), mudflows and tsunami. Volcanic earthquakes frequently precede or accompany eruptions but by themselves are rarely of sufficient magnitude or intensity to cause severe damage.

Almost every volcano emits ash. The ***ash falls*** may occur simultaneously or alternately with other eruptive phenomena, and vary widely in volume and intensity, but, while ash may fall over a wide area, it generally totals less than one cubic kilometer in volume.

Some eruptions cause ***pyroclastic flows***, the most dangerous of volcanic phenomena. The flows vary widely in volume, duration, and composition. They move very fast (several hundred kilometers per hour), and are very hot (up to 1,000°C). They last for a few minutes to a few tens of minutes, but may be repeated at irregular intervals during eruptions and in extreme cases may continue intermittently for several years. They will typically affect and deposit material over a distance of several kilometers.

After pyroclastic flows, ***mudflows*** (sometimes called "lahars"), are the most dangerous of volcanic phenomena and are most common on volcanoes in regions of high rainfall. They are usually caused by heavy rain falling on ash and loose volcanic material, creating a dense but fluid mixture, like wet concrete, which flows easily downhill at speeds sometimes exceeding 100 km/hour. They can also be triggered by any condition (not associated with an eruption) that causes large amounts of water to mix with loose material on the slopes of a volcano. This may occur following the release of water from a crater lake, or the rapid melting of snow or ice. Mudflows which can be hot (up to 100°C) or cold, uproot and destroy virtually everything in their path, depositing materials tens of meters thick. In certain cases, they have buried entire towns. They silt up waterways, causing floods and changes in river courses.

Lava flows and ***volcanic gases*** are less dangerous volcanic hazards. Lava flows are formed by molten rock issuing non-explosively and flowing over surrounding land at speeds ranging from a few meters per hour to tens of kilometers per hour; they will destroy what is in their path, but their rate of movement is usually slow enough for people and animals to move to safety. Volcanic gases are emitted in every eruption, and may also be emitted by a volcano during periods of quiescence. Several volcanic gases are lethal, but are rarely the direct cause of death or injury.

Predictability

If the history of a volcano has been thoroughly studied and if scientific measurements are made systematically during periods of dormancy as well as during eruptions, it will usually be possible to predict its behavior well enough to make decisions on protective measures. Advance warning . . . ((*to be completed in next version,*)

Factors contributing to vulnerability

Siting human settlements and activities close to a volcano, particularly in the direction of prevalent winds, in the path of possible channels for mud and lava flows, or close to waterways likely to flood because of silting up.

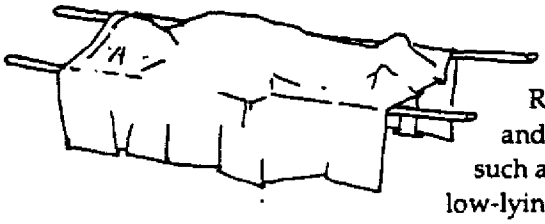
Roof designs which do not prevent or resist ash accumulation.

Typical adverse effects

Casualties and health

Deaths from pyroclastic and mud flows, and to a much lesser extent from lava flows and toxic gases.

Injuries from impact of rock fragments or lava lumps.



Skin burns and burns to breathing passages and lungs, resulting from exposure to steam and hot dust clouds.

Respiratory difficulties for people and animals due to ashfall and toxic gases. (Non-toxic gases of densities greater than air, such as carbon dioxide can be dangerous when they collect in low-lying places).

Occasionally, contaminated water supplies due to ash containing toxic chemicals such as fluorine.

Settlements, infrastructure and agriculture

Complete destruction of vegetation, agricultural land, human settlements, structures, bridges, roads, etc. in the path of pyroclastic, mud or lava flows.

Collapse of structures under the weight of ash (up to 1 ton/m^3 when wet).

Fire caused by red-hot ash.

Flooding due to waterways filling up with volcanic deposits; possible change in river courses.

Destruction of irrigation systems from ashfalls and accumulated volcanic debris.

Crops and food supplies

Crops in the path of mud, pyroclastic or lava flows will be destroyed and agricultural land exposed to ash fall may be temporarily unusable.

Occasionally, grazing lands may be poisoned by ash containing toxic chemicals such as fluorine.

Secondary flooding will compound the effects.

Possible risk reduction measures

Placing human settlements and activities at a reasonable distance from any active volcano—avoiding the direction of the prevailing wind, possible channels for pyroclastic, mud and lava flows, and waterways likely to flood because of silting up.

Roof design and construction to prevent/resist ash accumulation. Blast resistant shelters for volcano observatories and essential service facilities which have to be placed in the vicinity.

Construction of protective works, lava barriers and "catch" dams.

Specific preparedness measures

Scientific monitoring of the volcano, and establishment of warning systems for local populations

Preparation of an emergency evacuation plan, specific to each active volcano, identifying safe refuge zones, evacuation routes, assembly points, etc.

Typical post-disaster assistance needs

Typically needed from local sources: initially, assistance in evacuation and search and rescue, short-term feeding and shelter; subsequently, relocation assistance, credit, assistance to agriculture and small business.

Resources typically *needed* from foreign sources

Initially, cash; subsequently, relocation assistance, credit and financial assistance; assistance to agriculture and small business.

Resources typically *not needed* from foreign sources

(to be completed in next version)

Hong Kong

Hillside failure.

From *Geological Hazards*, Bolt

Fugro, Inc. Long Beach

Landslides

Causal phenomena

Landslides occur as a result of changes (sudden or gradual) in the composition, structure, hydrology or vegetation on a slope. These changes can be due to:

- vibrations (earthquakes, blasting, machinery, traffic, even thunder);
- removal of lateral support (erosion, previous slope failure, excavation/ construction, deforestation/loss of stabilizing vegetation);
- loading (weight of rain/hail/snow, accumulation of rock/volcanic materials, rock/ore/waste piles, weight of structures and vegetation);
- heavy rainfall, rises in groundwater levels.

Landslides in dense urban areas are often induced by human actions:

- interuption of water courses; water table changes
- new construction which involves cut and fill and disrupts slope stability
- perhaps the wieght of structures (unproven as yet)

Predictability

When good historical information is available on geologic, geomorphic and hydrologic conditions, it is possible to estimate the frequency of occurrence, extent and consequences of landslides. While it is not possible to predict actual occurrences, it is possible to anticipate situations of high risk—for example when high rainfall intensities are forecast.

General characteristics

Landslides are frequently experienced as secondary effects of heavy storms, earthquakes and volcanic eruptions. They can be falls of rock or other materials from steep slopes and scarps, major slides of materials, and mudflows which can move rapidly over distances of several miles.

Typical adverse effects

Destruction of settlements and infrastructure in the path of the landslide.
Blockage of lines of communication and water ways (creating a flood risk).

Possible risk reduction measures

Concrete retaining walls, large-scale engineering works, improved drainage, slope modification.

Land use controls to avoid placing buildings on or below slopes which are identified to be hazardous. It is not considered feasible to strengthen buildings against landslides.

Specific preparedness measures

Community education on causes and effects of landslides, and on climatic conditions likely to increase the risk of landslides and of action to take should these conditions exist.

Monitoring and warning mechanisms established for populations in the event of heavy rains.

Typical post-disaster assistance needs

Search and rescue, likely to require earth removal equipment.
Emergency shelter.

Cyclones
Indian Ocean

Hurricanes
North Atlantic, Carribean, South Pacific

Typhoons
North and West Pacific

US National Oceanic and Atmospheric Administration