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ACKNOWLEDGEMENT

The Emergency Preparedness and Response Manual is a product of patience, hardwork, dedication, research and perseverance of many individuals.

It has been actively developed for the past two years and was made possible through the collaboration of Filipino and expatriate MSF team in the implementation of emergency preparedness and relief programs. This experience gave the opportunity to implement theories and principles learned before. Mistakes were made. Strengths and weaknesses were assessed from which valuable lessons and insights were consolidated.

Deepest gratitude are extended to those who participated and gave support for the development of the EPRP Manual for the Philippines.

Above all, heartfelt thanks to all survivors of volcanic eruption, typhoons, flood and lahar for being involved as volunteers and partners in the planning and implementation of all relief services.

The first edition of the manual realized last January 1994 during a symbolic anniversary, ten years after the first emergency operation in the Philippines in 1984. (See Annex 1 for Summary of MSF's Emergency Assistance in the Philippines).

After EROP - IV, revisions were made based on the realities in the field. Thus, this is the second edition of the manual.

MARAMING SALAMAT PO!

MSF BELGIUM/HOLLAND IN THE PHILIPPINES
April 1995

LIST OF ANNEXES

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LIST OF ABBREVIATION

BHW	Barangay Health Worker
CDRN	Citizen's Disaster Response Network
CHW	Community Health Workers
COMMED	Community Medicine Development Foundation
DND	Department of National Defense
DOH	Department of Health
DSM	Dry Skimmed Milk
DSWD	Department of Social Welfare and Development
EEC	European Economic Community
EPRP	Emergency Preparedness and Response Program
GO	Government Organization
IADRN	Inter-Agency Disaster Relief Network
ID	Identification
Kcal	Kilo Calorie
LPG	Liquified Petroleum Gas
MOA	Memorandum of Agreement
NDCC	National Disaster Coordinating Council
NDF	National Democratic Front
NGO	Non-Government Organization
OCD	Office of Civil Defense
ONCC	Office of Northern Cultural Communities
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PBSP	Philippine Business for Social Progress
PDCC	Provincial Disaster Coordinating Council
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PNRC	Philippine National Red Cross
SFP	Supplementary Feeding Program
UNDRO	United Nations Disaster Relief Organization
UNICEF	United Nations International Children's Fund
WHO	World Health Organization

Definition of Terms

Disaster

A serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources.

Disaster Response

Aims of emergency and post-disaster assistance:

- ensure survival of maximum possible number of victims,
- re-establish self-sufficiency and essential services ASAP
- repair or replace damaged infrastructure and economy

Disaster Impact

Pre-disaster risk reduction phase

Preparedness

Relief

Mitigation

Rehabilitation

Reconstruction

Response phase

Disaster Preparedness

Disaster preparedness minimizes the adverse effects of a hazard through effective readiness measures to expedite emergency action, rehabilitation and recovery. It ensures the timely, appropriate and effective delivery of relief and assistance following a disaster.

Passive aspects of disaster preparedness include:

- the preparation of disaster manuals
- stockpiling of relief goods
- the development of computer lists of resources and personnel

Active disaster preparedness includes:

- the development of comprehensive response plans
- the monitoring of hazard threats
- the training of emergency personnel and of members of the communities at risk.

Disaster Preparedness Framework		
Vulnerability Assessment	Planning	Institutional Framework
Information Systems	Resource Base	Warning Systems
Response Mechanisms	Public Education amd Training	Rehearsals

Disaster Response Activities

1. Warning

2. Evacuation/migration

3. Search and rescue

4. Assessment

5. Emergency relief
   - health
   - food
   - water and sanitation
   - shelter
   - social services

6. Logistics and supply

7. Communication and information management

8. Survivor response and coping

9. Security

10. Emergency operations management and coordination

11. Expedite rehabilitation and reconstruction

INTRODUCTION

Note on the April 1995 edition

After the Emergency Relief Operation in Pinatubo last September 1994 up to January 1995, it was observed that the manual needs to be updated particularly on the logistics side. For example the plan and estimate for 1 latrine, radio frequency, directory of contacts, etc. Hence, the original manual dated January 1994, was studied and revised. However, this edition still retains the general concept and contents of the previous manual.

