



LIVE&LEARN  
Environmental Education

# Living with volcanoes

A community's guide to preparedness and response,  
before, during and after volcanic eruptions





This guide was developed by Live & Learn Environmental Education for the World Health Organization (WHO) & the Applied Geoscience and Technology Division (SOPAC), Secretariat of the Pacific Community (SPC).



## Acknowledgements

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- Whitesands, Tanna 26-28 October 2010
- Port Vila, Efate 12 November 2010
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# Introduction

## About Live & Learn Environmental Education

Live & Learn Environmental Education is a non-government, not-for-profit organisation which aims to promote greater understanding of environmental and human sustainability through education and communication. Live & Learn was founded in 1992 and has offices in Vanuatu, Solomon Islands, Fiji, Papua New Guinea, Cambodia, the Maldives, Vietnam and Indonesia.

Live & Learn focuses on integrating environmental, cultural and development concepts in environmental education programs for the younger generation of

the South Pacific community. This is done through action-based programs, which build skills for problem solving, dialogue building and linking knowledge to change for sustainability.

## What this programme is about?

This programme has been developed as a tool to complement disaster risk reduction efforts in Vanuatu. This resources seeks to provide a framework for linking drinking water safety planning with public awareness campaigns targeting the impacts of volcanic eruptions.

Impacts from volcanic activity can be planned for and managed using generally accepted disaster risk reduction (preparedness) and management (response) approaches. For these to be effective community awareness campaigns will need to ensure quality information is available, accessible and readily understood such that knowledge can be transferred and turned into self motivated action.

At the local level, disaster risk reduction activities can focus on identifying issues of concern for communities as well as simple steps that can be taken to help prepare before, during and after a volcanic eruption.

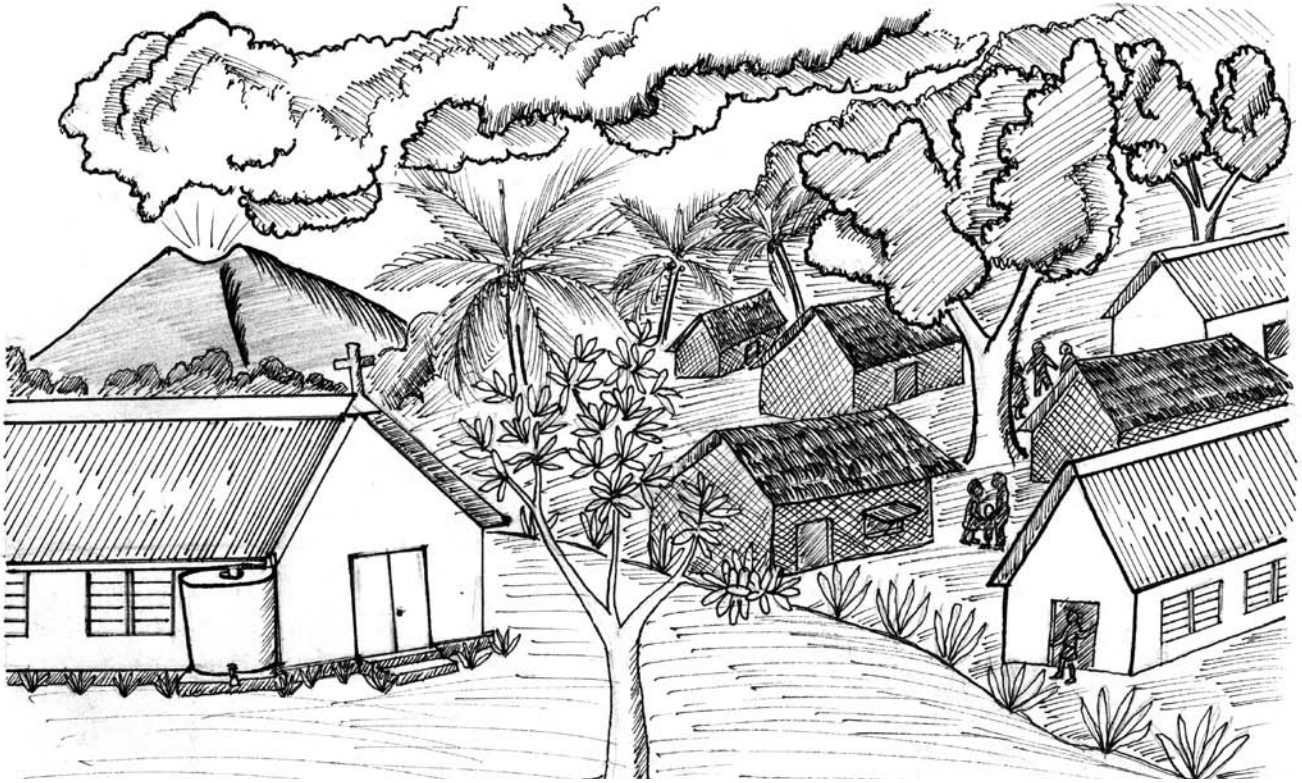
## **How to use this resource?**

This guide aims to provide a short range of options that can be used by communities who are living with volcanoes when preparing disaster risk reduction plans. It is written for community facilitators or government officers who are working with communities to reduce their vulnerability to the impacts of volcanic eruptions.

