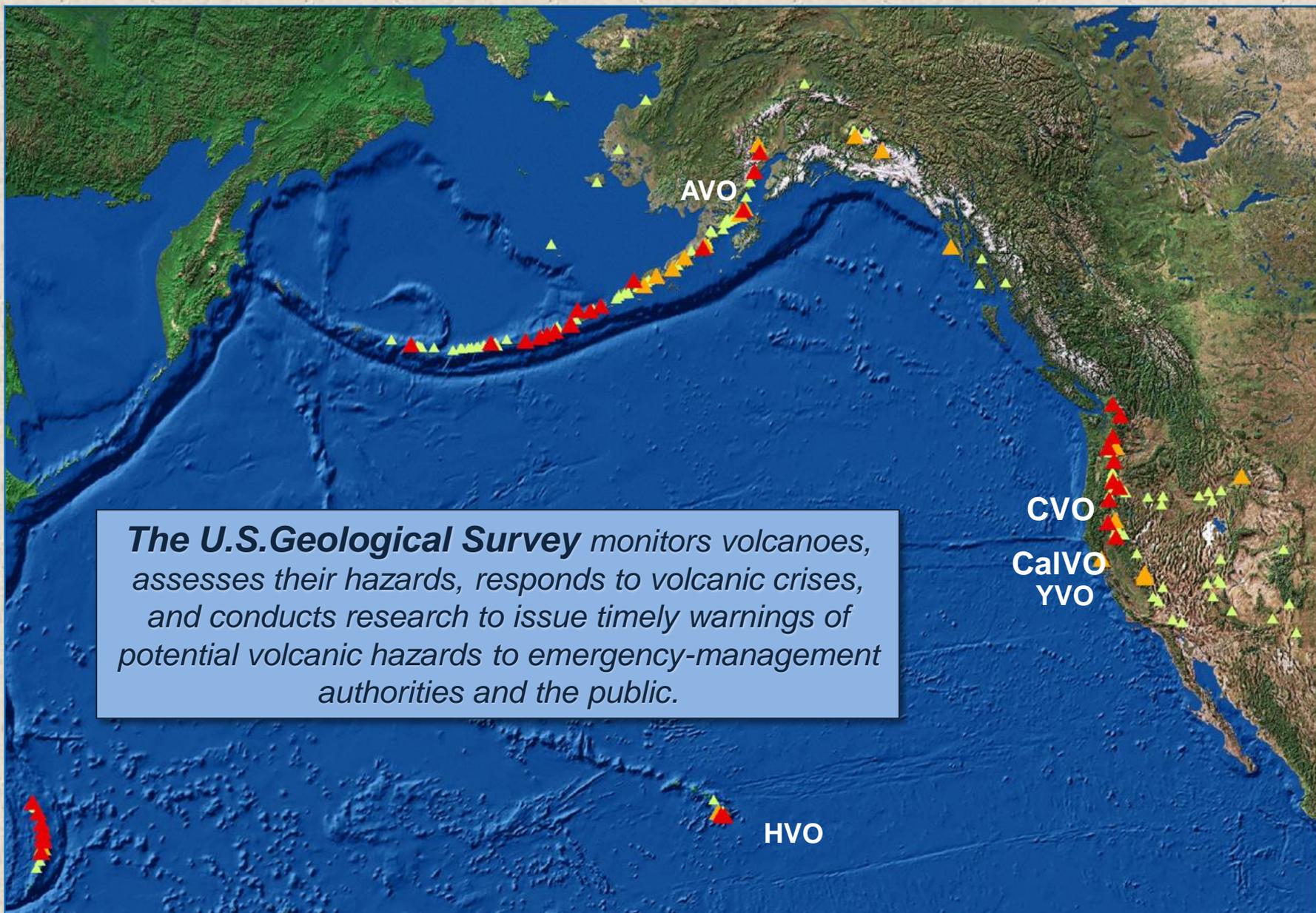




Margaret Mangan and Jennifer Lewicki
USGS, Menlo Park





Volcanic eruptions occur in the State of California about as frequently as the largest San Andreas Fault Zone earthquakes.

Ten eruptions in California over the past 1,000 years, most recently at Lassen Peak (1914 to 1917).

1915 Lassen Peak Eruption
Viewed from Red Bluff California
65 km to the west of the volcano



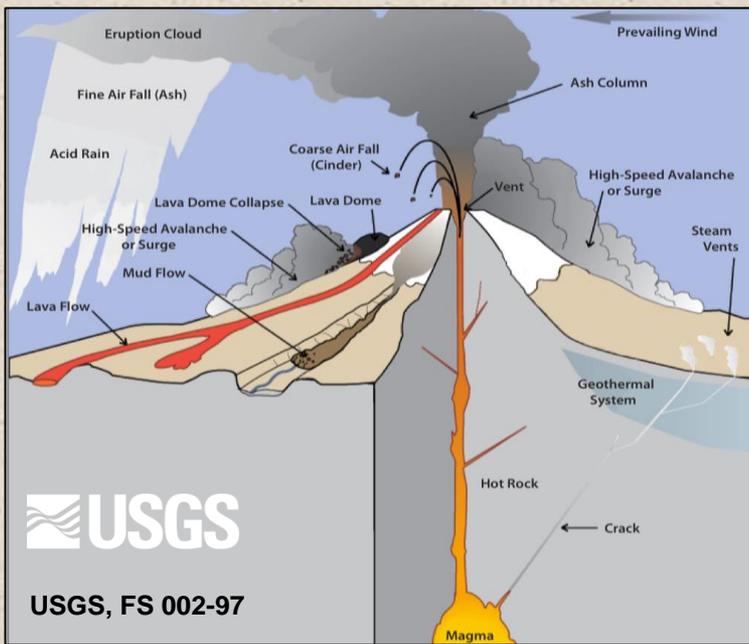
As a part of the U.S. Geological Survey's Volcano Hazards Program, the California Volcano Observatory aims to advance scientific understanding of volcanic processes and lessen the harmful impacts of volcanic activity in the volcanically active areas of California.