The MSF Emergency Preparedness and Response Manual

The EPRP Manual has been prepared as a step in achieving a state of preparedness in providing disaster assistance. It is true that there are other guidelines developed by other agencies, thus, it is important to gather, organize, revise and adapt to the Philippine setting all the relevant and practical documents. The objectives of the manual are as follows:

1. To help/guide field workers in the implementation of preparedness and emergency relief programs;

2. To serve as a training manual/reference for staff development activities;

3. To orient MSF volunteers and staff of other agencies concerning the emergency preparedness and response program in the Philippines.

This manual is meant to be used by MSF field personnel and volunteers as a guide in the implementation of relief operations. It can also be shared to relief and health workers of other agencies, government or non-government involved in disaster response.

The manual focuses on activities and programs before and during an emergency phase of a disaster. The mitigation, rehabilitation and reconstruction phases are not discussed.

The guidelines present the processes in the implementation of different activities and programs adapted to the Philippine situation. It assigns duties and responsibilities and sets guidelines in the conduct of emergency relief operations. All the guidelines are subject to revision based on actual MSF experience in the field. Practical problems and recommendations are identified after each relief operation and to be consolidated and included in the manual.

Method of Presentation

The manual is divided into 7 chapters to facilitate the flow of discussion and to organize the different topics into general headings.

Chapter 1 - Philippine Disaster Scenario

The first chapter presents the situation of the Philippines. It shows how vulnerable the country is to both natural and human-made disasters. Past experiences of emergency programs particularly the Pinatubo are discussed. This part provides a rationale for the operationalization of an Emergency Preparedness and Response Program (EPRP) in the country.

Chapter 2 - Emergency Preparedness and Response Program

The objectives of the EPRP are presented in this chapter. Readings on the relationship of the MSF's EPRP to government and non-government agencies are included to provide a perspective of the strategies and approach to be used in the implementation of the program.

Chapter 3 - MSF Standard Operational Procedures During Emergencies

This chapter discusses standard operational procedures implemented by MSF in the Philippines. This, together with chapter 4, is the main content of the manual. The organization for emergency relief operations is presented to identify duties and responsibilities, plans of action for the implementation of disaster preparedness and response program.

Chapter 4 - Technical Section

Chapter 4, the technical section of the manual provides guidelines for planning and implementation of the standard services MSF provide in times of emergency. The chapter is divided into: health services, water works, sanitation, nutrition programs, and logistics.

Chapter 5 - Overview of Government Operations

An overview of government operations during disasters is included to provide a perspective of how they provide disaster assistance. Duties and responsibilities of each line agency is also presented to determine who to contact or coordinate with regarding particular matters.

Chapter 6 - Directory of Partners

Directory of agencies involved in disaster response, government and non-government, is necessary in a manual. Potential suppliers (with previous MSF contract) of equipments, materials, medicines, and shelter materials are included in this chapter to facilitate the procurement process.

Chapter 7 - Maps

Maps provide valuable assistance during emergencies. This manual includes only the areas at high risk of disasters. Maps focusing on hazards like the lahar and flood in Central Luzon are also included.

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Chapter 1

PHILIPPINE DISASTER SCENARIO

1.1 NATURAL DISASTERS IN THE PHILIPPINES: THE LAST DECADE

Though often pictured as a tropical paradise in the Western media, the Philippine archipelago is also a frequent victim of nature's excess. Its 7,107 islands are riddled with over 200 volcanoes, 21 of them active; it is criss-crossed by seismically-active fault lines stretching along its length; and its shores are visited by an average of 19 tropical cyclones every year.

The annual procession of typhoons alone account for the wholesale loss of lives and property. Over the last ten years, from 1981 to 1990, the National Disaster Coordinating Council (NDCC) recorded a total of 6,021 persons killed, over seven million homeless and an estimated Pesos 45.96 billion worth of property destroyed.

Towards the end of the decade, in 1988, a particularly destructive series of typhoons were claimed by storm surges rather than by winds. The surges occurred when the approaching storm's powerful winds caused the ocean water to pile up against the coastline.

