Hawaii’s Volcano
An Ongoing Exceptional Event
Hawaii Department of Health (HDOH)
Clean Air Branch

NACAA Cleveland 2018
- Island State
- 8 main islands
- Population 1.4 million
- Oahu most populated
- Hawaii (Big Island) second
- Industry – Tourism
How Vog Travels
Pu’u ‘O’o Eruption

- Erupting continuously since 1983
- Longest and most voluminous outpouring of lava
Halema’uma’u eruption

- March 2008 vent appeared at the Kilauea Summit
- Substantially elevating SO2 emissions at 2 to 10 times background levels at times exceeding the NAAQS
Lower East Rift Zone eruption

- May 2018 – August 2018
- Fissure 8 – Not named yet
Kilauea Volcano Emissions

- Sulfur Dioxide (SO2) emissions were approximately >10,000 tons per day (TPD), at times >50,000 TPD
- Highest SO2 emitter in the state is the HECO Power Plant on Oahu, approximately 20 TPD
VOG

• Volcanic smog aerosols
  \[ SO_2 \rightarrow H_2SO_4 \rightarrow SO_4 \rightarrow PM_{2.5} \]

• Raymond Chuan study (1997)
  – Leeward side of island
    • Bimodal distribution
      – 1.7 μm, largely sodium sulfate and sodium chloride
      – 0.3 μm, almost entirely sulfuric acid
  – Windward side
    • Unimodal
      – 1.7 μm, dominant species sodium chloride
VOG

- Volcanic smog
- “Haze” in the air caused by a combination of weather, wind conditions, and volcanic emissions & activity.
- The direction & amount of wind, and other weather conditions affects the consistency of the vog.

This image, taken by the crew of Space Shuttle Atlantis, shows volcanic plumes from Kilauea rising up from Halema‘uma‘u Crater, Pu‘u ‘O‘o vent, and from along the coastline where lava flows from the East Rift zone into the ocean. The plumes have created a blanket of vog over the Big Island of Hawai‘i. May 2009.

NASA STS-125 crew, NASA Earth Observatory
This NOAA-15 satellite image taken at 0243 UTC on July 10 shows a plume of gases and ash (volcanic smog) to the north and southwest of the Kilauea Volcano which is located at 19.25N 155.16W in the southeastern part of Hawaii’s big island.
VOG on Oahu
Vog Monitoring

- Sulfur Dioxide, PM2.5, wind direction and wind speed
- HDOH stations located in Kona and Hilo prior to 2008
- HDOH added 3 stations located in Mountain View, Ocean View and Pahala after 2008
- The stations monitor impacts in areas where the majority of the population live and work
- HDOH developed an SO2 Short Term Advisory
- The National Park Service (NPS) maintains two stations in the Hawaii Volcanoes National Park (HVNP)
- NPS developed their own advisory and website to alert park employees and visitors
HDOH and NPS Existing Monitors
How people affected?

• Higher levels of sulfur dioxide and fine particulates emissions with possible exceedance of the NAAQS
• Volcanic ash
• Impacts to property, agriculture, and livestock
• Short term and long term health effects
• Increased doctors and hospital visits
• Acid Rain
• Effects on water catchment systems
NAAQS Exceedances

Daily Maximum 1-Hour SO₂ Data: January 1 to February 28, 2011
(1-Hr SO₂ NAAQS: 0.075 ppm - Preliminary Data - Subject To Change)

CAB 2/28/11 update
Volcanic Ash

• Ash fall in Hawai‘i was reported in early 2008 in:
  – Pahala
  – Na‘alehu in Ka‘u
• Described as “like dust”
• Larger particles of ash fall closer to the source of the volcanic emission
• Fine particles carry longer distances

Rising plume from a March 2008 Halema‘uma‘u explosion, drifting over the deserted parking lot, which is coated in brown ash.
U.S. Department of Interior, U.S. Geological Survey

Explosion debris on Crater Rim Drive near the Halema‘uma‘u Overlook, March 2008. The largest fragments at this distance from the source vent (~350 m.) are about 2 cm. in diameter. The yellow stripes on the road are barely visible.
U.S. Department of Interior, U.S. Geological Survey
Volcanic Ash Health Issues

• Short-term exposure to ash can cause eye, nose & throat irritation.