The guide can be used on its own when talking with communities about volcanoes, or during discussions and workshops for more general disaster risk reduction planning.

It is divided into five sections.

1. Living with Volcanoes
2. The Impacts of Volcanic Eruptions
3. Preparing for Volcanic Eruptions
4. Protecting Your Rainwater Supply
5. Mobilising Community Action



# 1 Living with Volcanoes

## Background

In recent years, volcanic activities in Vanuatu have become a major cause of concern due to the potential impact to human health. Of particular concern are the islands of Ambrym, Gaua, Ambae and Tanna. Experiences from Ambrym, and more recently in Gaua, have called for stronger community awareness and community action plans in relation to volcanic hazards. The Environmental Health Unit of the Ministry of Health (MOH) and the Water Resources Unit of Department of the Geology Mines and Water Resources are considering trialing a drinking water safety

planning approach. This approach aims to mitigate immediate and long term impacts in volcanic affected areas.

## Purpose

This guide has been developed to help communities prepare for volcanic eruptions, with a focus on protecting drinking water safety.

Its purpose is to provide a source of information to support public awareness campaigns and disaster risk reduction planning activities for communities affected by volcanic eruptions.

## Living with volcanoes

Communities living with volcanoes in Vanuatu may face challenges during and after volcanic eruptions, including shortages of food and safe drinking water, relocation to new sites, and health and economic difficulties. If communities have an understanding about volcanoes and how to plan for volcanic hazards, they will be better prepared to respond and recover quickly.

## What is a volcano?

A *volcano* is an opening in the earth that allows *molten rock*, *volcanic ash* and *gases* to escape from below the surface of the earth.

When a volcano erupts it can send hot *lava*, *steam*, ash and rocks into the air. *Ashflows* and lava can occur on all sides of a volcano. Ashfall can affect communities a long way downwind. Dangerous *mudflows* and floods can occur in valleys leading away from volcanoes. Molten rock flows down the sides of the volcano at high speeds killing anything in its path.

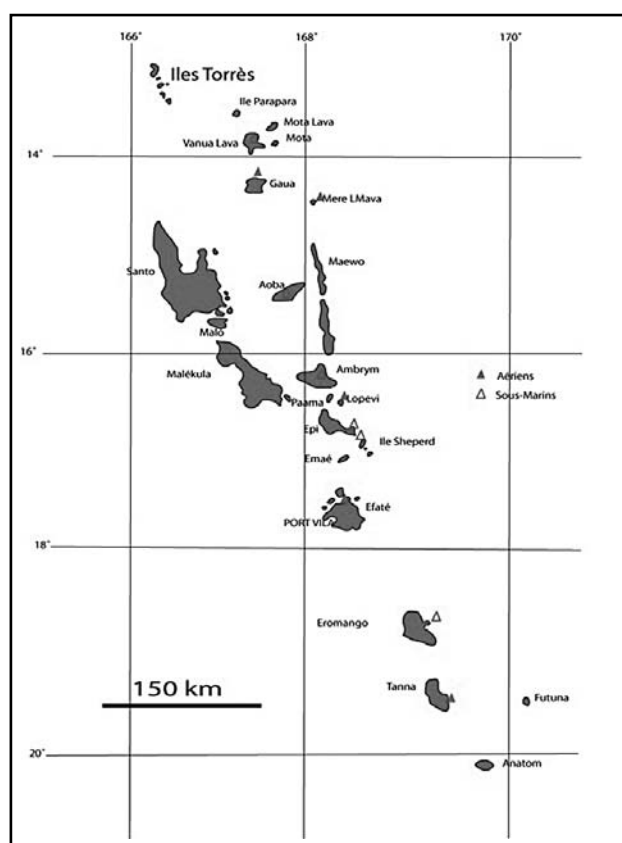
## Why you should prepare for volcanic eruptions

A community that is well prepared to respond to volcanic eruptions is one that will better recover after the eruption, and will be in a good position to help other communities.