Eight "Watch List" Volcanoes in California

Assessment of Volcanic Threat and Monitoring Capabilities USGS Open-File Report 2005-1164



Volcanoes of very high to low threat are scattered throughout California, from the Oregon border (north) to Mexico (south). Other older volcanoes in California are of less concern. California's volcano watch list is subject to change as new data on past eruptive activity are collected, as volcanic unrest changes, and as populations in threatened areas grow or decline.



Montserrat, MVO photo

Explosive Eruptions

Damaging and life-threatening

Effusive Eruptions

Damaging, generally not life threatening

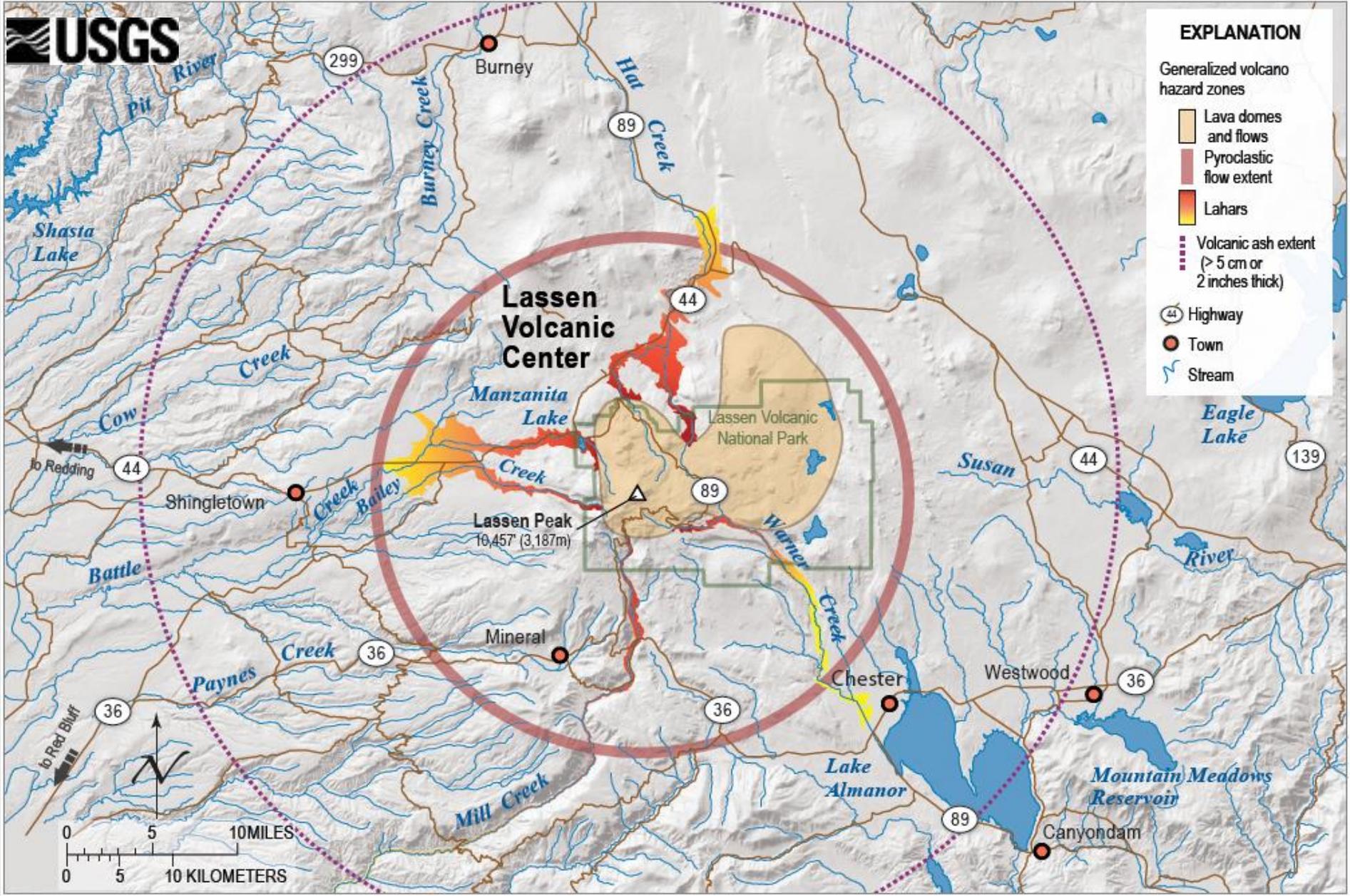


Hawaii, HVO photo

California Volcano FAQs

- Chances of California eruption about 1 in a few 100 to 1 in a few 1000 annually
- California volcano hazard zones cover 24,000 square miles and cross 19 counties
- More than 190,000 Californians live within a volcano hazard zone

WHAT ARE VOLCANO HAZARD ZONES?