The Philippines' long stretches of shoreline are also vulnerable to both foreign and locally-generated "tsunami". These large sea waves are created by underwater or nearshore earthquakes or volcanic eruption.

In 1989, the conditions swung to the other extreme. The typhoon season was over earlier than usual, and by December that year, the drought had set in completely. It lasted for over five months, spreading to 36 provinces in all 12 regions of the country.

The 1989 drought hit during the second cropping season, considered the main crop of the year, destroying Pesos 3.386 billion worth of produce. This caused serious cuts in food production which resulted in localized food shortages. Over one million people were affected, particularly in the rural areas.

The year that followed was even more catastrophic. The new decade brought with it the drought; and what the drought spared that year, the earthquakes did not. A series of strong tremors shook the main islands of Luzon, Visayas and Mindanao, leaving in its wake 1,298 dead; 1,233,788 homeless, and an estimated Pesos 12.45 billion worth of property destroyed. The NDCC recorded three major earthquakes; one which hit both Region 7 and Region 10 on February 8, another in Region 6 on June 14 of the same year and finally the July 16 quake which laid waste Northern Luzon, killing 1,283 persons with 321 still missing.

In Northern Luzon, the damage caused by these quakes was aggravated by continuous monsoon rains and typhoons. The combined effect of the rains, flash floods and after shocks resulted in

numerous landslides that isolated villages and communities in the affected areas. With trade and all services cut off, these communities soon succumbed to food shortages and outbreaks of disease. Since transportation and communications to these communities were also disabled, there was little hope of getting emergency relief assistance from the outside.

The following is a compilation by the Office of Civil Defense (OCD) of the average annual damages caused by natural disasters over a 17 year period from 1970 to 1986:

AVERAGE DAMAGES CAUSED BY NATURAL DISASTERS (1970 - 1986)

NATURAL DISASTERS	HUMAN DAMAGE			PROPERTY DAMAGE				Average Frequency per year
	Dead	Missing	Injured	Agri.	Govern.	Private	TOTAL	
Typhoon	403.80	193.30	638.00	634.137	356.102	243.377	1,233.619	21
Flood	39.18	16.60	904.00	9.357	18.563	5.839	33.759	0.69
Earthquake	5.30	0.00	13.70	0.000	0.000	1.403	1.403	0.25
Tornado	1.60	0.00	9.20	0.000	0.000	0.721	0.721	0.69
Landslide	5.20	0.00	6.00	0.000	0.000	0.009	0.009	0.44
Storm Surge	24.50	6.20	70.70	19.363	4.337	0.003	23.703	0.19
Volcanic Eruption	0.00	0.00	0.00	2.750	1.310	0.000	4.060	0.19
Tsunami	237.00	1121.00	577.50	0.128	11.432	3.870	15.430	0.06
Drought	0.00	0.00	0.00	47.696	0.000	0.000	47.696	0.13

The Pinatubo Experience

Exactly eleven months after the killer earthquake hit Northern Luzon, on June 16, 1991, another disaster struck. Mt. Pinatubo, a dormant volcano some twenty kilometers off Angeles City in Pampanga, erupted after six hundred years of silence. It spewed out seven cubic kilometers of ashes, rocks and volcanic debris in an explosion so violent that the volcano caved in on itself.

Hardest hit was Central Luzon, considered the rice bowl of the Philippines. The ashfall that resulted from this eruption immediately covered towns and villages in the provinces of Pampanga, Tarlac and Zambales.

For weeks, the pyroclastic materials from the eruption accumulated around the slopes of the volcano. But in the days that followed, heavy monsoon rains caused these materials to come cascading down through the fifteen major rivers originating from Mt. Pinatubo.

As a result, entire towns were buried in several meters of mud and volcanic debris, destroying hundreds of hectares of rice fields, sugarcane plantations, mango orchards, and vegetable farms.

The disaster is far from over. According to the Philippine Institute of Volcanology and Seismology (PHIVOLCS), only 4 to 6 percent of pyroclastic materials have been released from the slopes of the volcano. PHIVOLCS said that low-lying areas in Central Luzon will remain at high risk for the next five years at the very least.

Furthermore, materials released into the major tributaries are still threats. As the rivers lose their capacity to hold these materials, volcanic debris will be diverted to smaller waterways which will then carry these to areas as far as 80 to 100 kilometers away from the volcano.

