



Protecting Keiki From Vog (Volcanic Emissions and Volcanic Ash)

What is vog?

Vog (short for *volcanic smog*) refers to the hazy mixture in the air that comes from Kīlauea volcano on Hawai'i Island. Vog usually contains sulfur dioxide (SO₂) and other gases, along with tiny particles known as particulate matter (PM_{2.5}).

What areas/regions are most affected by vog?

During trade wind conditions, areas downwind and close to the eruption sites, such as the in Ka'u District, can be exposed to SO₂ and PM_{2.5}. Areas farther downwind (e.g., the west side of Hawai'i Island and other islands in the state) are mostly affected by fine particles. However, with changes in the winds (e.g., low trades, variable winds or Kona winds) areas normally unaffected may experience "voggy" conditions and poor air quality (e.g. Volcano Village, Puna District, Hilo, Hamakua Coast and other islands). Sometimes, Kīlauea also releases ash that falls in the areas of the wind direction and can sometimes travel very far distances.

Who is at risk for health effects from vog?

The components in vog are acidic and irritate the moist surfaces in our breathing passage. Some people are more sensitive to vog and air pollution in general than are other people.

Sensitive groups include:

- Infants and children,
- People with pre-existing lung and heart conditions (e.g., asthma, bronchitis, emphysema),
- The elderly, and
- New or expectant mothers.

People across Hawai'i Island are also at risk because vog levels are primarily dependent on the amount of emissions released by the volcano, the distance from the source vents, and the wind direction and speed on a given day. Parents can take precautions to protect their children from the effects of vog (see below).

How does the SO₂ and fine particulate matter in vog affect my keiki?

Children are more sensitive than adults because they breathe in higher amounts of air pollution (vog) over the same time period. They commonly breathe faster, are more active, and have larger lungs in proportion to their body size than most adults. Some air pollution can be filtered out by our nose and breathing passage before reaching the lungs. However, children tend to breathe through their mouths and their noses are less efficient at filtering out gases and small particles found in vog.

- SO₂ in vog can affect your child's health and may become life threatening for those with a very high rate of exposure close to the eruption site, and/or those with pre-existing respiratory or heart disease, such as asthma.
- Children who live in areas affected by vog may experience:
 - Irritation of the eyes, nose, throat, or skin

- Coughing and/or phlegm
- Chest tightness and/or shortness of breath
- Headache
- Increased susceptibility to respiratory ailments

Can ash affect my keiki?

Ash particles can vary from a very fine powder to sand-like grains and may fall during the eruption or after when ash is resuspended (sent back) into the air. Children and adults may accidentally breathe in ash through the nose and mouth. If the particles are small enough, these can be harmful because they may be inhaled deep into the lungs.

- The best way to protect your child from ash is to limit their exposure to it by remaining indoors with windows and doors shut.
- N-95 particulate masks are designed to protect users from ash or other particulates but those generally available in the U. S. are not made to protect children.
 - They will not properly fit children's faces because they are made for adults.
 - Children with developing lungs or pre-existing respiratory or heart disease may find the masks difficult to breathe through.
 - Use of masks can raise the risk of suffocating, especially for infants.
 - Handkerchiefs, bandanas, and other coverings are not effective at protecting your child from fine ash particles.
- Make sure children avoid ash during any cleanup activities after an ashfall event.
- Ash particles are sharp and abrasive and can be very irritating if they get in your child's eyes. Contact lenses should be taken out during an ashfall event or around ashy conditions.

How can I protect my child from SO₂, particulate matter (PM_{2.5}), and ash found in vog?