• People with asthma, emphysema, & other respiratory conditions may experience:
  – Runny nose
  – Sore throat
  – Worsening of pre-existing respiratory conditions
  – Difficulty breathing
  – Eye & skin irritation

A robust, brown, ash-rich plume from Halema‘uma‘u Crater, drifting over Crater Rim Drive on the Big Island of Hawai‘i, December 2008.

U.S. Department of Interior, U.S. Geological Survey
Lava enters the ocean (LAZE)
Agricultural & Livestock Impacts
Catchment Water Systems & Vog

- Catchment water systems can collect acidic water that can leach harmful contaminants from roofing & plumbing materials.
- Volcanic ash can get into the water, causing contamination, and interfering with common water treatment methods such as filtration and chlorination.
- Homeowners should NOT use catchment water for drinking or preparing food. County water spigots should be used instead.
Lower East Rift Zone Eruption
May 3, 2018
Hawaii County Response

• The County recognized the magnitude of the emission impact requested assistance from the State and Federal Agencies.
• An emergency proclamation was issued
• Emergency responders
• Hazard assessments and surveys
• Evacuations
• Air Monitoring Viewer
Emergency Response Agencies

• Civil Defense
• Hawaii Emergency Management Agency
• District Health Office
• Hazard Evaluation and Emergency Response
• EPA – Emergency Response Team (ERT)
• National Guard and Coast Guard
• Fire Department/Police
Agencies

**Local**
- Hawaii County
- Hawaii Fire Department (HFD)
- Hawaii Police Department (HPD)
- Hawaii County Civil Defense (HCCD)
- University of Hawaii
- Center for the Study of Active Volcanoes
- Hawaii County Data Systems
- Public Works

**State**
- 93d Civil Support Team (CST)
- Hawaii National Guard
- State Civil Defense
- Hawaii State Laboratories (HSL)
- Hilo Hospital
- Ka’u Hospital
- Pacific Disaster Center (PDC)
- Department of Health (DOH)
- Hazard Evaluation Emergency Response

**Federal**
- Environmental Protection Agency (EPA)
- United States Coast Guard (USCG)
- Superfund Technical Assessment and Response Team (START)
- Response Engineering and Analytical Contract (REAC)
- Federal Fire Department
- National Park Service (NPS)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- Defense Threat Reduction Agency (DTRA)
- American Red Cross
- United States Public Health Service (USPHS)
- United States Geological Service – Hawaii Volcano Observatory (USGS -HVO)
- Edgewood Chemical Biological Center
Hazard Survey

- Planned and executed more than 80 Survey missions
- Conducted 18 sorties of air-insertion Surveys to monitor isolated hazard areas
- Deployed strategic network of Area Rae monitors to provide early warning system for residential areas near the volcano
- Provided QRae and Area Rae training to over 50 HFD Hazmat (Train the Trainer)
- Assisted Hawaii County with developing a comprehensive SO2 response plan
Pahala SO$_2$ Levels (July 24, 2008)
Air Monitoring Viewer

United States Environmental Protection Agency

Air Monitoring Viewer
Hawaii Kilauea Eruption

*Unified Agencies*

*Layers*

*Legend*

*Air Monitoring Data*

The Blue, Orange, and Red County Civil Defense color codes are being used to inform emergency responders and the public about changing local conditions near current volcanic activity. Refer to the DOH Sulfur Dioxide Short Term Advisory Levels Table for specific health guidance on measured air concentrations.

The map is showing the average concentration of all Sulfur Dioxide (SO2) and Hydrogen Sulfide (H2S) readings received in the last 30 minutes and is updated every time a new reading is received. (Please click on a location in the map to view the air monitoring information.)

<table>
<thead>
<tr>
<th>Code</th>
<th>Color</th>
<th>SO2 Level (ppm) - 30 min average</th>
<th>H2S Level (ppm) - 30 min average</th>
<th>Health Effort</th>
<th>Public Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td></td>
<td>0.0 to 0.2</td>
<td>0.0 to 0.8</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td>&gt; 0.2 to 1.0</td>
<td>&gt; 0.8 to &lt; 7.0</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>Red</td>
<td></td>
<td>above 1.0</td>
<td>7.0 or above</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>Instrument Connection Status = Down</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other Resources for Residents and Visitors Islandwide
EPA has assigned a specific color to each AQI category to make it easier for people to understand quickly whether air pollution is reaching unhealthy levels in their communities. For example, the color orange means that conditions are "unhealthy for sensitive groups," while red means that conditions may be "unhealthy for everyone," and so on.