EXPLANATION

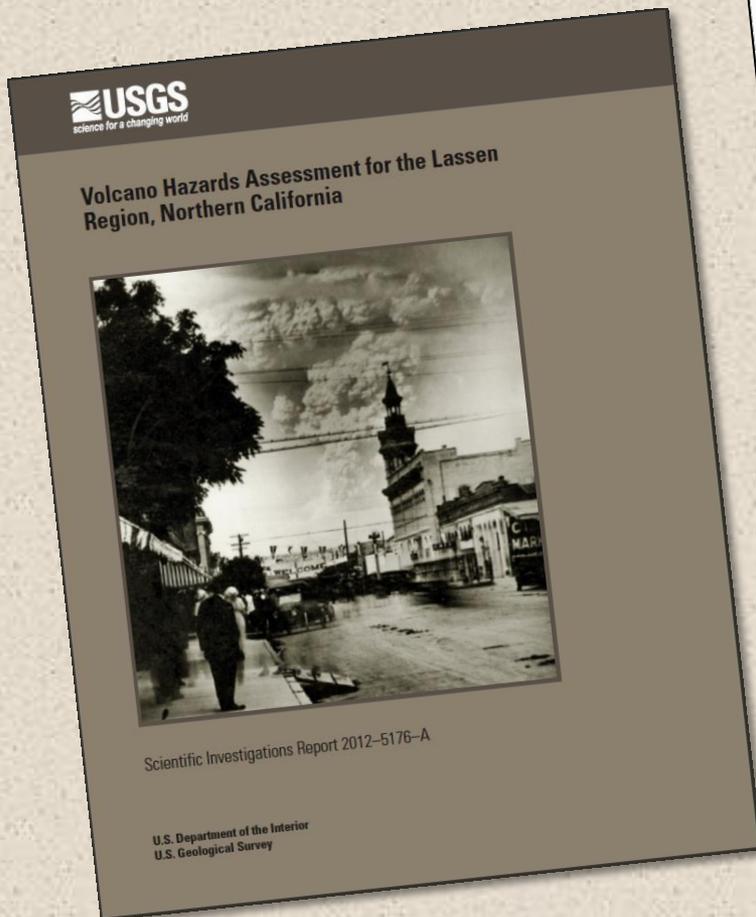
Generalized volcano hazard zones

- Lava domes and flows
- Pyroclastic flow extent
- Lahars
- Volcanic ash extent (> 5 cm or 2 inches thick)
- Highway
- Town
- Stream

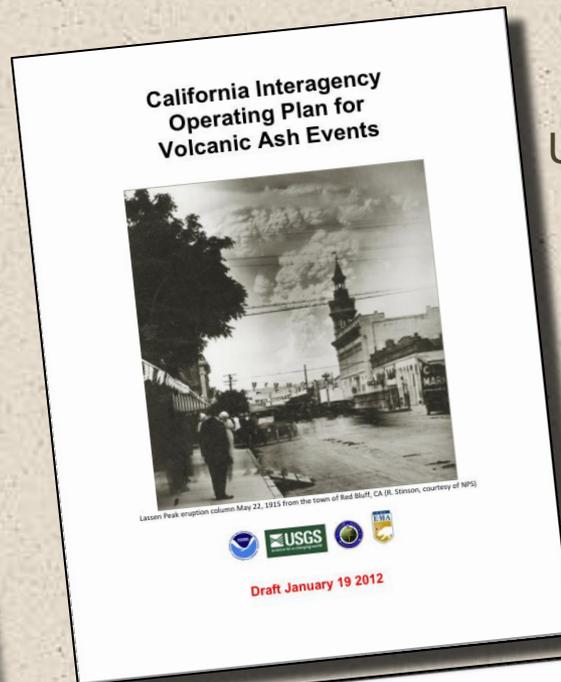
Science in Public Service...



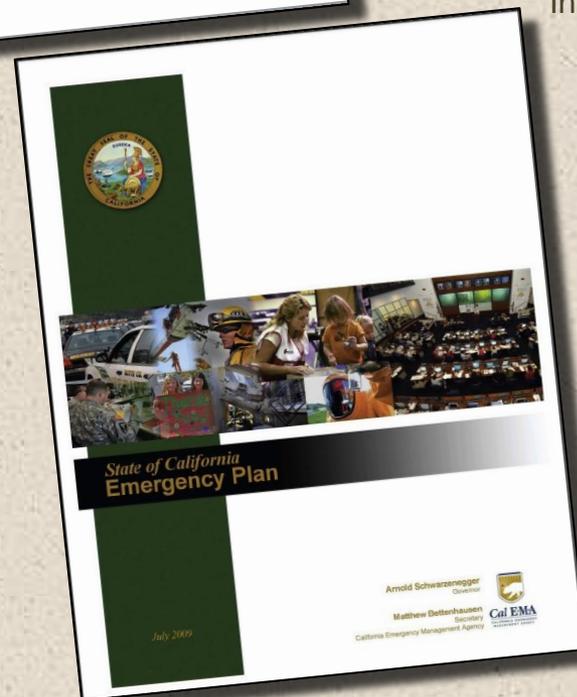
USGS, NOAA, FAA, CalEMA
Interagency Ash Event Plan 2012



USGS Volcano Hazard Assessment
Lassen Volcanic Center 2012



CalOES, USGS, CGS
Volcano Hazards Annex
State of California Emergency Plan
In preparation, 2015