The Department of Social Welfare and Development (DSWD) reported that 68,432 families have so far been displaced by mud flows, half of them coming from the devastated Bacolor town in Pampanga. However, with the mud flows remaining as threats to life and property the department estimated that a total of 264,000 families will be displaced.

The Department of Health (DOH) reported that measles reached epidemic proportions in the centers, so have broncho-pneumonia and diarrhea, affecting mostly children. Older evacuees suffered from acute malnutrition, and pneumonia.

The on-going devastation in the towns surrounding the volcano is expected to cause further damages to more families but perhaps the worst victims are the tribal communities who have lived in the nearby mountain range for generations. Of the 97,000 evacuees still living in camps, now called "Tent Cities", the Office of Northern Cultural Communities (ONCC) reported that 38,000 of them are Aetas, one of the biggest surviving tribal communities in the country. The tribal evacuees are scattered in different camps in the provinces of Pampanga, Nueva Ecija, Zambales and Tarlac.

The Central Luzon Regional Office of the DOH reported the main causes of death as broncho-pneumonia, measles, diarrhea and upper-respiratory ailments. The spread of diseases, the department said, is heightened by the poor health and sanitary conditions in the camps. To date, the DOH has reported 579 deaths in the evacuation centers, or an average of two deaths every day.

1.2 HUMAN-MADE DISASTERS: VICTIMS OF INTERNAL CONFLICT

With the exception of the 1983 sinking of M/V Doña Paz, an inter-island passenger vessel, a tragedy which claimed over 4,000 lives in a single incident, the most devastating human-made disaster in the Philippines is the dislocation of thousands of families in the countryside due to internal conflict.

However, the first difficulty in dealing with victims of internal conflict is that there are no reliable records of how many they are and where they evacuate following armed conflicts. Local organizations working with internal refugees like the Citizens' Disaster Response Network (CDRN) have reported that these victims do not usually troop to evacuation camps but instead set up micro-villages of their own to escape the warring armies in the rural areas.

The only official record of internal refugees appeared in the 1990 report of the NDCC, under the heading "Victims of Social Disorganization."

In 1986, the CDRN recorded 54,229 persons displaced by armed conflict throughout the country. After the collapse of the cease fire between the government and the National Democratic Front (NDF), this figure ballooned to 340,425 the following year. The number dipped further to 321,495 in 1988. CDRC's incomplete 1989 tally showed 196,868 persons displaced. 1990 figures are unavailable.

To date, only the CDRN is ready to offer rough estimates of the total number of internal refugees but these figures, by the network's own admission is incomplete. The figures nonetheless attest to the increasing number of Filipinos displaced by the country-insurgency strategy of gradual constriction.

The most severely affected by these conflicts, according to the CDRN, are tribal communities. Years ago, they had been forced to retreat deeper into the hinterlands by migrating lowlanders. And now, new pressures are upon them as a result of armed encounters between rebels and pursuing government troops.

In Mindanao, for instance, ethnic minorities account for only 15 percent of the total population, but the CDRN recorded that a full third of the internal refugees in the Philippines' second-largest island are tribes people. The figure is even higher in Luzon where tribespeople account for 42 percent of the refugees on an island where they represent less than six percent of the total population.

1.3 MONSOON RAINS IN THE PHILIPPINES

In the Philippines, a great portion of its rainfall is associated to monsoon weather. The monsoons play an important role in the determination of different climates in the different regions of the Philippines. These are caused by thermal variations of the Asiatic Mainland. There are two types of monsoons: the Northeast and the Southeast monsoons.

The Southeast Monsoon

This air stream is also given other names by some authors, SUMMER MONSOONS and INDIAN SOUTHWESTERLIES. It originates as an Indian Ocean Trades Anticyclones during the Southern Hemisphere winter. It generally arrives in the Philippines as southerly stream, although, it may sometimes come from other directions such as westerly or southerly.
It first appears in the Philippines in May, attains maximum intensity in August and gradually disappears in October. In some occasions, however, it may appear as early as April and persists up to November or December.

