Preliminary Ambae eruption VMGD-WASH-FSAC-HEALTH Volcanic Gas, Acid Rain and Ash key messages – Version 3.1

(See Page 2 of 4 for What to do during and after impacts, page 3 of 4 for Protecting water supplies, and advice if water supplies are affected by volcanic ash, gas or acid rain and page 4 of 4 for dust mask and mudflow/debris flow advice)

This preliminary advice summary has been prepared with input from the following agencies: VMGD, WASH Cluster Members, FSAC Cluster Members, Health Cluster Members, World Animal Protection, the International Volcanic Health Hazard Network, and GNS Science.

For this summary, the range of public education materials currently in use in Ambae was reviewed. The following key messages bring those pieces of advice together in one place. In some places this summary provides updated advice, and adds new information.

As further information on volcanic impacts comes in, further analyses are made, or further impacts occur, this advice may be updated. See the version number and date in the top right. The latest version of this advice can be downloaded from: http://www.vmgd.gov.vu/vmgd/index.php/geohazards/volcano/volcano-info/resources

	Volcanic - Gas	- Acid Rain	- Ash
Cause	• Gas comes out of the magma up at the top of the volcano. The main gas is thought to be sulphur dioxide (SO_2). • It travels with the wind direction and can create a layer close to the ground or be higher in the air. • The amount released on any day can differ a lot.	• Gas or ash from the volcano mixes with rain to form acid rain. • Acid rain appears to have been strongest after mixing with gas (e.g. in November 2017)	• Ash is tiny pieces of lava blown apart by gas escaping from magma as it erupts. • Ash travels with the wind direction and falls to the ground. The grains of ash are just like fine sand but they can have a strong acid layer on them from the gas. The acid can be rinsed off the ash, e.g. by rainfall.
Impact	• SO_2 gas has an acrid smell like burning matches. • Health symptoms include: irritation of eyes, nose, throat, skin; cough; and chest tightness/shortness of breath. Some people also report fatigue or dizziness. • Asthmatics are highly susceptible to low levels of SO_2.	• Acid rain may irritate or cause stinging in the eyes. • Acid rain may cause metals to rust faster. • Acid rain is likely to kill fish in fish ponds. • Acid rain can make water taste sour like lemon juice. Acid rain can damage plants, especially the leaves.	• Ash makes vegetables hard to eat unless you clean them, and if you eat ash it can make you feel sick. • Ash can impact a person's health. It can irritate eyes and skin and make it hard to breathe. It can also make asthma and other similar breathing conditions worse. • Ash is good fertiliser in the long term but will need to be mixed into soil (especially if more than 2 cm thick). • Ash can cause sickness or death in animals if they eat it. • Ash can make drinking water look cloudy and taste bad (metallic, or sour like lemon juice). • Thin ash (<2 mm) causes less damage to crops than acid rain does. • Ash over 1 cm can break gutters and may break some crops. • Very thick ash (>10 cm) can break crops and trees, bury soil, harm livestock and collapse traditional roofs.
Do before	• Think and talk about whether you can smell gas in your village. • Know who has breathing conditions such as asthma. • Make a plan (with your village) about how and where you will go if you need to leave the village because gas is strong. When developing your plan consider issues such as transporting older people and persons with disabilities. Remember, everyone in your village should know this plan!	• **Be ready to disconnect downpipes from rain-water tanks or wells.** • Be ready to shelter your family and animals from acid rain (under a roof). • Talk about acid rain in your village and make a plan about how you will respond if there is acid rain. Remember, everyone in your village should know this plan! • Be aware yams seem more vulnerable than other crops. • If possible, plant crops under a canopy. Do not remove all canopy from planting area as it will protect the crops from acid rain damage. • Recommend that people plant quick-producing crops as food sources.	• Make sure all water tanks and wells are covered. Concrete wells can be covered by sheets of roofing metal over timber, metal or bamboo poles. For additional protection from ashfall, cover the metal sheets with a tarpaulin. • **Be ready to disconnect downpipes from rain-water tanks.** • Be ready to shelter your family and animals from ash under a roof or indoors if possible. • Know who in your village has breathing conditions. • Talk about ash in your village and make a plan about how you will respond if there is an ashfall. Remember, everyone in your village should know this plan!