- Stay indoors when vog levels are high or during an ashfall event and protect yourself and loved ones in these ways:
 - Close all outside doors and windows but beware of becoming overheated. If vog is severe, seal up large gaps and spaces to the outdoors, by using tape and plastic sheeting, rolled-up towels, etc. Close up the house before vog levels are high and refresh the air in your home by airing out the house once vog levels are low. Most higher levels of vog persist for a limited time.
 - If your home has air conditioning, set the unit to 'air recirculation' or 'closed vent' to avoid sucking in vog or ash from the outside.
 - Even if a room is not well sealed, closing it up may provide some protection for short periods of time.
 - Consider a temporary visit to a neighbor or commercial indoor area that is better sealed or has air conditioning. Air-conditioned buildings are good options since they are often 'tighter' and better protect from poor air quality conditions outside.
 - Use a room air cleaner if available, for a closed-off room. If close to the volcanic activity, look for an air cleaner with a HEPA (fine particulate) filter and an acid gas (SO₂) filter. If farther away from the volcanic activity, an air cleaner with a HEPA filter will be sufficient.
- If ashfall continues or is severe, consider leaving the area temporarily, if necessary.
- Limit or stop all strenuous outdoor activities when levels of vog are high.
- Close up your vehicle if driving through areas with elevated vog or ash in the air.
 - Close car windows and vents and turn off the air conditioning and fan to avoid sucking in air and ash.

What other ways can I protect my keiki?

- Be informed about air quality and wind conditions that might affect your area.

- Know if the direction of the wind will bring vog to your area (see UH Vog Forecast Model in “More Information” below).
- Use sites that provide real-time monitoring information on SO₂ and PM_{2.5}. (See Air Quality Data in “More Information” below).
- Know your child’s school action plans for vog and ash events.
- If your child has asthma or other respiratory conditions, monitor their health for early signs of distress, and keep your child’s medicine handy.
 - Assume that your child’s asthma could get worse during periods of high vog.
 - If you don’t have medications but feel your child may need them, call your doctor.
 - If you haven’t already done so, develop a written Asthma Action Plan with your child’s clinician to help guide self-management of flare-ups at home or at school.
 - Coordinate with your school’s health aide on your child’s Asthma Action Plan.
- Treat symptoms of vog exposure, such as congestion or irritation.
 - Over-the-counter nasal sprays or eye drops may help to reduce symptoms.
- Monitor your child’s health and seek medical assistance if necessary.
 - Even children with no known health conditions can be affected by higher levels of vog.
- Keep your child away from volcanic activity, which includes threats from toxic fumes, smoke and fires, and other hazards to breathing.
- Protect your child from secondhand smoke, which can make respiratory problems worse.
- Make sure your child drinks plenty of water to stay hydrated.
- If conditions worsen, consider temporarily relocating to a less impacted part of the island.

Water catchment systems and your keiki’s health

Ash, laze, and Pele's Hair have been found to contain various metals and are hazardous to ingest. Catchment users should take precautions to protect their catchment tanks and avoid accumulating it in their water tanks. Volcanic ash may also interfere with common water treatment methods, such as filtration and chlorination. SO₂ gas or acidic particles in vog can also generate ‘acid rain’ downwind of an eruption, which if deposited on your roof could leach toxic metals from roofing materials and lower the pH level of the water.

Follow these recommendations to protect your catchment:

- Temporarily disconnect the gutters feeding into the tank.
- Test the pH of your catchment water periodically. The pH level of the catchment tank can be raised by adding baking soda (see Catchment Information in “More Information” below).
- Do not reconnect the system until the volcanic hazards (i.e. ash, laze, Pele's hair in the air) have passed and the ash and debris are washed off the roof, out of the gutters and the tank.
- Place a free-standing or self-supporting non-porous canopy to protect mesh tank covers so that less debris will get in.

County water spigots can be used instead as a safer water supply. The Department of Health does not recommend using catchment water for drinking or for preparing food.

What are the different SO₂ and Particulate Matter (PM_{2.5}) advisory levels?

