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The National Volcano Early Warning System

In 2019, Congress authorized a National Volcano Early Warning and Monitoring System (NVEWS; Section 5001 of P.L. 116-9; 43 U.S.C. 31k). The law directed the Secretary of the Interior to establish NVEWS to monitor volcanoes, warn U.S. citizens of volcanic activity, and protect citizens from "undue and avoidable harm" resulting from volcanic activity.

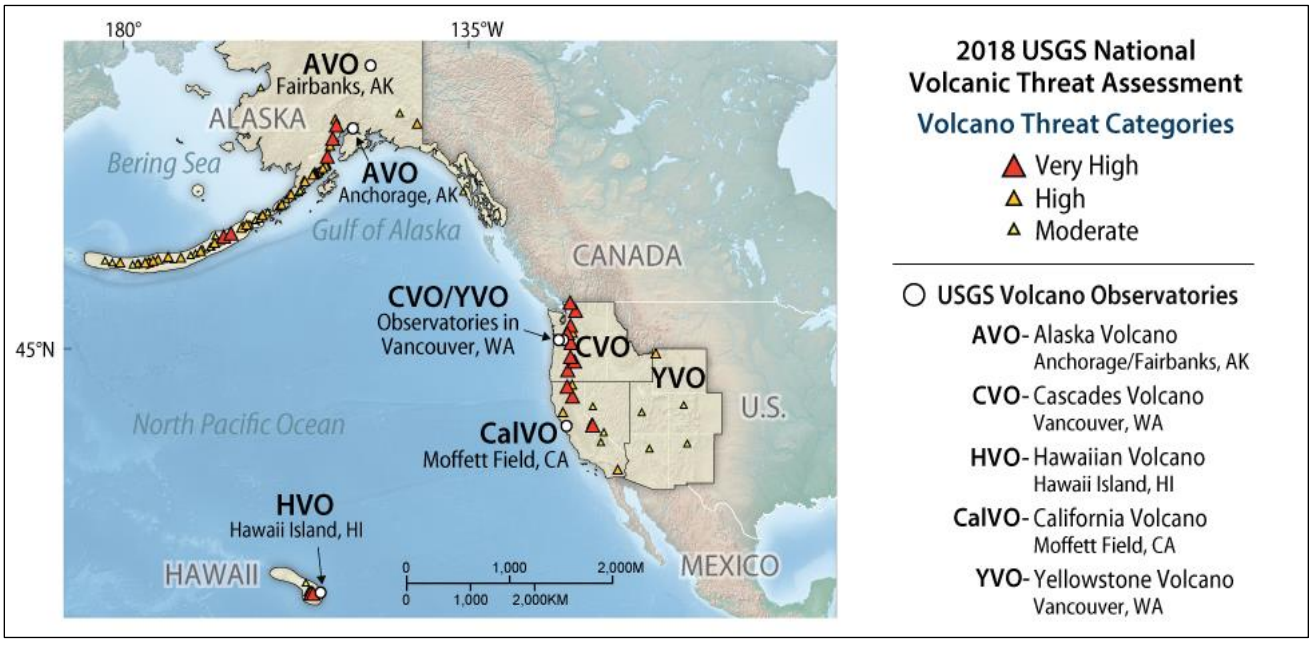
Congress is interested in a volcano early warning and monitoring system because the nation faces threats from many active volcanoes. In 2018, the U.S. Geological Survey (USGS, a bureau within the Department of the Interior) published an assessment of the volcanic threat, which indicated that better monitoring is necessary for effective warnings. The USGS volcanic threat assessment assigned five threat levels (very high, high, moderate, low, and very low) to 161 volcanoes in 14 states and U.S. territories (see **Figure 1**).The assessment ranked 18 volcanoes as very high and 39 as high threats. Eleven of the 18 very high threat volcanoes are in Washington, Oregon, or California; five are in Alaska; and two are in Hawaii. The assessment noted that the high- and moderate-threat volcanoes are mostly in Alaska and that the more explosive Alaskan volcanoes can affect national and international aviation. The volcano ranked as the highest threat is Kilauea, the Hawaiian volcano whose 2018 intense eruptions were accompanied by destructive lava flows and frequent earthquakes.

The USGS asserted that many of the very high and high threat volcanoes are not monitored well enough to provide adequate warnings (i.e., monitoring gaps exist). Congress authorized the USGS to remedy these monitoring gaps and enhance warnings by establishing NVEWS. NVEWS is to be organized within the USGS's Volcano Hazards Program (VHP). VHP studies, monitors, assesses and warns the public about threatening volcanoes in the United States. VHP operates five volcano observatories (Alaska, California, Cascades, Hawaiian, and Yellowstone; see **Figure 1**), a Volcano Science Center, and a Volcano Disaster Assistance Program (to assist with volcano threats internationally).

NVEWS Authorization

The 2019 law authorized NVEWS and specified that the system's objective is to monitor U.S. volcanoes at a level commensurate with the volcanic threat. NVEWS is to have two purposes: (1) organize, modernize, standardize, and stabilize the monitoring systems of the five U.S. volcano observatories and (2) unify the monitoring systems of these observatories into a single interoperative system.