<table>
<thead>
<tr>
<th>Air Quality Index Levels of Health Concern</th>
<th>Numerical Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0 to 50</td>
<td>Air quality is considered satisfactory, and air pollution poses little or no risk.</td>
</tr>
<tr>
<td>Moderate</td>
<td>51 to 100</td>
<td>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.</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups</td>
<td>101 to 150</td>
<td>Members of sensitive groups may experience health effects. The general public is not likely to be affected.</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>151 to 200</td>
<td>Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.</td>
</tr>
<tr>
<td>Very Unhealthy</td>
<td>201 to 300</td>
<td>Health alert: everyone may experience more serious health effects.</td>
</tr>
<tr>
<td>Hazardous</td>
<td>301 to 500</td>
<td>Health warnings of emergency conditions. The entire population is more likely to be affected.</td>
</tr>
</tbody>
</table>

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the "Hazardous category." Additional information on reducing exposure to extremely high levels of particle pollution is available here.
• Provide assistance to the County
• Deployed portable temporary air monitors (EPA)
• Developed emergency response action levels with input from EPA, Hawaii Poison Center and ATSDR/CDC
• Provide public advisories and information via website, brochures, and community meetings
• Additional ambient air monitoring
Emergency Response - AIR

• Temporary Air Monitoring
  – MIT Sensors for SO2
    9 sensors placed
    approximately 30 additional sensors arriving for various pollutants
  – EPA monitors for SO2, H2S, PM10 and PM2.5
  – Data available to Civil Defense and Hawaii County
  – Borrowed monitors from other states/agencies arriving
Temporary EPA Monitors

- Data used for emergency response efforts in the lower East Rift Zone
- Measures SO2 and hydrogen sulfide (H2S)
- 15 EPA stations
- Majority placed around the active fissure area
- Few placed in the southern and western areas of Hawaii island
- Replaced with DOH owned temporary monitors
Temporary EPA Monitors
HAWAII COUNTY S02 RISK ASSESSMENT AIR MONITORING PLAN
April 24, 2008
(Draft)

Auto Alert to Fire Chief at This Level

Air Quality Monitoring System

<table>
<thead>
<tr>
<th>MONITOR LOCATION</th>
<th>Status</th>
<th>Agency</th>
<th>Type</th>
<th>S02 Detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilo</td>
<td>active</td>
<td>State DOH</td>
<td>Fixed</td>
<td>≤1 PPM</td>
</tr>
<tr>
<td>Mt. View</td>
<td>active</td>
<td>State DOH</td>
<td>Fixed</td>
<td>≤1 PPM</td>
</tr>
<tr>
<td>Leilani (Funa E)</td>
<td>active</td>
<td>State DOH</td>
<td>Fixed</td>
<td>≤1 PPM</td>
</tr>
<tr>
<td>Pahoa</td>
<td>active</td>
<td>State DOH</td>
<td>Fixed</td>
<td>≤1 PPM</td>
</tr>
<tr>
<td>Kona</td>
<td>active</td>
<td>State DOH</td>
<td>Fixed</td>
<td>≤1 PPM</td>
</tr>
<tr>
<td>Volcano (proposed)</td>
<td>proposed</td>
<td>State DOH</td>
<td>Fixed</td>
<td>≤5 PPM</td>
</tr>
<tr>
<td>S. Kohala (proposed)</td>
<td>proposed</td>
<td>State DOH</td>
<td>Fixed</td>
<td>TBD</td>
</tr>
<tr>
<td>Various Locations (8)</td>
<td>planned</td>
<td>Hawaii County</td>
<td>Semi-mobile Area RAES</td>
<td>0-20 PPM</td>
</tr>
<tr>
<td>County Fire Stations</td>
<td>active</td>
<td>Hawaii</td>
<td>Field Q</td>
<td>0-20 PPM</td>
</tr>
</tbody>
</table>