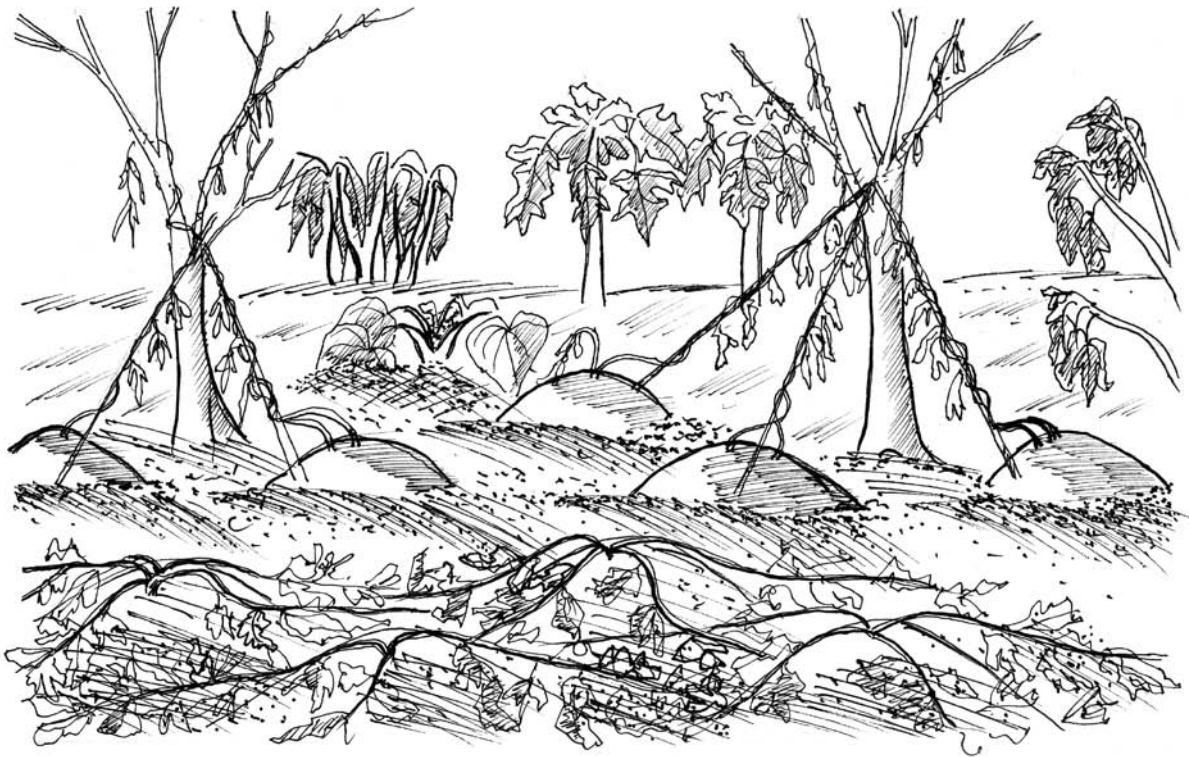
The first line of awareness and response is the community. Communities living with volcanoes must develop actions plans and know what steps to take **BEFORE**, **DURING** and **AFTER** a volcanic eruption.

## Volcanoes in Vanuatu

In Vanuatu many people live with volcanoes. There are several active volcanoes on the islands of Ambae, Ambrym, Lopevi, Gaua, Vanua Lava and Tanna. The Yasur volcano in Tanna is one of the world's most active volcanoes, erupting fairly constantly for over 200 years (Government of Vanuatu). It consists of a *cone* and an *ash plain* and most of the ash from the volcano is deposited by the trade winds over the island of Tanna.



Map showing location of volcanoes in Vanuatu



## 2 The impacts of volcanic eruptions

### Ashfall

Ashfall is made up of fine particles of volcanic rock that is ejected from a volcano during an eruption. *Plumes* of ash move down wind and then fall to the ground as ashfall, covering houses, gardens and affecting people and animals. Heavy ashfall can cover plants and strip leaves from trees, as well as cause roofs on buildings to collapse. Ash can form large plumes that block out sunlight and cause acid rain. Acid rain may pollute water supplies or damage vegetation and crops.

### Food shortages

During a volcanic eruption, gardens and food crops can be damaged. Ashfall and acid rain affect the leaves and fruits of plants and trees and spoil root crops. Taro, manioc, kumala, banana and island cabbage can become difficult to grow and be in short supply.

People often face difficulties in getting access to other sources of food during and after a volcanic eruption.



## Drinking water challenges

Clean water is essential for drinking and cooking food, as well as washing and basic sanitation needs.

Ashfall can contaminate water supplies and cause clogging and damage to water supply pipes, tanks and pumps. The quality of drinking water can be greatly reduced during a volcanic eruption to the point where it can no longer be consumed.

Many communities in Vanuatu rely on natural water sources such as springs and rivers for drinking water. Some communities have wells, water tanks and other small catchment containers to store water. These catchments and storage containers must be covered during and after a volcanic eruption to prevent water contamination.