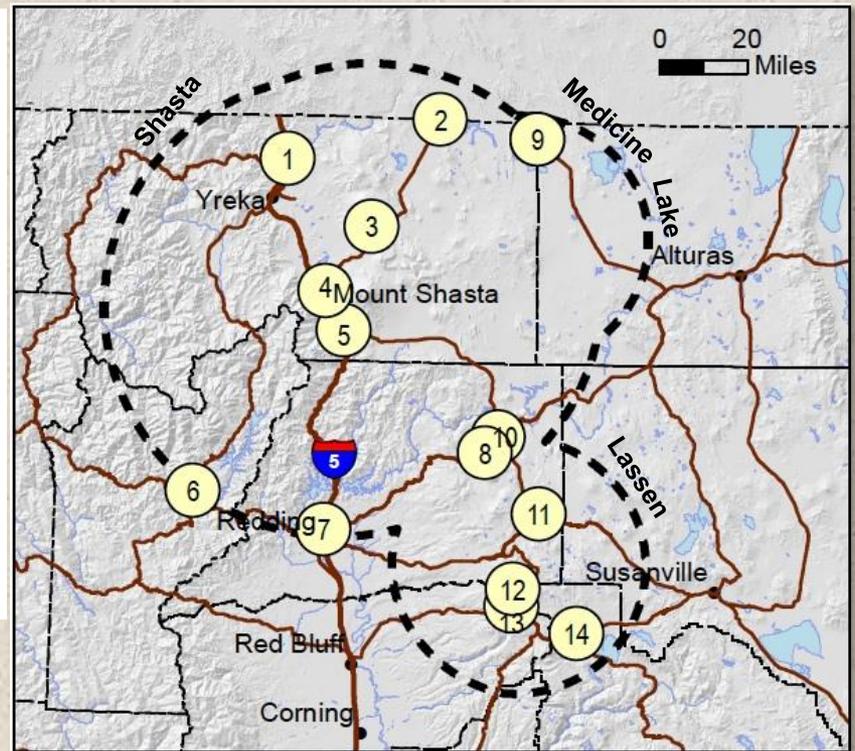


USGS-CaIOES-CGS Vulnerability Study

Several million vehicles annually in NorCal volcano hazard zones

Annual Traffic Volume (thousands)					
Number	Back	Ahead	Number	Back	Ahead
1	164		17	3,979	3,906
2	1,314		18	2,847	2,409
3	1,132	1,132	19	2,957	4,052
4		3,796		4,052	4,052
5	1,132				6,497
6	511	1,369	20	197	172
7	19,710	15,148	21	1,186	1,241
8	3,139	3,139	22	1,533	1,643
9	785	785	23	1,424	1,424
10	639	712	24	2,665	
11		529	25	2,336	2,336
12	106		26		1,270
13		106	27	329	296
14	621		28	3,760	3,541
15	2,993	4,271	29	2,081	2,044
16	3,212	2,738			

Volcano Hazard Zones
Lassen, Shasta
Medicine Lake

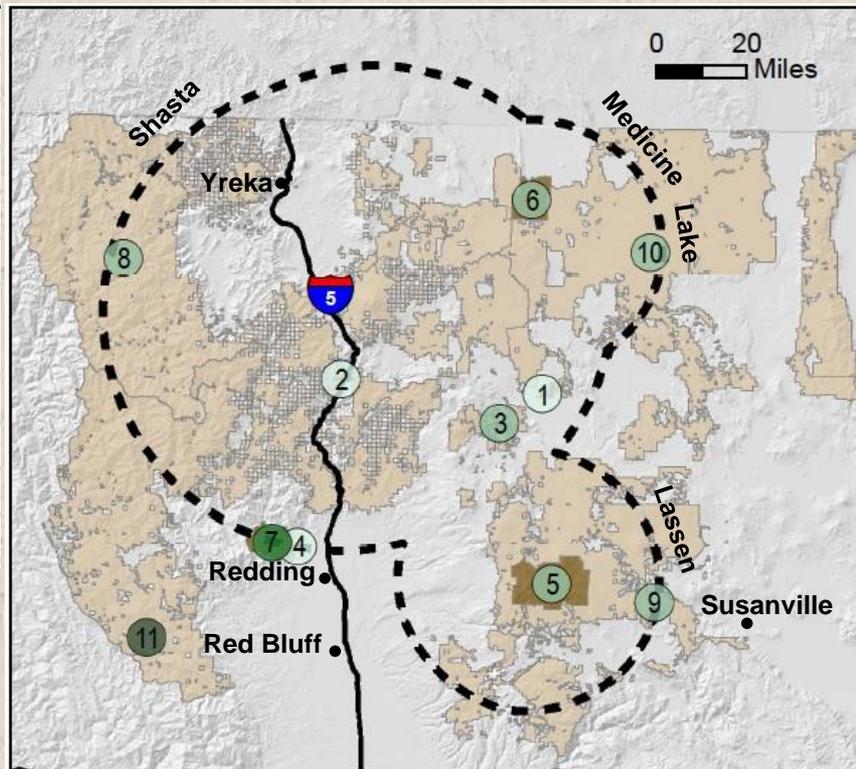


USGS-CaIOES-CGS Vulnerability Study

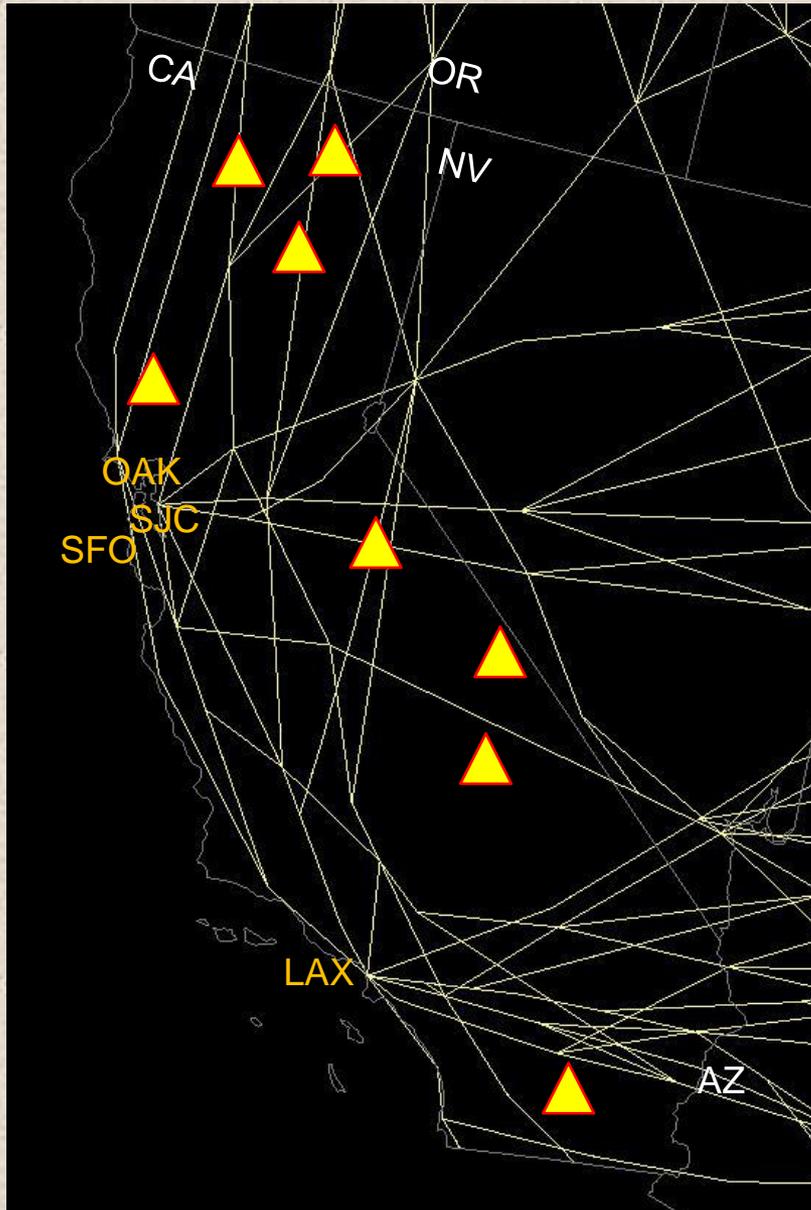
About a million visitors annually in NorCal hazard zones