SO2 Level | Time Wt. Ave
0.8 ppm   | 15 min
3.0 ppm   | 1 hr

Recommend Evacuation Advisory

Dispatch FD Response Monitoring Crew to Impact Areas

Or

<table>
<thead>
<tr>
<th>SO2 Level</th>
<th>Time Wt. Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 ppm</td>
<td>15 min</td>
</tr>
<tr>
<td>SO₂ Conc. (ppm)</td>
<td>Color Code &amp; Air Quality Condition</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>&gt;0 – 0.2</td>
<td>Green (Good)</td>
</tr>
<tr>
<td>&gt;0.2-0.4</td>
<td>Yellow (Moderate)</td>
</tr>
<tr>
<td>&gt;0.4 - 1</td>
<td>Orange (Unhealthy for Sensitive Groups)</td>
</tr>
<tr>
<td>&gt;1 - 3</td>
<td>Red (Unhealthy)</td>
</tr>
<tr>
<td>&gt;3 - 5</td>
<td>Purple (Very Unhealthy)</td>
</tr>
<tr>
<td>&gt; 5</td>
<td>Maroon (Hazardous)</td>
</tr>
</tbody>
</table>

¹ If you experience breathing difficulties, such as chest tightness or wheezing, stop activities, use a rescue inhaler and find a place to sit down and rest.

² Everyone Else

³ Sensitive Groups

⁴ Red (Unhealthy)
### Schools affected by the Vog

- **Provide portable SO2 monitors**
- **Email alerts from HDOH stations**
- **Developed an action plan**
- **Shelter in Place**

### SULFUR DIOXIDE ACTION PLAN

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>SCHOOL ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green</strong></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>1) Maintain normal school operations</td>
</tr>
<tr>
<td>0.0 – 0.2 ppm</td>
<td>2) Monitor air quality</td>
</tr>
<tr>
<td></td>
<td>3) Notify headroom if staff/students are in need of medical attention</td>
</tr>
<tr>
<td></td>
<td>4) Affected staff/students will be evaluated by school health aide with reference to Respiratory Action Plan (RAP)</td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1) Maintain normal school operations</td>
</tr>
<tr>
<td>0.0 – 0.2 ppm</td>
<td>2) Monitor air quality</td>
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<td></td>
<td>4) Affected staff/students will be evaluated by school health aide with reference to Respiratory Action Plan (RAP)</td>
</tr>
<tr>
<td></td>
<td>5) Updates will be made every hour or as needed</td>
</tr>
<tr>
<td>Orange</td>
<td></td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups</td>
<td>1) Limit outdoor exposures by conducting indoor activities (Recess, PE)</td>
</tr>
<tr>
<td>0.2 – 0.4 ppm</td>
<td>2) Conduct Shelter in Place Procedures</td>
</tr>
<tr>
<td></td>
<td>3) Monitor air quality</td>
</tr>
<tr>
<td></td>
<td>4) Notify headroom if staff/students are in need of medical attention</td>
</tr>
<tr>
<td></td>
<td>5) Affected staff/students will be evaluated by school health aide with reference to Respiratory Action Plan (RAP)</td>
</tr>
<tr>
<td></td>
<td>6) Updates will be made every hour or as needed</td>
</tr>
<tr>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Unhealthy</td>
<td>1) Limit outdoor exposures by conducting indoor activities (Recess, PE)</td>
</tr>
<tr>
<td>1.0 – 3.0 ppm</td>
<td>2) Monitor air quality</td>
</tr>
<tr>
<td></td>
<td>3) Notify headroom if staff/students are in need of medical attention</td>
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<tr>
<td></td>
<td>5) Updates will be made every hour or as needed</td>
</tr>
<tr>
<td>Purple</td>
<td></td>
</tr>
<tr>
<td>Very Unhealthy</td>
<td>1) Conduct Shelter in Place (School-Wide Safe Room Procedure)</td>
</tr>
<tr>
<td>3.0 – 5.0 ppm</td>
<td>2) Monitor air quality</td>
</tr>
<tr>
<td></td>
<td>3) Notify headroom if staff/students are in need of medical attention</td>
</tr>
<tr>
<td></td>
<td>4) Affected staff/students will be evaluated by school health aide with reference to Respiratory Action Plan (RAP)</td>
</tr>
<tr>
<td></td>
<td>5) Updates will be made every hour or as needed</td>
</tr>
<tr>
<td></td>
<td>6) Communicate with district office on current conditions and next steps</td>
</tr>
<tr>
<td>Maroon</td>
<td></td>
</tr>
<tr>
<td>Hazardous</td>
<td>1) Conduct Shelter in Place (School-Wide Safe Room Procedure)</td>
</tr>
<tr>
<td>5.0+ ppm</td>
<td>2) Monitor air quality</td>
</tr>
<tr>
<td></td>
<td>3) Notify headroom if staff/students are in need of medical attention</td>
</tr>
<tr>
<td></td>
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<td>5) Updates will be made every hour or as needed</td>
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<td></td>
<td>6) Communicate with district office on current conditions and next steps</td>
</tr>
</tbody>
</table>