The Southwest Monsoon brings rainy season for the western portion of the Philippines and dry season over the eastern portion.

The Northeast Monsoon

In winter, the Asiatic continent is snow bound and the high pressure spill over China sends northeasterly winds over the Philippines, giving cold temperatures and much rainfall.

The Northeast monsoon brings rain especially in the eastern regions of the Philippines and conversely, it results in a dry season for the western regions. It could be intensified by the presence of a cold front moving southward as far as the Philippines giving prolonged rains along the eastern coastal areas of the Philippines.

The monsoons are of moderate strength and may have speed of 16 to 64 km/hr and are dangerous to small boats when their intensities exceed 40 km/hr.

Tropical Cyclones

In some tropical regions, intense cyclonic circulations occur. These cyclonic circulations develop much greater surface wind speed than any other type of synoptic disturbances. They are referred to as HURRICANES, TYPHOONS or simply TROPICAL CYCLONES in various parts of the world. Tropical cyclones/storms have been given local names according to the region. In the North Atlantic, Eastern North Pacific and South Pacific Ocean, they are called "Hurricanes". In the Bay of Bengal, Arabian Sea and Western South Indian Ocean, the name is "Cyclonic". In the eastern part of the Southern Indian Ocean, it is "willy-willy" and in the western North Pacific Ocean they are called "typhoons".

Naming of Tropical storms

The following is a "List of Names" adopted for the tropical cyclones in the Philippines Area of Responsibility.

	I	II	III	IV
	1993	1994	1995	1996
	1997	1998	1999	2000
	2001	2002	2003	2004
	2005	2006	2007	2008
A	ATRING	AKANG	AURING	ASIANG
B	BINING	BISING	BEBENG	BIRING
K	KURING	KLARING	KARING	KONSING
D	DALING	DELING	DIDING	DITANG
E	ELANG	EMANG	ETANG	EDENG
G	GORING	GADING	GENING	GLORING
H	HULING	HELING	HELMING	HUANING
I	IBIANG	ILIANG	ISING	ISANG
L	LUMING	LORENG	LUDING	LUSING
M	MILING	MIDING	MAMENG	MARING
N	NARSING	NORMING	NENENG	NINGNING
O	OPENG	OYANG	ONTANG	OSANG
P	PINING	PASING	PEPANG	PARING
R	RUBING	RITANG	ROSING	REMING
S	SALING	SUSANG	SENDANG	SENYANG
T	TASING	TERING	TRINING	TOYANG
U	UNSING	UDING	ULDING	ULPIANG
W	WALDING	WELING	WARLING	WELPRING
Y	YEYENG	YANING	YAYANG	YERLING

	I	II	III	IV
	1993	1994	1995	1996
	1997	1998	1999	2000
	2001	2002	2003	2004
	2005	2006	2007	2008
A	ANDING	ANING	ADING	APIANG
B	BINANG	BIDANG	BARANG	BASIANG
K	KADIANG	KATRING	KRISING	KAYANG
D	DINANG	DELANG	DADANG	DORANG
E	EPANG ESANG	ERLING	ENANG	

Classification of Tropical Cyclones

Tropical cyclones are classified based upon their degree of intensity.

Tropical Disturbance

- Wind circulation poorly developed and velocities weak.
- Most widespread of tropical disturbance.
- Common throughout the West tropics and Sub-tropics.

Tropical Depression

- Maximum wind speed within the disturbance up to 63 kph.
- Most common in the region of the equatorial or intertropical convergence.

Tropical Storm

- Maximum speed within the disturbance of 64 - 118 kph.

Typhoon or Hurricane

- Maximum speed within the disturbance exceeds 118 kph.

Storm Warning Signals

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) has the responsibility of issuing information for all tropical cyclones that are found in the area of the Philippines.

When anyone of these signals is up in the vicinity, there is an impending danger due to tropical storms. The meaning of these signals are:

SIGNAL NO. 1 (one siren blast)

Disturbance existing. Winds up to 60 kph maybe expected in the locality within the next 24 to 36 hrs. Be on alert for further developments. Tune in to any radio station or switch on televisions for further information.