1	Ahjumawi Lava Springs State Park
2	Castle Craggs State Park
3	McArthur-Burney Falls Memorial State Park
4	Shasta State Historic Park
5	Lassen Volcanic National Park
6	Lava Beds National Monument
7	Whiskeytown-Shasta-Trinity National Recreation Area
8	Klamath National Forest
9	Lassen National Forest
10	Modoc National Forest
11	Shasta-Trinity National Forest

	California State Parks
	National Parks
	National Forests
Annual visitation	
	<= 100,000
	> 100,000 - 500,000
	> 500,000 - 1,000,000
	> 1,000,000



Volcano Hazard Zones
Lassen, Shasta
Medicine Lake



Not just a “*local*” problem

Volcanoes and
High Altitude Jet Routes

 California's
“watch list” volcanoes



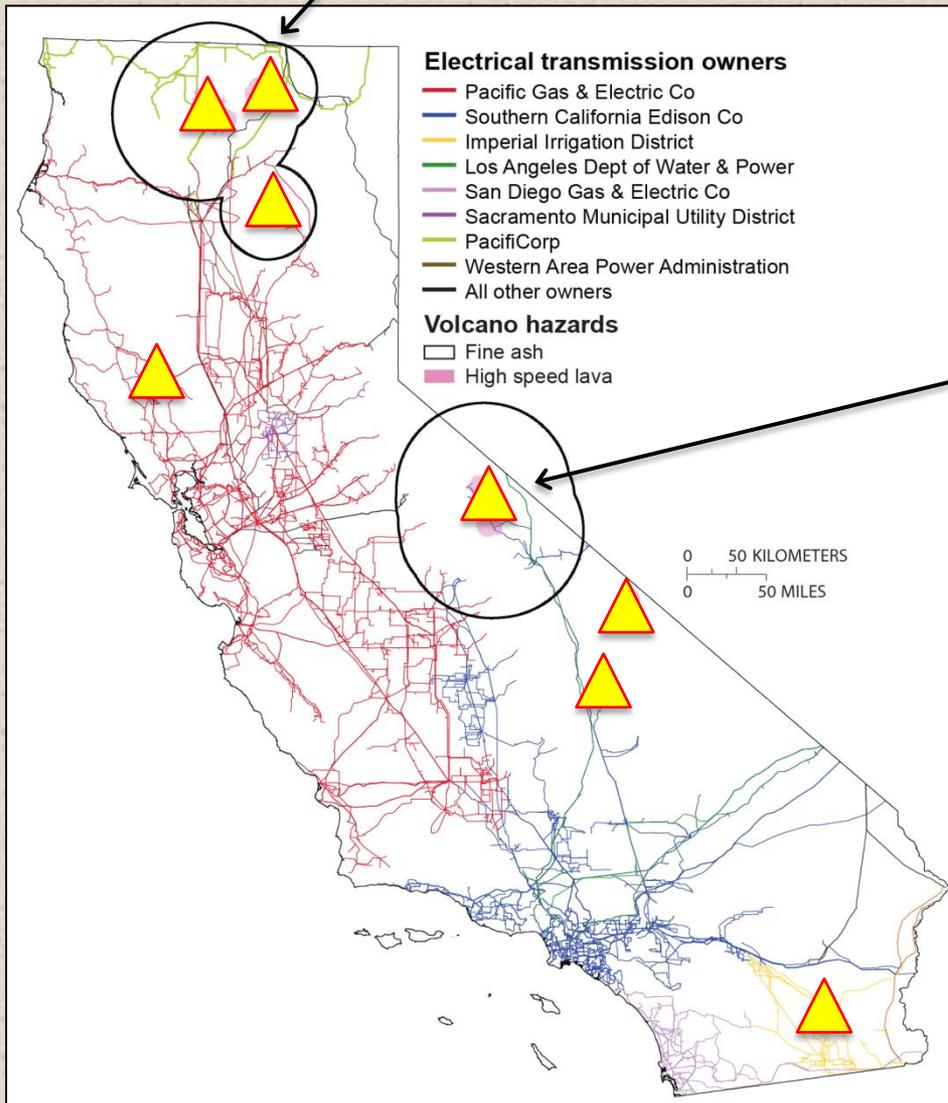
California Volcano Observatory

Not just a “local” problem

Volcanoes and Electrical Transmission

Pacific DC Intertie
(Oregon/Washington)