- Conditions are continuously monitored by the School Safety Manager and/or Vice Principal. Condition reports are made to the Principal.
- When SO2 elevated levels last for more than 30 minutes, appropriate actions are taken.
- Teachers and staff should continuously monitor reactions to Vog/SO2

**Vog:** Headache, breathing difficulties, increased respiratory ailments, watery eyes, sore throat

**Sulfur Dioxide:** Irritation to eyes, nose, throat and respiratory tract, burning eyes, coughing, difficulty in breathing, tightness in chest

© KKPSO2.2 - DRAFT
Advisory System

• Established station alarm to alert Hawaii County Civil Defense and schools
• HDOH dissemination of the monitored results to the public through websites, text or email notifications
• PM2.5 Air Quality Index on EPA AirNow website
• Hawaii SO2 Advisory
• Hawaii Ambient Air Quality
Message on AirNow page

Air Quality Information for Hawaii Residents and Visitors

The Hawaii Department of Health reports that vog conditions may increase and fluctuate in various areas of the state as the eruption of Kilauea volcano continues. Vog is a hazy mixture of sulfur dioxide gas (SO2) and fine particles (PM2.5) emitted from an erupting volcano.

If you are a Hawaii resident or visitor, stay tuned to and follow directions provided by Hawaii County public officials and emergency personnel.

Here are several resources for learning about Hawaii air quality conditions:

- Hawaii Interagency Vog Information Dashboard [www.ivhno.org/vog/](http://www.ivhno.org/vog/) This site provides comprehensive information on vog and SO2.
- Hawaii Short Term SO2 Advisory: [http://www.hisot2index.info/](http://www.hisot2index.info/)
- Hawaii outdoor quality data [https://emdweb.doh.hawaii.gov/air-quality/](https://emdweb.doh.hawaii.gov/air-quality/)
- AirNow information from real time PM2.5 monitors in Hawaii: [https://www.airnow.gov/index.cfm?action=airnow.local_state&stateid=12&mapcenter=0&tabs=0](https://www.airnow.gov/index.cfm?action=airnow.local_state&stateid=12&mapcenter=0&tabs=0)

The Department of Health has advised residents and visitors to be prepared and aware of the surrounding conditions, and how they feel or may react to vog in the air.

Here are some precautionary measures to take in the event of vog conditions:

- Reduce outdoor activities that cause heavy breathing. Avoiding outdoor activity and exercise during vog conditions can reduce exposure and minimize health risks. This is especially important for sensitive groups such as children, the elderly, and individuals with pre-existing medical conditions such as asthma, bronchitis, emphysema or heart disease.
- Stay indoors and close windows and doors. If an air conditioner is used, set it to recirculate.
- Always keep medications on hand and readily available. Daily prescribed medications should be taken on schedule.
- Contact a doctor as soon as possible if any health problems develop.
- Do not smoke and avoid second-hand smoke.
- Drink plenty of fluids to avoid dehydration.
- Have family emergency plans prepared and ready.
AirNow EnviroFlash

• Email notifications
• Subscribe at http://www.enviroflash.info/

Current Air Quality for Kona, HI

Tuesday, June 05 - 12 AM
The most recent hourly estimate of Particle Pollution (2.5 microns) reached 129 AQI (Unhealthy for Sensitive Groups).
We are sending you this alert because your local air quality may be changing. Take action appropriate for your health conditions – and please monitor the latest conditions at www.airnow.gov.
Hawaii SO2 Advisory

The information on this page provides current sulfur dioxide (SO2) levels due to the Kilauea Volcano on the Island of Hawaii. Click on the site links for current day historical data. For additional information about other air pollutants, please visit AirNow's Hawaii State Page.