Contaminated water can make people sick. Young children and the elderly are especially vulnerable.

Water that has become contaminated will need to be treated and then tested to ensure that it is safe.

It is very important that communities living with volcanoes take active measures to keep their drinking water safe.

Contact WHO or SOPAC-SPC for a copy of the 'Keeping Your Drinking Water Safe Community Toolkit' which contains more detailed information on drinking water safety planning for Community Trainers, Facilitators & Health Officers.



*Household water storage options can include covered containers & tanks of many different sizes*

## Health issues

During and after an ashfall, many people notice an increase in respiratory illnesses. Skin and eye irritation can occur, especially if proper precautionary measures are not taken.

## Economic loss

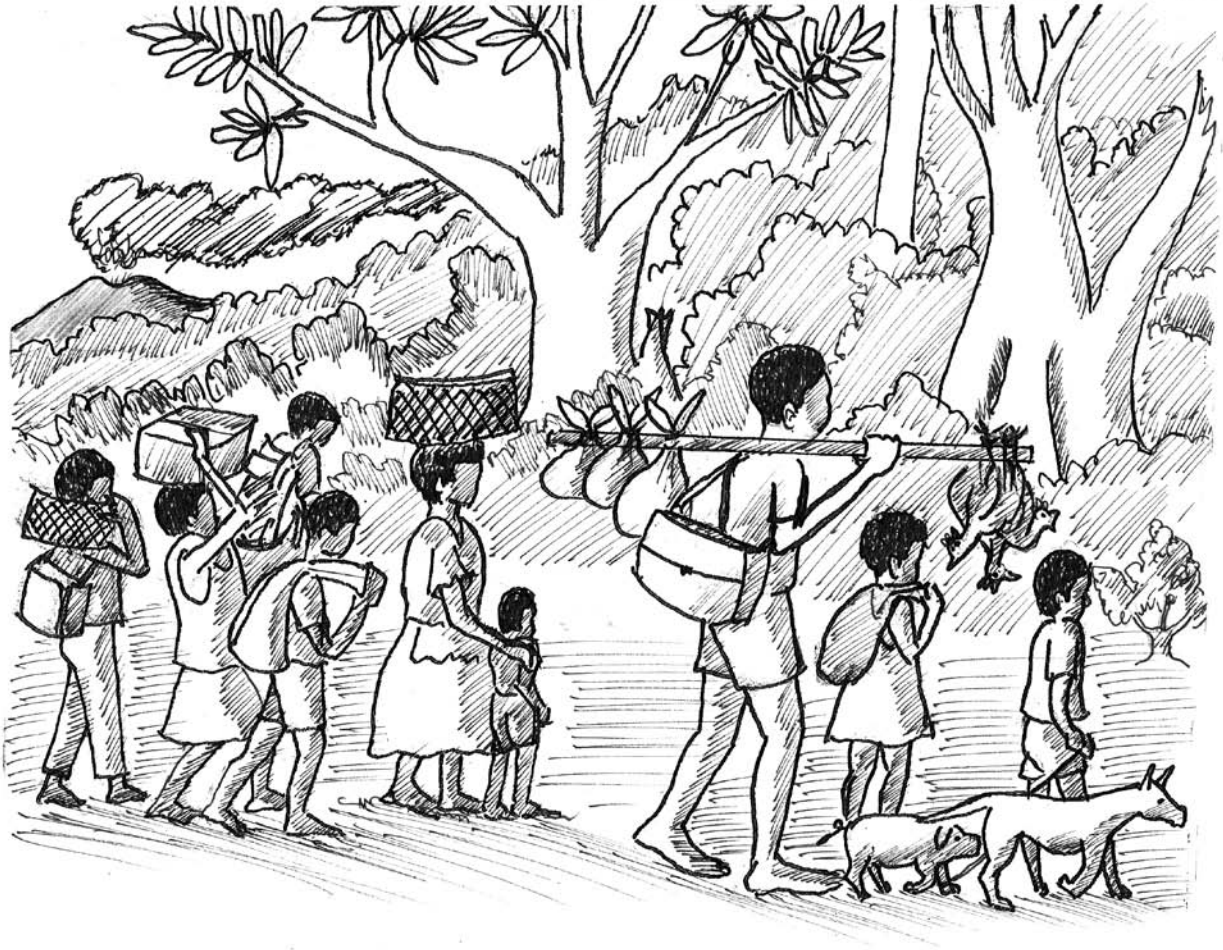
In Vanuatu, many people are subsistence farmers and rely on their crops to earn money for their families. Ashfall and other impacts from volcanic eruptions can destroy gardens and crops. When this happens, people often do not have enough money to buy food or pay for everyday items like transport and school fees.