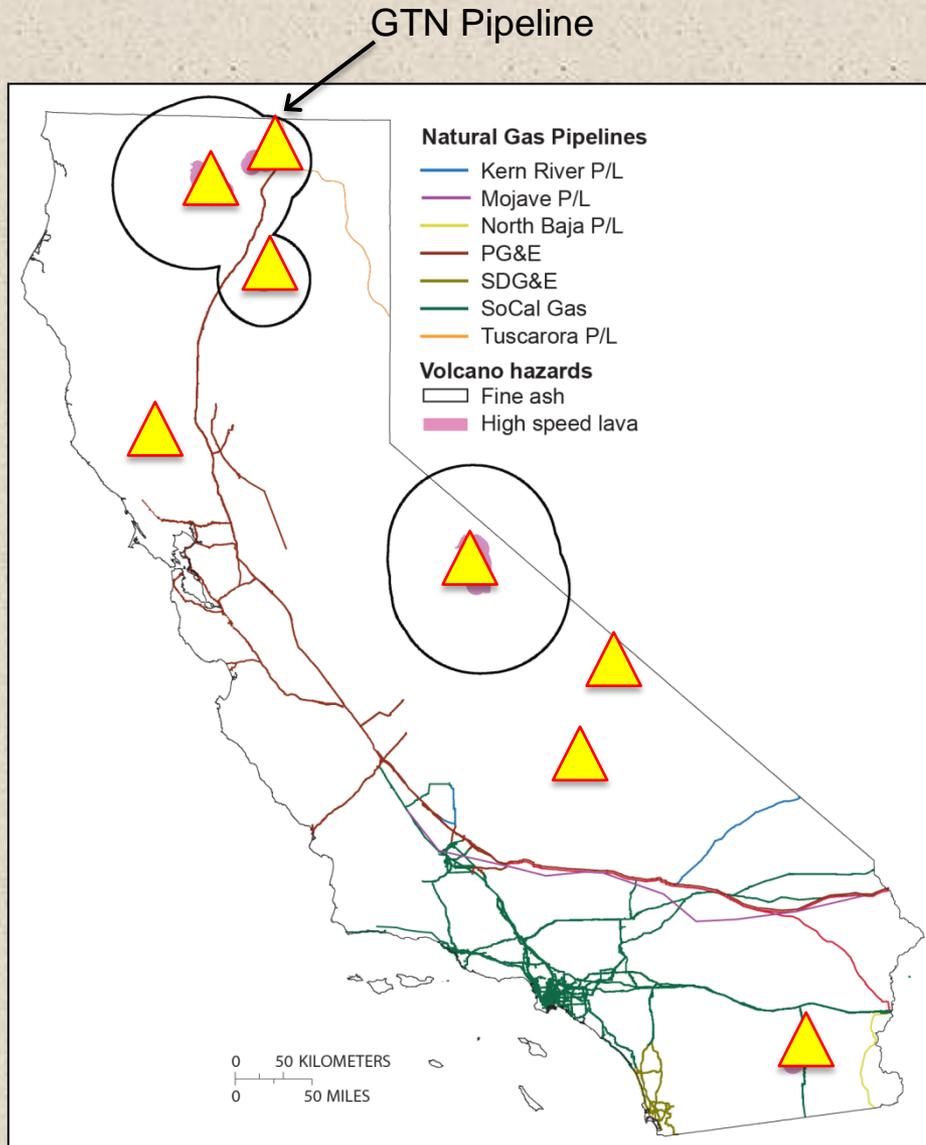
Pacific AC Intertie
(Oregon/Washington/Canada)