<table>
<thead>
<tr>
<th>Site</th>
<th>SO2 (ppm)</th>
<th>Air Quality</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawaii Volcanoes NP - Jagger Museum</td>
<td>0.10</td>
<td>Good</td>
<td>1:15 pm</td>
</tr>
<tr>
<td>Hawaii Volcanoes NP - Visitor's Center</td>
<td>0.04</td>
<td>Good</td>
<td>1:15 pm</td>
</tr>
<tr>
<td>Hilo</td>
<td>0.00</td>
<td>Good</td>
<td>12:30 pm</td>
</tr>
<tr>
<td>Kona</td>
<td>0.06</td>
<td>Good</td>
<td>1:15 pm</td>
</tr>
<tr>
<td>Mountain View</td>
<td>0.00</td>
<td>Good</td>
<td>1:15 pm</td>
</tr>
<tr>
<td>Pahala</td>
<td>0.05</td>
<td>Good</td>
<td>12:45 pm</td>
</tr>
<tr>
<td>Ocean View</td>
<td>0.03</td>
<td>Good</td>
<td>1:15 pm</td>
</tr>
</tbody>
</table>

Advisory Levels:
- Good
- Moderate
- Unhealthy for Sensitive Groups
- Unhealthy
- Very Unhealthy
- Hazardous
- Data Not Available

More Information:
- Short-term Sulfur Dioxide (SO2) Advisory Level Information
- AirNow's Hawaii State Page
- National Park Service - Hawaii Volcanoes National Park
- Hawaii Ambient Air Quality Data
- Clean Air Branch - Home Page
- County of Hawaii Civil Defense
- Vog Measurement and Prediction Project (MMAP)
- USGS Volcano Hazards Program
- Frequently Asked Questions on Vog, from Kilauea Volcano
- Data Disclaimer

Disclaimer and Terms of Use
Hawaii State Department of Health 1250 Punchbowl Street Honolulu, HI 96813
Hawaii Ambient Air Quality
VMAP
Vog Measurement and Prediction Project

- **University of Hawaii at Manoa**
  - Steven Businger, PI, Dept. of Meteorology
  - Keith Horton, CO PI, Hawaii Institute of Geophysics and Planetology
  - Roy Huff, Dept. of Meteorology

- **Collaborators**
  Jeff Sutton, USGS Hawaiian Volcano Observatory
  Tamar Elias, USGS Hawaiian Volcano Observatory
  Roland Draxler, NOAA Air Resources Laboratory
Air Quality Data on the Internet

- Hawaii Short Term SO2 Advisory: 
  http://www.hiso2index.info/
- AIRNow’s Hawaii State Page: 
  http://airnow.gov/now.local_state&stateid=12&tab=0
- National Park Service – Hawaii Volcanoes National Park: 
  http://www.nature.nps.gov/air/WebCams/parks/havoso2alert/havoalert.cfm
- Hawaii Ambient Air Quality Data: 
  http://emdweb.doh.hawaii.gov/air-quality/
- Vog Measurement and Prediction Project VMAP: 
  http://mkwc.ifa.hawaii.edu/vmap/hysplit/
Hawaii Interagency Vog Information Dashboard

Welcome to the Vog Dashboard. Please click on the links below to find comprehensive information and data related to vog and its impacts.

- **What is vog?**
  - Description of vog and links to factsheets

- **Vog and wind forecasts**
  - Links to the VMAP vog and NWS wind forecast models
General Information

• Hawaii Interagency Vog Information Dashboard: http://vog.ivhhn.org
• National Park Service for park closures and advisories www.nps.gov/havo/closed-areas.htm
• County of Hawaii Kilauea Eruption Update http://lavainfo.us
• Hawaii county civil Defense for current information, advisory or message http://co.hawaii.hi.us/cd/message.htm
• American Lung Association of Hawaii http://www.ala-hawaii.org/
Ambient Air Monitoring
Existing HDOH and NPS Monitors