SIGNAL NO. 2 (two siren blasts)

Disturbance approaching or affecting locality. Winds of 60 - 100 kph maybe expected in the locality within the next 24 hours. Strengthen houses of light materials. Children are advised to stay indoors. Suspension of classes is optioned and upon the advice of higher authorities.

SIGNAL NO. 3 (three siren blasts)

Disturbance is dangerous to the locality. Winds in excess of 100 kph or more would be expected in the locality within the 12 - 24 hours. Everybody is advised to stay indoors. Classes are automatically suspended.

1.4 MEDICAL ASPECTS OF VOLCANIC DISASTER

Introduction

Massive dramatic volcanic events such as the eruption of Mt. Pinatubo on the 12th of June, 1991 are uncommon but they inevitably re-awaken world interest in volcanism. The violence of a major eruption makes the health and safety of nearby population the first concern.

The health and safety hazards posed by volcanic eruptions are outlined. The ability of volcanologists to predict the timing and the impact on local community of an impending eruption is limited. With the expansion of world population into hazardous volcanic areas, there is a growing need to develop appropriate emergency response measures.

Classification of Volcanoes

When appraising volcanic hazards in a particular area, we must first classify the types of eruption to be expected. In describing their potential for damage, eruption is divided into 3 types:

(a) Effusive - lava flows predominating
(b) Explosive - little or no lava but a large volume of tephra (any solid fragments from a volcanic vent including ash)
(c) Mixed - with certain features of both types

Health Hazards

For descriptive purposes, it is useful to distinguish between hazards near volcanoes and those at a distance perhaps as far as hundreds of kilometers away, and which are mainly due to tephra fallout, though in practice the two groups will overlap.

Figure 1. Principal Health and Safety Hazards of Volcanic Eruptions

NEAR	*FAR*
Pyroclastic Flows	Ash Toxicity
Mudflows	Respiratory Problems
Lava Flows	Eye Problems
Ejecta	Accidents
SO_2, CO, CO_2, H_2S, HF	Acid Rain
Lightning	Transport
Earthquakes	Communication
Air Shock Waves	Sewage
Psycho-social	Water Supply
	Roof Collapse
	Electricity
	Psycho-social

(a) Pyroclastic Flows

Extremely hot mixtures of gas, rocks which can travel at high speeds and for considerable distances. Deaths can be due to effects of blast, intense heat and asphyxiation from air densely laden with ash particle.

(b) Mudflows and Floods

Mudflows or lahars are also deadly volcanic phenomena and are responsible for much of the destruction caused by volcanic eruptions. Mudflows have the consistency of wet concrete and because of their large volume and the effect of gravity, they can travel many kilometers along valley floors causing destruction and flooding of rivers and reservoirs.

Mudflows and water running off from erupting volcanoes can also be very hot and cause fatal burns. Floods, in addition to causing death by drowning and widespread devastation, can destroy intakes for water supplies and outlets for sewage along river beds.

(c) Lava Flows

Although they can be immensely destructive, lava flows generally pose little risk to life because they travel so slowly that people can walk away from them.

(d) Ejecta

Eruptions may sometimes become unexpectedly violent and cause death. During explosive eruptions, dense rock fragments can be thrown far from a volcano.

(e) Gases

The main volcanic gases are H_2O, CO_2; SO_2 and HCl and some minor ones. The asphyxiants are CO_2, CO and H_2S and the lung irritants are SO_2,HCl and HF. In general, gases do not pose a serious hazard.

(f) Lightning

Lightning is frequently discharged from ash clouds in the vicinity of a volcano. It may cause fires and damage to electricity supplies or property and death from electrocution.

(g) Earthquakes, Shock Waves and Tsunamis

Minor earthquakes are frequent concomitant of eruptions but destructive earthquakes are less common. Tsunamis are giant sea waves produced by a submarine earthquake or volcanic eruption.

(h) Ash-related Respiratory and Eye Problems

Ash particles less than 10 micrometers in size are respirable and are commonly produced in explosive eruptions. Effusive or mixed eruptions usually release smaller quantities of ash of larger grain size and this would be expected to cause fewer, if any, respiratory problems. The potential for acute adverse respiratory effects of newly erupted ash of respirable size would depend upon its chemical and physical properties, level of exposure and the susceptibility of exposed people. Possible manifestations include the precipitation or worsening of asthmatic conditions as an acute response to heavy exposures, increased secretion of mucus in airways which might contribute to a development of chronic bronchitis and if the ash contained free silica, a fibrotic reaction of the lung tissue (silicosis).