 California's
“watch list” volcanoes

Not just a “*local*” problem

Volcanoes and Natural Gas Pipelines

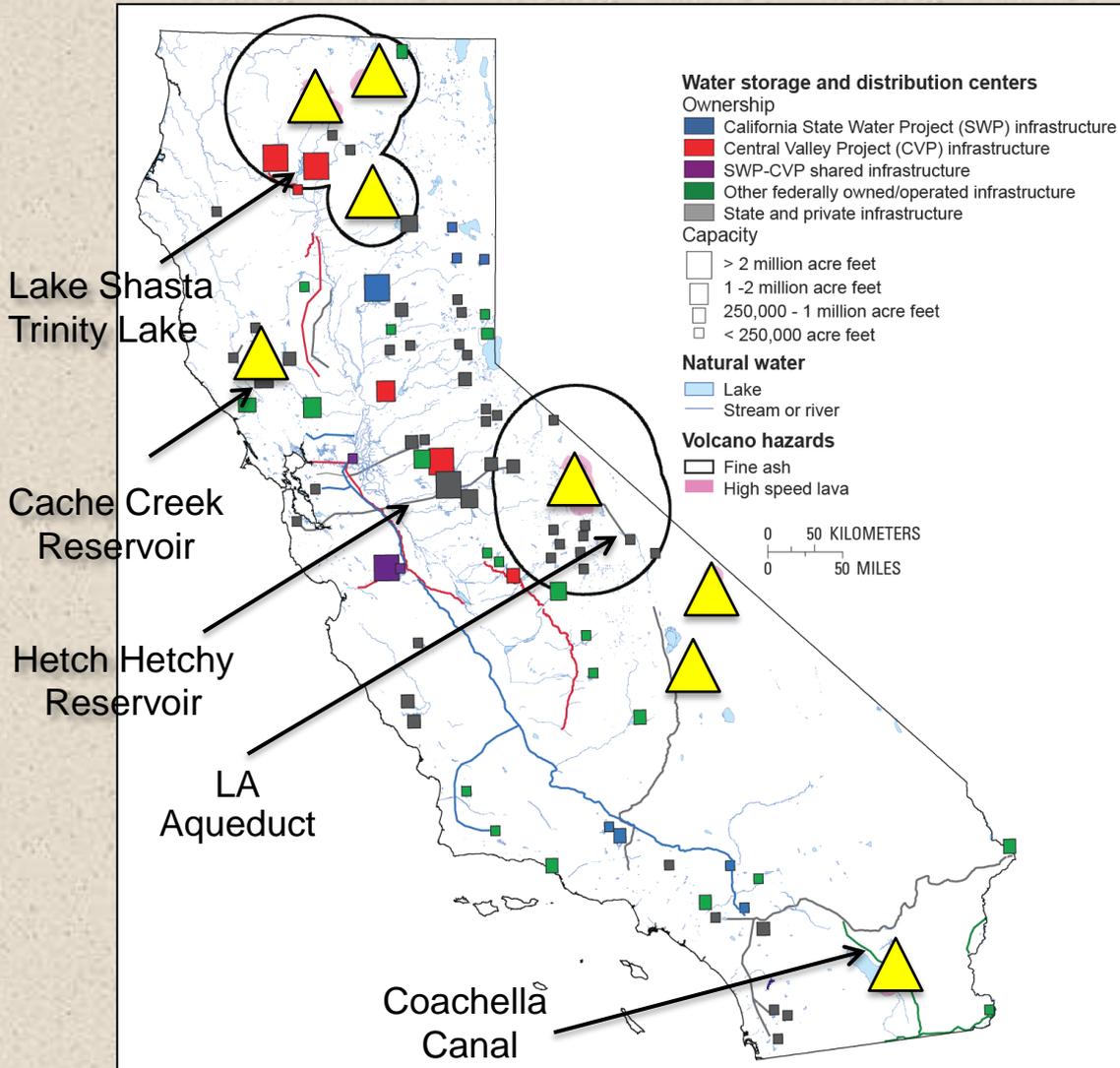


 California's
“watch list” volcanoes



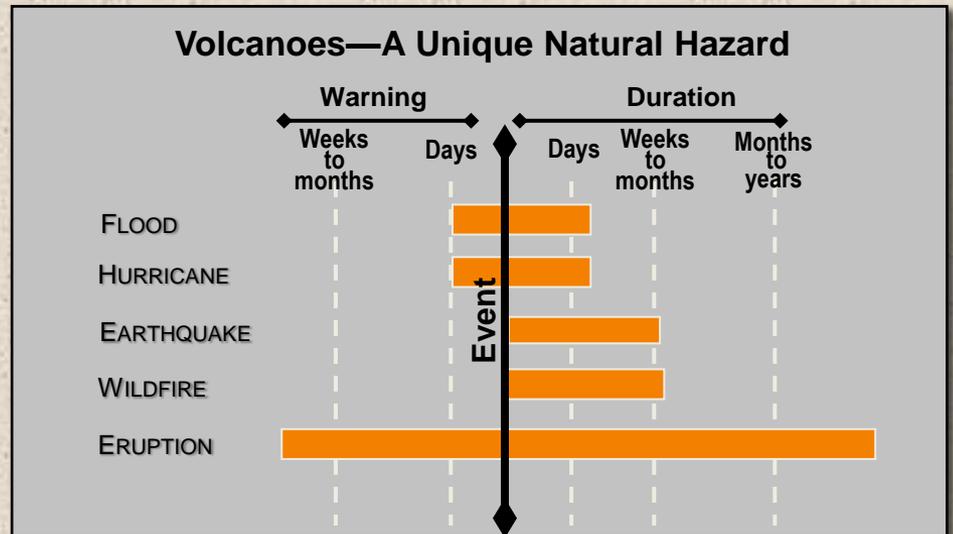
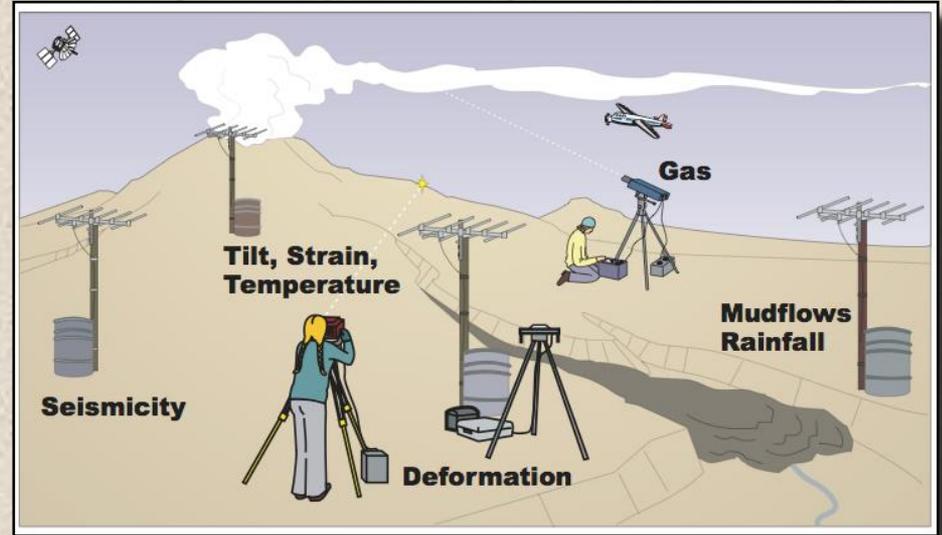
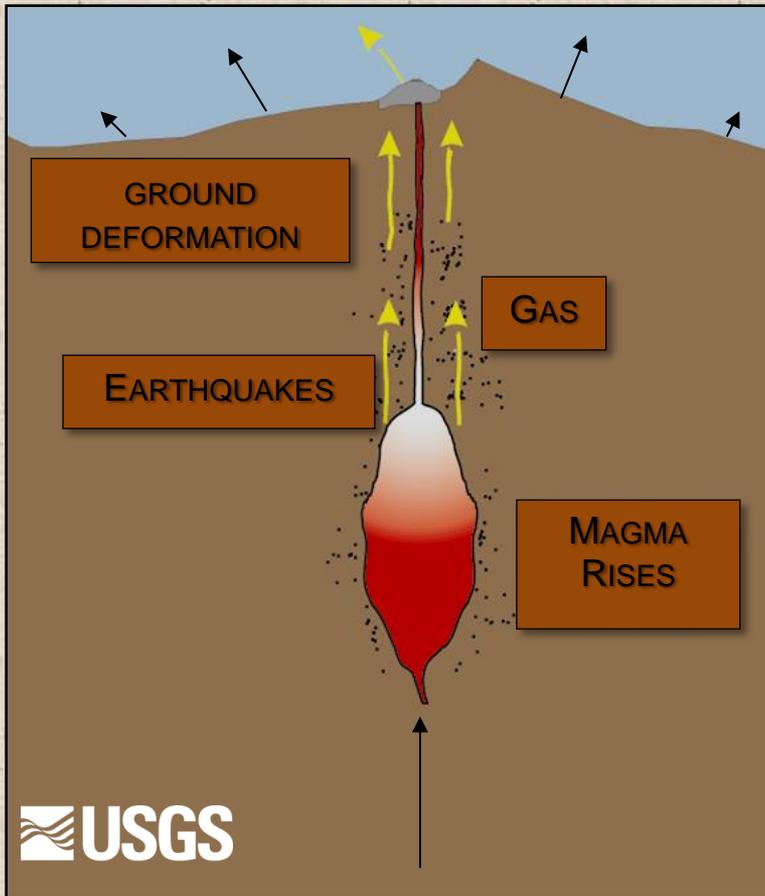
California Volcano Observatory