• 5 HDOH and 2 NPS monitoring stations
• Measures sulfur dioxide (SO2) and particulates (PM2.5)
• Located in Kona, Hilo, Ocean View, Pahala, Mountain View and the Volcano National Park
• Data available on websites
• Puna station was taken by the lava
Pahala and Oceanview SO2

Eruption Begins

Federal 1-Hour Standard for SO2 = 75 ppb

Eruption Ends
Kona PM2.5

Federal 24-Hour Standard for PM2.5 = 35 μg/m3
Vog in Kona

Before

Now
HDOH and NPS Existing Monitors
Additional Air Monitoring Stations

- Developing plan for long term stations
- Place additional stations in communities where currently no monitoring
- Replace the temporary EPA and MIT sensors
- Special purpose monitors (SPM)
- Regulatory monitors (SLAMS)
- Provide the data to the public
Additional Monitoring

• Proposed 10 additional monitoring stations
• Measures sulfur dioxide and fine particulates
• Around Hawaii Island
• Populated areas
• Targeted schools
• Community Feedback
• Few months to a year to establish and deploy
Siting Requirements

• Area 12 by 18 feet
• Security
• Access
• Utilities (electrical and communications)
• Meet EPA siting guidelines
• Approvals
• Lease or MOU agreements
Challenges of Siting

• Costs (site improvements)
• Security issues, vandalism and theft
• Finding open areas
• Away from other sources of pollution (construction, imu)
• Does not meet EPA siting guidelines
• Schools
  – Policies, procedures, rules to abide by
  – Liability/safety concerns for students and staff
  – Lack of space
  – Lack of utilities
### Additional Regulatory Monitoring Stations

<table>
<thead>
<tr>
<th>Geographic Area</th>
<th>Pune</th>
<th>Oahu</th>
<th>Maui</th>
<th>Kauai</th>
<th>Hawaii</th>
<th>Big Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Paia High School (behind gymnasium)</td>
<td>Kaena State Park</td>
<td>Waimea Elementary School</td>
<td>Enchanted Forest Park</td>
<td>Hamakua</td>
<td>Waimea Elementary School/Pauilo Elementary &amp; Intermediate School</td>
</tr>
<tr>
<td>Priority for PM 2.5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Priority for SO2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>GPS Coordinates</td>
<td>19° 39' 36.36&quot; N 155° 26' 39.00&quot; W</td>
<td>19° 36' 21.41&quot; N 155° 03' 05.30&quot; W</td>
<td>19° 26' 33.95&quot; N 155° 58' 43.06&quot; W</td>
<td>19° 40' 08.77&quot; N 155° 58' 43.06&quot; W</td>
<td>19° 59' 31.03&quot; N 155° 47' 13.10&quot; W</td>
<td>20° 01' 06.09&quot; N 155° 40' 04.53&quot; W</td>
</tr>
<tr>
<td>Elevation</td>
<td>400 feet</td>
<td>500 feet</td>
<td>644 feet</td>
<td>910 feet</td>
<td>360 feet</td>
<td>2675 feet</td>
</tr>
<tr>
<td>Approval Obtained</td>
<td>REQUEST LETTER TO BE SENT FOR MEETING</td>
<td>REQUEST LETTER TO BE SENT FOR MEETING</td>
<td>REQUEST LETTER TO BE SENT FOR MEETING</td>
<td>REQUEST LETTER TO BE SENT FOR MEETING</td>
<td>REQUEST LETTER TO BE SENT FOR MEETING</td>
<td>REQUEST LETTER TO BE SENT FOR MEETING</td>
</tr>
<tr>
<td>Contact Information</td>
<td>SCAI FNSH: PRINCIPAL 313-4300</td>
<td>PETER FUCHS, DIRECTOR OF CAMPUS OPERATIONS 182-0538</td>
<td>CYRUS YOUNG, MECHANICAL ENGINEER V 301-0795</td>
<td>DARL方 JUAREZ, PRINCIPAL 313-4300</td>
<td>ROBERT HAUNAN, WATER DISTRICT SUPERVISOR 322-0630</td>
<td>ROBERT HAUNAN, WATER DISTRICT SUPERVISOR 322-0630</td>
</tr>
</tbody>
</table>