SO₂ and PM_{2.5} Levels of health concern	Color	Meaning
<p>Good</p> <p>SO₂ is 0.0 to 0.10 ppm (ppm = parts per million of air)</p> <p>PM_{2.5} is 0.0 to 12.0 µg/m³ (µg/m³ = micrograms per cubic meter of air)</p>	Green	Air quality is considered satisfactory. Air pollution poses little or no risk.
<p>Moderate</p> <p>SO₂ is 0.11 to 0.20 ppm</p> <p>PM_{2.5} is 12.1 to 35.4 µg/m³</p>	Yellow	Air quality is acceptable. However, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
<p>Unhealthy for Sensitive Groups</p> <p>SO₂ is 0.21 to 1.00 ppm</p> <p>PM_{2.5} is 35.5 to 55.4 µg/m³</p>	Orange	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
<p>Unhealthy</p> <p>SO₂ is 1.01 to 3.00 ppm</p> <p>PM_{2.5} is 55.5 to 150.4 µg/m³</p>	Red	Everyone may begin to experience health effects. Members of sensitive groups may experience more serious health effects.
<p>Very Unhealthy</p> <p>SO₂ is 3.01 to 5.00 ppm</p> <p>PM_{2.5} is 150.5 to 250.4 µg/m³</p>	Purple	Health alert: Everyone may experience more serious health effects.
<p>Hazardous</p> <p>SO₂ is greater than 5.00 ppm</p> <p>PM_{2.5} is 250.5 to 500.4 µg/m³</p>	Maroon	Health warnings of emergency conditions. The entire population is more likely to be affected.

Sources:

1. U.S. Environmental Protection Agency (www.airnow.gov/index.cfm?action=aqibasics.aqi)
2. HDOH Short-term SO₂ Advisory (<http://www.hiso2index.info/assets/FinalSO2Exposurelevels.pdf>)

Can laze harm my keiki?

“Laze” (lava + haze) occurs when hot lava hits the cold ocean, producing billowing white plumes of steam. Laze can contain dangerous hydrochloric acid and fine glass particles, which can cause damage if inhaled. Both children and adults should avoid areas near laze plumes because it can irritate or damage eyes, skin, and lungs.

Where can I go for more information?

- **VOG Dashboard:** The Vog Information Dashboard is the result of a partnership with the International Volcanic Health Hazard Network (IVHHN), County of Hawai'i, state and federal agencies. It is a one-stop-shop and provides complete, clear and current information on the health effects of vog.
 - **Home page:** <https://vog.ivhhn.org/>
 - **Frequently Asked Questions:** <https://vog.ivhhn.org/FAQ.pdf>
 - **Air Quality Data:** <https://vog.ivhhn.org/current-air-quality>
 - **Vog Forecast Model (University of Hawai'i):** <http://mkwc.ifa.hawaii.edu/vmap/>
 - **Room Air Cleaner Information:** <https://vog.ivhhn.org/air-purifier-information>
 - **Water Catchment Information:** <https://vog.ivhhn.org/catchment-systems>
- **DOH Hawai'i short-term SO₂ monitoring and advisory**
www.hiso2index.info
- **U.S. EPA AirNow current particulate (PM_{2.5}) conditions**
www.airnow.gov
- **Volcanoes (US Centers for Disease Control & Prevention)**
www.cdc.gov/disasters/volcanoes/index.html
- **Volcanic Air Pollution Hazards in Hawai'i (US Geological Survey)**
pubs.usgs.gov/fs/2017/3017/fs20173017.pdf
- **Ashfall Protection Information:** www.ivhhn.org/ash-protection

Resources for parents:

- **The Hawai'i Poison Helpline (1-800-222-1222)**
www.hipionsoncenter.org
- **Aloha United Way 211**
www.auw211.org
- **The Parent Line**
www.theparentline.org
- **Vog Talk Facebook Group**
<https://www.facebook.com/group/VogTalk>

Resources for Healthcare Professionals

- **Promoting Adjustment and Helping Children Cope in a Disaster (American Academy of Pediatrics)**
www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Children-and-Disasters/Pages/Promoting-Adjustment-and-Helping-Children-Cope.aspx

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