The economic status of a family is reduced as well as that of the community in which they live.



Growing food crops that are best suited to soils in volcanic prone areas is important for fast recovery after ashfall has affected gardens.





For health and safety reasons people may be asked to move to new areas during or after a volcanic eruption.

Having to rebuild our life from scratch, after moving to a new area can have many negative impacts on health and productivity. People may have to work hard to build new gardens and homes and children will have to get used to attending a new school.

## Wellbeing and identity

Relocation to a new site from an old one after a volcano has destroyed most of the gardens, houses, water sources and other infrastructure can be very hard.

When people are relocated to new areas, other communities must also prepare for the arrival of families who have had to leave their homes.

Relocated families and communities will lose their normal way of life and will have to adapt to living in a new place. They may lose their identity and sense of belonging.



Sometimes communities must prepare for the arrival of new people who have been evacuated from their homes because of volcanic eruptions.



A Community Disaster Management Committee should create a Disaster Management Plan that outlines the steps that communities will need to take in the event of a volcanic eruption.



# 3 Preparing for volcanic eruptions

Communities living with volcanoes must take responsibility. There are many things you can do to prepare for the impacts of volcanic eruptions.

There are clear steps to follow **BEFORE**, **DURING** and **AFTER** an eruption.

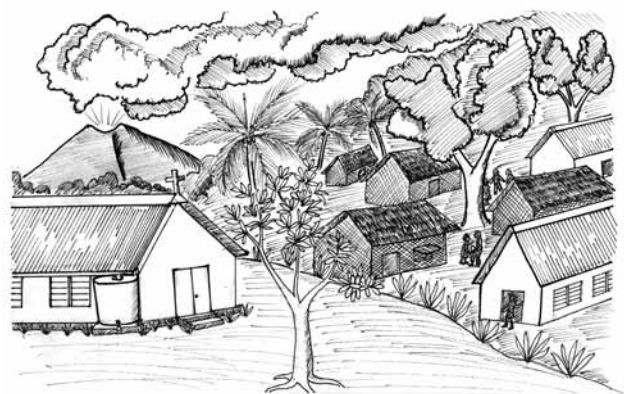
## What to do **BEFORE** a volcanic eruption

- Set up a disaster management committee.
- Create a disaster management plan.
- Learn about community warning systems.
- Make sure enough food is available for your community.
- Make sure enough drinking water is available for every person (15-20 litres).
- Have disaster supplies on hand (first aid kit & essential medicines, radio and batteries, protective clothing and dust masks).
- Cover water tanks and other storage sources.
- Install first flush diverters on rainwater catchments.

## What to do DURING a volcanic eruption

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- Listen to the radio for disaster information.
- Follow the evacuation order issued by authorities.
- Activate the disaster management plan.
- Implement disaster procedures as planned.
- Use community communication networks.
- Avoid low lying areas, rivers and valleys.
- Help your neighbors who may require special assistance (elderly, infants and disabled people).
- Close intakes for water supply systems.
- Close all doors and windows.
- Cover any machinery or water pumps that may be outside.