Not just a “local” problem Volcanoes and Water Delivery Systems



 California's
“watch list” volcanoes

CAN VOLCANO HAZARDS BE FORECAST?





Alert-level System

Volcanic alert levels

- Patterned after NIWS with EM input
- Activity on the ground
- Designates 4 levels of activity at any volcano
- Quiet state is 'NORMAL'

Aviation color codes

- Similar system but includes ash-cloud information
- Quiet state is 'Green'
- International standard

Alert-level System VOLCANIC-ALERT LEVELS	
NORMAL	Volcano is in typical background, noneruptive state or, after a change from a higher level, volcanic activity has ceased and volcano has returned to noneruptive background state.
ADVISORY	Volcano is exhibiting signs of elevated unrest above known background level or, after a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
WATCH	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, OR eruption is underway but poses limited hazards.
WARNING	Hazardous eruption is imminent, underway, or suspected.
AVIATION COLOR CODES	
Green	Volcano is in typical background, noneruptive state or, after a change from a higher level, volcanic activity has ceased and volcano has returned to noneruptive background state.
Yellow	Volcano is exhibiting signs of elevated unrest above known background level or, after a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
Orange	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, OR eruption is underway with no or minor volcanic-ash emissions [ash-plume height specified, if possible].
Red	Eruption is imminent with significant emission of volcanic ash into the atmosphere likely OR eruption is underway or suspected with significant emission of volcanic ash into the atmosphere [ash-plume height specified, if possible].

USGS California Volcano Observatory Emergency Communications



**CalVO
Operations
Center**

VAAC / WFO

ARTCC / CWSU

CalOES

County Sherriff

USFS / NPS/BLM /Tribal

CGS

FEMA IX

Assessment

Seismic

Deformation

Gas Emissions

Monitoring Data





Volcanic Activity Notice (VAN) and Volcano Observatory Notice for Aviation (VONA)

AVO/USGS Volcanic Activity Notice

Volcano: Shishaldin (CAVW #1101-36-)

Current Volcano Alert Level: ADVISORY Previous Volcano Alert Level: NORMAL

Current Aviation Color Code: YELLOW

Previous Aviation Color Code: GREEN

Issued: Tuesday, January 6, 2009, 3:28 PM AKST (20090106/0028Z)

Source: Alaska Volcano Observatory

Notice Number: 2009/A2

Location: N 54 deg 45 min W 163 deg 58 min

Elevation: 9373 ft (2857 m)

Volcanic Activity Summary: AVO has detected a significant thermal anomaly and a slight increase in earthquake activity at Shishaldin Volcano on Unimak Island in the eastern Aleutians. Together, these observations indicate a departure from background conditions at Shishaldin. AVO is raising the Aviation Color Code to YELLOW and the Volcano Alert Level to ADVISORY. There is no indication that an eruption is imminent or certain, although the potential for an eruption has increased. AVO will continue to monitor the volcano closely.

Recent Observations: Over the past 24 hours, several satellite passes over the volcano have recorded strong thermal signatures over the summit of the volcano. Such intense thermal anomalies are fairly rare for Shishaldin.

Hazard Analysis: Higher thermal output and small earthquakes could increase the possibility of rock and snow avalanches on the steep cone. Sudden steam explosions could also produce minor amounts of ash and blocky ejecta on the slopes of the volcano

Remarks: Shishaldin is one of the most active volcanoes in the Aleutian volcanic arc, erupting at least 28 times since 1775. Most of Shishaldin's eruptions have consisted of small ash and steam plumes, although the most recent eruption in April-May 1999 produced an ash column that reached a height of 45,000 ft above sea level.

Contacts: Peter Cervelli, Acting Scientist-in-Charge, USGS pcervelli@usgs.gov (907) 786-7497

Volcano Notification Service

<http://volcanoes.usgs.gov/vns/>



Volcanic Crises Awareness

COURSE for Responders, Planners, and Civil Authorities

Developed by experts from the US Geological Survey and the National Disaster Preparedness Training Center

<https://ndptc.hawaii.edu/training/catalog>



FEMA