Figure 1. USGS Volcano Observatories and U.S. Volcanoes Posing Moderate or Higher Threat



Source: CRS adapted from Peter F. Cervelli et al., USGS, *Five-Year Management Plan for Establishing and Operating NVEWS: The National Volcano Early Warning System*, Open-File Report 2021-1092, at https://doi.org/10.3133/ofr2021109.

Notes: The two high and seven moderate threat volcanoes in the Commonwealth of the Northern Mariana Islands are not shown here. The AVO is responsible for these volcanoes.

Section 5001 of P.L. 116-9 authorized three system components for NVEWS: (1) a 24-hour, 7-day-a-week operational national volcano watch office; (2) a national volcano data center; and (3) an external grants program to support volcano research. The law established an advisory committee composed of representatives of relevant agencies and members of the scientific community to assist the Secretary of the Interior in implementing the system. The law authorized the Secretary of the Interior to enter into cooperative agreements with academic institutions and state agencies as volcano observatory partners. In addition, the law required a five-year management plan for the system and an annual report describing the activities carried out under authorities provided in the law.

The law authorized the USGS to modernize monitoring systems at existing volcano observatories to incorporate emerging technologies, such as digital broadband seismometers, real-time Global Positioning System receivers, satellite and airborne radar interferometry, acoustic pressure sensors, and spectrometry to measure gas emissions from volcanoes. These technologies are intended to provide more accurate and real-time measurements of volcanic activity, enabling better assessments of the timing and location of volcanic eruption threats.

Status of Implementation

The USGS submitted to Congress a five-year plan for establishing and managing NVEWS in 2020. The plan identified 34 very high or high threat volcanoes from the 2018 volcanic threat assessment that have the greatest monitoring gaps and called for improved monitoring for these volcanoes. In addition, the plan called for establishing a national volcano data center with watch capabilities, launching an external grants competition, standing up an NVEWS advisory committee, and implementing cooperative agreements with states and universities. The plan also called for creating a supply of monitoring equipment that could be rapidly deployed to enhance monitoring and improve warnings at the start of volcanic activity.

Congress provides annual appropriations to the USGS through the Interior, Environment, and Related Agencies appropriations bills, but as of November 2021, the USGS had not begun the activities outlined in the management plan due to a lack of specific appropriations for implementing NVEWS, according to the USGS. The USGS five-year plan includes a cost estimate of about $11 million per year for NVEWS, which would include $7-$9 million per year to enhance monitoring to provide adequate warning; $1-$3 million per year to establish and operate the data center; and up to $1 million per year to perform coordinated activities, such as cooperative agreements, external research grants and committee activities.

The USGS is establishing an NVEWS implementation committee, composed of observatory staff and cooperative partners, to guide the implementation of NVEWS once funds are appropriated. Further, the USGS is establishing the NVEWS advisory committee, as directed by the NVEWS law and anticipates the committee's formulation by FY2023.

Issues for Congress

Congress may consider whether appropriating funds for NVEWS would help the system meet its objectives of monitoring commensurate with volcanic threats in order to provide effective volcano warnings to prevent harm. The 2019 law authorized appropriations of $55 million over five years for NVEWS, or about $11 million per year; Congress has not appropriated funds specifically for NVEWS since authorization. The FY2022 President's budget requested $33.5 million for VHP, which included $1.8 million for NVEWS for national volcano data center improvements. In July 2021, H.Rept. 117-83, which accompanied the House FY2022 consolidated appropriations bill (H.R. 4502), recommended $33.5 million for VHP including funding for the NVEWS for national volcano data center improvements. In October 2021, the Senate Appropriations Committee chairman released a draft FY2022 Interior, Environment, and Related Agencies bill and report, which recommended $35.5 million for VHP including $3.7 million for establishing NVEWS and $1.8 million for high threat volcano monitoring and the national volcano data center.

VHP expresses that upgrades to monitoring systems, as authorized by P.L. 116-9, are necessary to achieve the objectives of NVEWS. Without NVEWS appropriations at the level authorized by P.L. 116-9, VHP estimates it would take 25 years to fill monitoring gaps for the 34 very high to high threat volcanoes identified in the five-year plan, leaving the nation unable to adequately monitor or warn the public if one of these under-monitored volcanoes were to erupt.

Congress has provided the USGS with funds for volcano monitoring in previous supplementary and annual appropriations that directed VHP to complete enhanced monitoring prerequisites. These activities included upgrading telemetry for Alaskan volcanoes and completing a next generation lahar (i.e., a mix of water and rock that flows down a volcanic slope and can cause damage) detection pilot system. For example, according to the USGS, VHP used $14.5 million in FY2018 supplemental appropriations that Congress specified for these prerequisite activities and $12.8 million of $30.3 million in FY2021 VHP appropriations for upgrades to telemetry and lahar detection.

If Congress chooses not to fund NVEWS at its authorized level, but wants to increase warning capabilities, then Congress might focus funding on enhanced monitoring activities. Congress also may consider the pace at which to enhance monitoring at the 34 under-monitored volcanoes to protect U.S. citizens. Improving monitoring at more volcanoes sooner (i.e., over three to five years instead of over decades), some argue, likely require an increase in appropriations for VHP over current would funding levels.

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