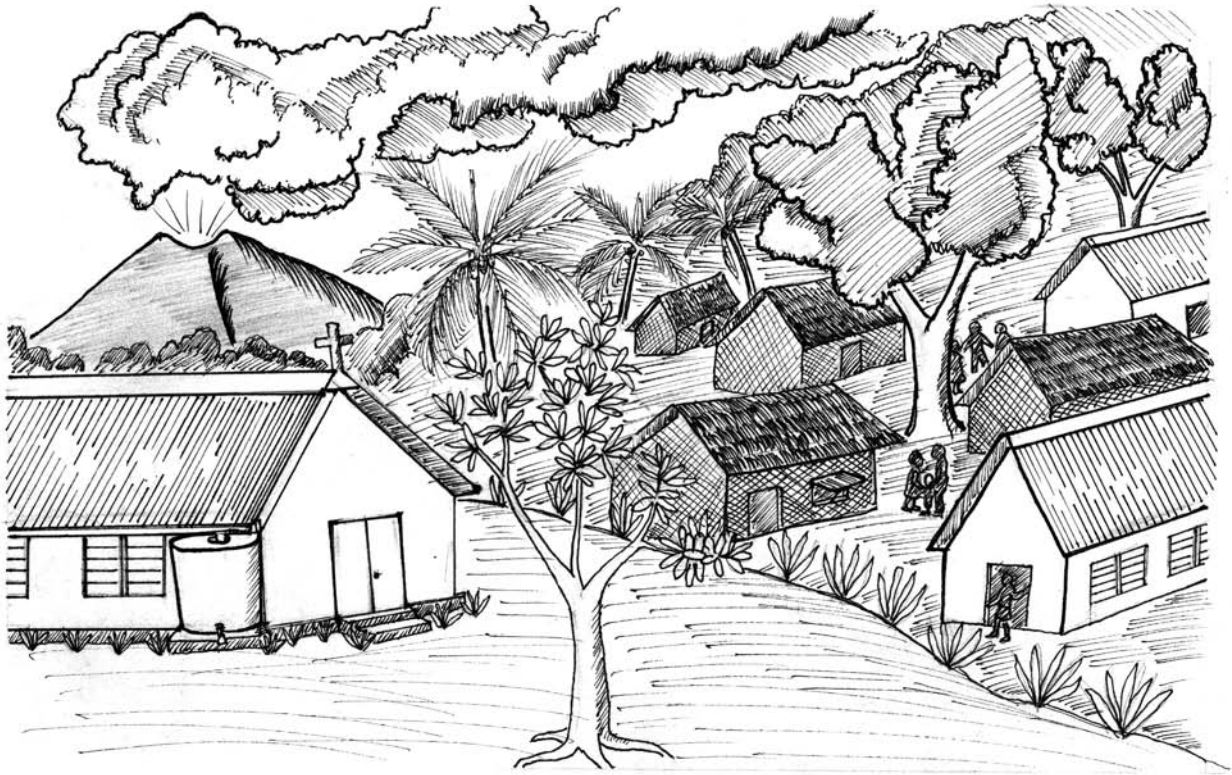
## What to do AFTER a volcanic eruption

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- Protect yourself from falling ash.
- Wear long sleeved shirts and long pants.
- Cover your mouth and nose, if outside.
- Keep doors and windows closed.
- Clean ash from roofs.
- Clean water tanks, equipment and water supply systems.
- Test drinking water supply systems.
- Treat contaminated water by filtering to remove ash, boiling or adding disinfectant to kill pathogens based on advice from Environmental Health Officers or Disaster Response Teams.
- Use clean stored water only for drinking and preparing food.

More information is available in the *Keeping Your Drinking Water Safe Toolkit*.





# 4 Protecting your rainwater supply

## First flush devices

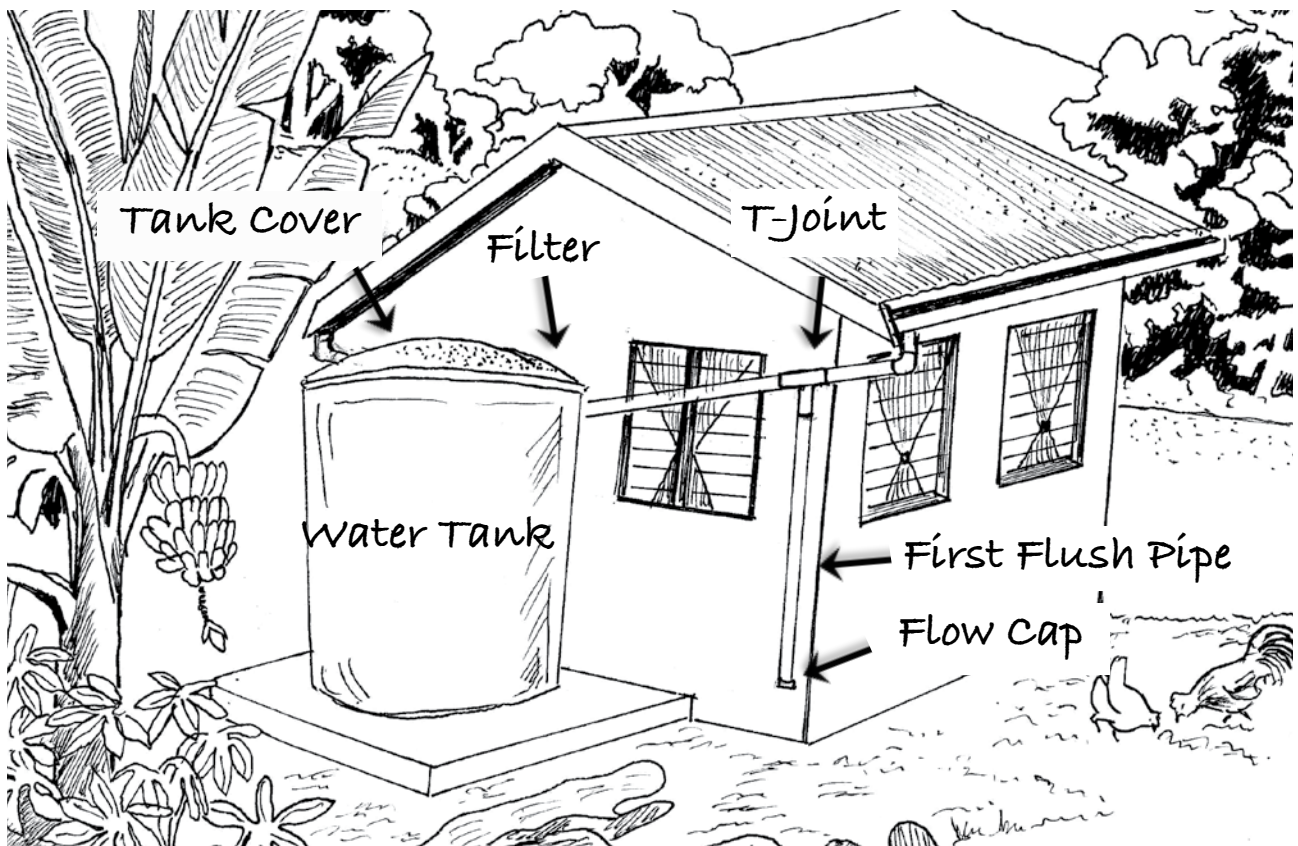
When rain falls during or after a volcanic eruption, ashfall can contaminate water in rainwater catchments. Installing a first flush device can help protect your water supply. It will prevent contaminated water from your roof entering a water tank when it first rains.