### Electrical

- **MEC installation required**: YES (estimate $1,200) | YES (estimate $2,400) | YES (estimate $6,000) | NO | YES (estimate $7,500) | YES | NO | YES | YES

### Security

- **Area secured**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **Need additional security**: YES | YES | NO | NO | NO | NO | NO | NO | YES

### Siting Requirements

- **Inlet pipe unobstructed**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **Unrestricted airflow arc of 270 degrees including predominant wind path**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **Away from sources such as hollowing or dunes**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **10 meters or further from tree drip lines**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **Minimum 1 meter vertically or horizontally away from any supporting structures**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **2.3 meters above the ground**: YES (grass) | YES (grass) | YES (grass) | YES (grass) | NO (rocks & gravel) | YES (gravel) | YES (gravel) | YES (gravel) | YES (gravel)
- **Neighborhood scale**: YES | YES | YES | YES | YES | YES | YES | YES | YES
- **Away from Road**: NO (30 ft.) | YES (100 ft.) | YES (300 ft.) | YES | YES | YES | YES | YES | YES

**Notes**: Select either Keaau site. May need to grade. Need to install window AC. May need platform for PM. May need to grade. Ensure that power pole does not interfere with access to tank. Provide cover for Kalaikini/Presidio. Currently no electrical outlets may consider solar EBAM.
Clean Air Branch

- Answer public and media calls or inquiries
- Provide information/data/technical guidance to Hawaii County, EPA, DOH DOC, and other Agencies
- Work with the DOH Communications to draft press releases and advisories
- Attended community meetings
- Reached out to EPA and other states for air monitoring equipment (sensors and analyzers)
- Reached out to EPA for assistance with funding
- Initiate plans for long term ambient air monitoring
Challenges - Monitoring

• Ambient air monitoring suddenly becomes emergency response monitoring
• Everyone wants a monitor in their backyard
• How many monitors and where to place them?
• Limitations and reliability of the data collection and data acquisition system
• Procurement and funding issues
• Providing email alerts from monitoring stations
• Maintaining possibly 15 stations on the Big Island with limited resources
• How to forecast due to the unpredictable nature of the volcanic emissions, topography and wind patterns
• Exceedance notification requirements
Other Challenges

• Coordination with other agencies
  • Roles and responsibilities
  • Communication

• Unpredictable high level spikes lasting from 5 minutes to several hours

• Agreement on advisory levels and time periods (5 minutes, 15 minutes, 1 hour)

• Public education, outreach and notification
  • Health effects, masks, air purifiers, shelter in place, etc.
  • Alerts, advisories, notifications, etc.
  • Tourism and businesses

• Providing information to people with no internet access
Lessons Learned

• Data must be of good quality, reliable, and useful to be meaningful
• To be useful the public needs to understand what the data means
• Shelter in place instead of evacuating
• The public wants timely alerts, notifications, and information
• To prevent public confusion information or alerts should be standardized
• Communicating health risk and educating the public is extremely important
Ongoing

• Continue to improve our monitoring capabilities and website to provide more timely information to the public
• Provide email notification to the public and media
• Forecasting air quality for particulates and SO2
• Exceptional events documentation due to the daily exceedances of the 1 hour SO2 standard
• Improve and update mitigation plans
• EPA Vog conference calls
• Vog studies
• Public outreach to educate the public
Preparedness and Planning

• Office of Public Health Preparedness
  • Determine roles and responsibilities
  • Provide training
  • Improve coordination between agencies
• Build capabilities for forecasting
• Prepare information for the public, press releases and advisories
• Ensure adequate inventory of equipment
• Reach out to other agencies for resources
• Comprehensive up-to-date Emergency Mitigation Plans
• Plan now for the possibility of the next event
We would like to acknowledge all of the state agencies and other organizations that offered assistance to Hawaii during this critical time. We would also like to give a special thanks to the organizations that loaned Hawaii air monitoring equipment during this event.

- EPA
- NACAA
- Western States Air Resources Council (WESTAR)
- California Air Resources Board (CARB)
- Sacramento Metropolitan Air Quality Management District
- Arizona DEQ
- State of New Jersey Department of Environmental Protection
Acknowledgements

Our thanks to everyone involved in assisting with or working on this ongoing exceptional event. There were too many to list...

ALOHA