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	Volcanic - Gas	- Acid Rain	- Ash
Do during	• Move people away who are having trouble breathing, to a less affected area. • Watch people with conditions closely and refer them to the nearest health facility (clinic) for treatment. • If the gas is very strong, everyone should move to a less affected area. • Stay inside if the effects are less there – tightly close windows and doors, block gaps with cloth. • Drink plenty of clean water. • Don't do strenuous work because it makes you breathe hard.	• **If rain irritates your eyes, and you don't have a first flush system, immediately disconnect downpipe from tanks or wells.** • Protect wells with a tarpaulin. • Cover your solar panels and electrical connections. • Shelter under a roof. • Drink plenty of clean water. • Shelter animals under roof or tarpaulin • If eye problems get worse then go to your nearest health clinic.	• **Immediately disconnect downpipe from drinking water tanks/wells, even with a first flush system installed.** • Protect wells with a tarpaulin. • Shelter inside the most sealed building there is, with windows and doors shut. If possible, hang up extra cloth over open doors or windows to keep ash out. **Stay inside, as long as it doesn't get too hot.** • Be especially careful to take shelter under a metal or concrete roof when volcanic stones are falling (lapilli and volcanic bombs) as they can be heavy and hurt people. • Watch people with breathing conditions closely. If possible they should wear a dust mask. Tying a cloth over the dust mask may improve fit but take care that this does not restrict their breathing. • Drink plenty of clean water. • Don't bring ash inside, leave shoes outside, sweep out ash from house. • If you must go outside wear long sleeves and pants, cover your mouth, nose and eyes and wear a hat. Change clothes and wash your skin afterwards. • Wash sore eyes – don't rub them. The ash can scratch your eyes. • Bring pets indoors and protect livestock in covered shelter or buildings. • If health symptoms get worse go to the nearest health clinic for treatment.
Do after	• Wash crops/food before eating until after the next good (enaf) clean rain. • Change your clothes and wash your skin afterwards.	• Carefully remove the tarpaulin from your well. • **If you don't have a first flush system: once the next good (enaf) clean rainfall starts wait 30 minutes then re-connect the tank/well.** • Wash crops/food before eating until after the next good rain. • Beware the loss of grass can cause livestock to starve. • Make sure that your livestock have access to adequate grazing or feed and clean water.	• Sweep ash off well covers. • **Once the next good (enaf) clean rainfall starts wait 30 minutes then re-connect the tank/well. Wait 30 minutes even with a first flush installed.** • Adults sweep ash out of house. Sweep ash from metal roof in dry season then you don't need to wait to reconnect. • When walking or travelling on dusty roads, protect your mouth, nose and eyes. • Don't play or work in ash until good rain has fallen if you can avoid it. **Don't let children play in ash!** • Minimise exposure of your pets and livestock to ash. • Cover with vegetation, or clean up and remove, ash in the areas you live in. • If you must work outside in ash that has not been rained on yet (e.g. cleaning up, gardening): wear long sleeves and pants, cover your mouth, nose and eyes and wear a hat. Wash afterwards. • Shake and then wash crops/food before eating to remove ash. • Cut and clean ash from grass and food to avoid livestock starving. Pay special attention to buried grass as your livestock may need you to clean and expose it before they can safely eat it. • Livestock need clean drinking water just like people do. Consider feeding animals food with high water content such as banana stumps. • **Thick volcanic ash can lead to mudflows – avoid valleys and low-lying areas.**

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Protecting water supplies

Your first approach should be to protect your water supplies by keeping volcanic ash, gas and acid rain out. This can be done by:

- Making sure tanks and wells are covered. Concrete wells can be covered by sheets of roofing metal over timber, metal or bamboo poles. For additional protection, cover the metal sheets with a tarpaulin.
- Disconnecting downpipes if volcanic ash or acid rain come.

For the dry season, you may not want to disconnect all tanks or wells in the village, because water that looks cloudy or tastes bad because of acid rain or ash can still be used for other purposes such as bathing, handwashing, cleaning dishes and cooking (but not cooking rice because the rice absorbs a lot of water, or foods with a high water content, such as soups or stews). If possible, you should avoid drinking this water and drink bottled water, coconut water or boiled bore water.