(i) Accidents

Even light ashfalls if accompanied by rain, can lead to slippery roads and traffic accidents. During clean-up operations, people were injured by falling off the roofs of their homes.

(j) Transport and Communication

Damage to transport and telephone networks from lava or mud flows and from associated flooding in the vicinity of volcanoes is a fairly obvious sequela of the more destructive eruptions. Theoretically, local radio and television communications can be hampered by static electricity in ash clouds. Electronic equipment and telephone exchanges can be damaged by ash.

(k) Sewage Disposal and Water Supply

Sewage treatment plants are easily put out of action by heavy ashfalls, because filter beds become overwhelmed. Water supplies might also be threatened by the occlusion of surface water intakes of ash, the heavy use of water in communities and the stopping of water pumps due to power failures.

(l) Roof Collapse

Very heavy ashfalls could build up on roofs; the weight of the ash especially if wetted by rain, can impose intolerable strains on structures, with the risk of catastrophic collapse. Large flat-roofed buildings may be designated as evacuation centers, but such structures are often built to minimum building code requirements. The regular removal of accumulated ash from a roof during a very heavy ashfall would be made difficult by poor visibility and the irritative effects of the ash on the eyes and the respiratory system.

(m) Electricity

Ash moistened with rain may cause shorting of exposed electrical insulators, particularly the horizontal type that permits ash to accumulate along the insulator's length.

(n) Psychological factors

Cultural factors will determine the ability of communities to cope with the stresses of living around or near active volcanoes and in areas subject to ashfalls and floods. Prolonged periods of evacuation can lead to severe disruption of communities and their means of subsistence.

Emergency Medical Response

Two types of medical functions can be distinguished. First, the undertaking of traditional emergency tasks (evacuation, treatment etc.) and second a coordinating intelligence activity requiring more specialized expertise. The first function can readily be performed by local emergency services. Should a major eruption occur, workers involved in the intelligence function need to be physically present at a center coordinating the over-all emergency response among the different agencies so that information on health matters can be obtained quickly and from where authoritative statements can be disseminated to the public.

Emergency Ash Analysis

Analysis of ash should be undertaken on bulk samples and also on the respirable portion.

Emergency Medical Measures

Pre-planning should include location and staffing of triage centers and referral hospitals for the injured if casualties are envisaged. Survivors with severe burns and inhalation injuries of the lungs must be anticipated. All survivors of a severe eruption who are close to a volcano should be examined and the clinical and exposure details recorded. The locations of the survivors and the dead at the time of eruption and the condition of the nearby trees, equipment, cars, etc. should be noted for the purposes of studying factors relating to survival. An emergency field morgue is necessary if there are many deaths and autopsies should be performed whenever possible to establish the nature of injuries and cause of death. A hospital surveillance system in ashfall areas is an invaluable intelligence network for monitoring health problems, whether due to respiratory infections, accidental or other causes. Hospitals should be contacted for daily reports of the numbers of, and diagnosis for patients attending emergency rooms and being hospitalized. Any marked deviations in the daily number of cases compared with those in previous weeks and, if the figures are available in the same period in the previous year, would be alerting to new hazards which might warrant investigation for special preventive measures.

Preventive advise and appropriate protective equipment should be given to emergency workers who have to work outdoors and be heavily exposed to ash. Mask must be available for the general public. People should be advised to stay indoors during an ashfall and to wear masks if they must venture outside.

Water supply should be monitored for turbidity, bacterial counts, toxic elements, and pH.

Standard chlorination procedures will usually prevent bacterial contamination of drinking water. Special measures to protect the public health by preventing water shortages and the breakdown of sewage treatment plants may have to be instigated.

Other Measures

In remote areas of developing countries, a major eruption may cause such great losses of crops and animals that the resulting famine may cause more deaths than the immediate effects of the eruption itself. Ensuring that adequate food supplies and medical aid reach such areas may be the most important task that relief teams can undertake.