Ensure your tank has a cover and there is a filter (gauze cloth) on the mouth of the inlet pipe where water enters the downpipe from the guttering (see figure above).

A First Flush Device can be installed using a 'T-Joint' connection in the main water pipe before it enters the tank. A downpipe connected to the T-Joint diverts water contaminated by ash and dirt from entering the tank. When the first flush downpipe is full, water will flow through the main collection pipe into the storage tank. A small hole at the bottom of the flow cap maintains a slight downward pull of the water in the first flush pipe. After the rainfall, the flow cap should be opened and water from the first flush pipe drained out.

### 3 key points:

1. After a volcanic eruption, ensure the water tank is securely covered.
2. After the ashfall stops, and it starts to rain, water will flow off the roof and through the first flush device. When the first flush device is full, water will flow into the tank.
3. After rainfall, drain out the first flush device.



Advice on the installation of first flush devices can be provided by the Rural Water Supply Unit of the Department of Geology, Mines and Water Resources.





# 5 Mobilising community action

## Vanuatu volcano alert levels

The Vanuatu Geohazards Observatory, within Vanuatu Meteorological and Geohazards Department, monitors the level of activity for volcanoes in Vanuatu and makes an assessment of the volcanic alert status.

The Vanuatu Volcanic Alert Level (VVAL) provides a guide to the danger a volcano poses based on the level of activity. When the level of activity increases, and there is an increased risk of an eruption impacting on people, the Alert Level will change.

Communities living with volcanoes must understand the Vanuatu Volcano Alert Levels and know what actions to take when levels change.



The Vanuatu National Disaster Management Office (NDMO) is responsible for advising communities that may be threatened by volcanic activity.

## Vanuatu volcanic alert levels (Vanuatu Geohazards Observatory)

| Colour | Level | Frequently Active Volcano (Yasur, Lopevi, Ambrym)  | Dormant Volcano (Ambae, Gaua, Vanua Lava)   |
|--------|-------|--|---|
| GREEN  | 0     | Normal low level activity  | Normal, quiet   |
|        | 1     | Increased activity. Danger near crater only  | Signs of awakening  |
| YELLOW | 2     | Moderate eruptions. Danger close to the volcano vent & within parts of the Volcanic Hazards Map  | Confirmation of awakening. Minor eruptions and danger near crater                     |
| ORANGE | 3     | Large eruption. Danger in specific areas within parts of Volcanic Hazards Map Red & Yellow Zones | Moderate to large eruption. Danger in areas near crater and along main stream valleys |
| RED    | 4     | Very large eruption, Island-wide danger  | Very large eruption. Island-wide danger and potential impacts on neighbouring islands |

(source: Vanuatu Geohazards Observatory, Vanuatu Volcanic Alert Level, 2009, available on 19 August 2011, at [www.geohazards.gov.au](http://www.geohazards.gov.au))

### Community action planning

Volcanic eruptions can be disastrous when people are not well prepared. Communities living with volcanoes need to take responsibility and be prepared for volcanic eruptions. Communities should set up a disaster management committee and develop a disaster management plan to prepare for volcanic eruptions.

### Disaster management committee

A community disaster management committee should include representatives of community leaders, men, women and youths.

The disaster management committee needs to develop a disaster management plan and meet regularly to update any information on volcanic activity, and review action plans to make sure communities are prepared.

Clear and reliable ways to communicate must be in place to ensure accurate information on Volcano Alert Levels and responsive actions are heard by all.