In each village, set up one or more tanks or wells that are disconnected to protect the water as drinking water. The other tanks/wells can remain connected so there is enough water for bathing, handwashing, cleaning dishes and cooking (but not rice, or foods with a high water content, such as soups or stews).

If water supplies are affected by volcanic ash, gas or acid rain:

Actions

- **All drinking water should be treated to reduce or eliminate microbes, using one of the following methods:**
  - Boiling for 1 minute.
  - Filtering through a membrane filter, then adding a chlorine tablet and allowing the water to stand for an hour.
  - Adding chlorine tables. If water is cloudy, first filter through a clean cloth then add the chlorine tablet and allow the water to settle for 2 hours. Note also that chlorine may not kill all types of microbes.
- It is important to keep drinking plenty to avoid becoming dehydrated.
- When you first take water from a tap in the morning, throw away the first cupful of water.
- If your family only has drinking water with volcanic gas, acid rain or ash in it:
  - Ensure babies and younger children drink only bottled water, coconut water or boiled bore water.
  - If water is cloudy: try standing water in container such as plastic jerrycan to allow ash to settle to bottom, or filtering water through a clean cloth.
  - If water tastes sour: try adding crushed shells or coral to a container of water (e.g. plastic jerrycan) to neutralise acid.

Cautions:

- Volcanic gas, acid rain and ash can make drinking-water look cloudy, and taste bad (metallic, or sour like lemon juice).
- Volcanic ash can also add fluoride to the water. If you drink this water for a short time, even for heavy ashfalls (>20 cm) it is unlikely to be a health risk for adults and older children. For babies and younger children, drinking water heavily contaminated by ash should be avoided for any length of time, as it may cause problems for their teeth (fluorosis). For everyone, and particularly children, drinking water with high fluoride over a long time is not recommended because it can cause problems for the teeth and bones.
- The acidity of water affected by volcanic ash, gas or acid rain can leach heavy metals from taps. Health risks can be minimised by throwing away the first cupful of water taken from the tank each day.

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Using dust masks for volcanic ash

- Use straps and any nose clip to fit mask tightly to face. The top strap should go high on head, and the bottom strap low.
- If you feel air escaping around the edges of the mask, adjust it until there are no gaps. A layer of cloth tied on top of the mask can help to hold it to the face (but be careful that this does not restrict breathing too much).
- Masks will not fit very well to children or people with beards.
- Dust masks do not give any protection against volcanic gases.

Volcanic mudflows and debris flows

After volcanic eruptions, loose volcanic ash and stones that fell on the ground and plants can be remobilised (moved again), especially during rainfall. This can make two types of special flows:

- **Mudflows:** mixtures of volcanic ash, boulders and water, and
- **Debris flows and Rock falls:** the sudden collapse (landslide) from an unstable side of a volcano into a steam or river

On steep slopes, rainwater can easily erode and carry volcanic ash and form a mudflow or slurry, especially if vegetation has not had time to grow back (the vegetation helps keep the ash in place). Mudflows can pick up large boulders and carry them.

The cause of a mudflow is usually heavy rainfall washing volcanic ash and stones from the slope of a volcano. Mudflows are often highly erosive to river banks and can destroy bridges, trucks, buildings, and vegetation caught in their path. Often, mudflows are noisy as the boulders rub and crash together. **People should remain at a safe distance from a river or creek.** A moving mudflow can look like a slurry of wet concrete, and as it rushes downstream, the size, speed, and amount of material carried can change – it can transport rocks, soil, vegetation, and even bridges or trucks.

Many volcanic cones are steep sided and unstable. Heavy rain can cause a rock fall of this unstable material. Very coarse mudflows full of boulders called debris flows happen when water is mixed in with the rockfall material and it goes further down the valley. They will make a lot of noise on the mountain and can carry big rocks.

Rainfall-induced mudflows including debris flows can greatly damage or change rivers and streams, sometimes depositing so much sediment that chronic flooding also becomes a problem.