### Disaster management plan

A disaster management plan should outline the steps that communities will take in the event of a volcanic eruption.

Many communities already have detailed a disaster risk management plan. The template on the next page can be used as a guide to help develop a disaster management plan. The plan will assist in working out what needs to be done and who needs to be involved before, during and after a volcanic eruption.

# Volcanic preparedness disaster management plan

Disaster Management Committee:

Community: \_\_\_\_\_

Date Plan Reviewed: \_\_\_\_/\_\_\_\_/\_\_\_\_

|                                 | What needs to be done?                                   | Who needs to do it?                                      | What resources do we need?                               |
|---------------------------------|--|--|--|
| <b>BEFORE Volcanic Eruption</b> | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ |
| <b>DURING Volcanic Eruption</b> | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ |
| <b>AFTER Volcanic Eruption</b>  | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ | 1. _____<br>2. _____<br>3. _____<br>4. _____<br>5. _____ |

# Glossary

**Ash fall:** volcanic ash that falls from the air after an eruption.

**Ash flows:** a pyroclastic flow consisting predominantly of ash-sized (less than 4 millimeters in diameter) particles. Also called a glowing avalanche if it is of very high temperature. (*Foxworthy and Hill, 1982*)

**Ash plain:** a large area of ground that has been covered by heavy ash fall deposited after volcanic eruptions.

**Cone:** the area around the vent or opening of a volcano that is formed by either the explosion or collapse at a volcanic vent.

**Gases:** a range of gases including steam, carbon dioxide sulphur dioxide and hydrogen chloride that are that are released from a volcano vent during an eruption

**Lava:** the term used for magma (molten rock) once it has erupted onto the Earth's surface.

**Magma:** molten rock that is beneath the surface of the earth.

**Molten rock:** rock that has been heated to a point where it has become a liquid.

**Mudflows:** the flowing mixture of water and debris (intermediate between a volcanic avalanche and a water flood) that forms on the slopes of a volcano. Sometimes called a debris flow or lahar, a term from Indonesia where volcanic mudflows are a major hazard. (*Teacher's Packet*)

**Plumes:** clouds formed by a mixture of volcanic gas and ash that is emitted by an eruption.

**Steam:** water that has been heated to a point where it changes from a liquid to a gas and is released into the air

**Volcano:** a vent (opening) in the surface of the Earth through which magma erupts; it is also the landform that is constructed by the erupted material. (*Teacher's Packet*)

**Volcanic ash:** fragments less than 2 millimeters (about 1/8 inch) in diameter of lava or rock blasted into the air by volcanic explosions. (*Teacher's Packet*)

## Resources

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[www.redcross.org](http://www.redcross.org) (2010) American Red Cross, *Preparing for Events, Volcanoes*, viewed 19th October 2010.

[http://vulcan.wr.usgs.gov/Glossary/volcano\\_terminology.html](http://vulcan.wr.usgs.gov/Glossary/volcano_terminology.html), viewed 30th August 2011.

# Feedback form

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Please help us to improve this handbook. Let us know what you think by answering the questions below and sending them to us. We suggest you photocopy this form or write/type out the questions and your responses, rather than tearing out this page, so other users of these materials can also tell us what they think. You can fax or mail this form to the Live & Learn office in Vanuatu (you can find the address on the inside front cover). Or you can provide feedback via email: [resources@livelearn.org](mailto:resources@livelearn.org)

Your name and location: \_\_\_\_\_

Organisation or community: \_\_\_\_\_

Contact details (optional) : \_\_\_\_\_

1. Briefly explain how you used this handbook. (e.g. are you an NGO worker, government or health care worker?)

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2. Is this guide easy to follow? (if not please tell us what was not clear)

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3. Was there information that you think was missing?

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4. How could this handbook be improved?

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5. Please list any other comments or suggestions below:

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Thank you!



# Vanuatu Volcanic Alert Levels

(Vanuatu Geohazards Observatory)

| COLOUR | LEVEL | FREQUENTLY ACTIVE VOLCANO<br>(YASUR, LOPEVI, AMBRYM)   | DORMANT VOLCANO<br>(AMBABE, GAUA, VANUA LAVA)   |
|--------|-------|--|---|
| GREEN  | 0     | Normal low level activity  | Normal, quiet   |
|        | 1     | Increased activity.<br>Danger near crater only   | Signs of awakening  |
| YELLOW | 2     | Moderate eruptions. Danger close to the volcano vent and within parts of the Volcanic Hazards Map  | Confirmation of awakening. Minor eruptions and danger near crater                     |
| ORANGE | 3     | Large eruption. Danger in specific areas within parts of Volcanic Hazards Map Red and Yellow Zones | Moderate to large eruption. Danger in areas near crater and along main stream valleys |
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