

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 directs 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. In FY2022, Congress provided funds to begin implementation of NVEWS.

Many in Congress are interested in a volcano early warning and monitoring system because the nation faces threats from many active volcanoes. The U.S. Geological Survey (USGS, a bureau within the Department of the Interior) published an assessment in 2018 of the volcanic threat and 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 threat assessment ranked 18 volcanoes as very high and 39 as high. Eleven of the 18 very-high-threat volcanoes are in Washington, Oregon, or California; 5 are in Alaska; and 2 are in Hawaii. The assessment notes 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

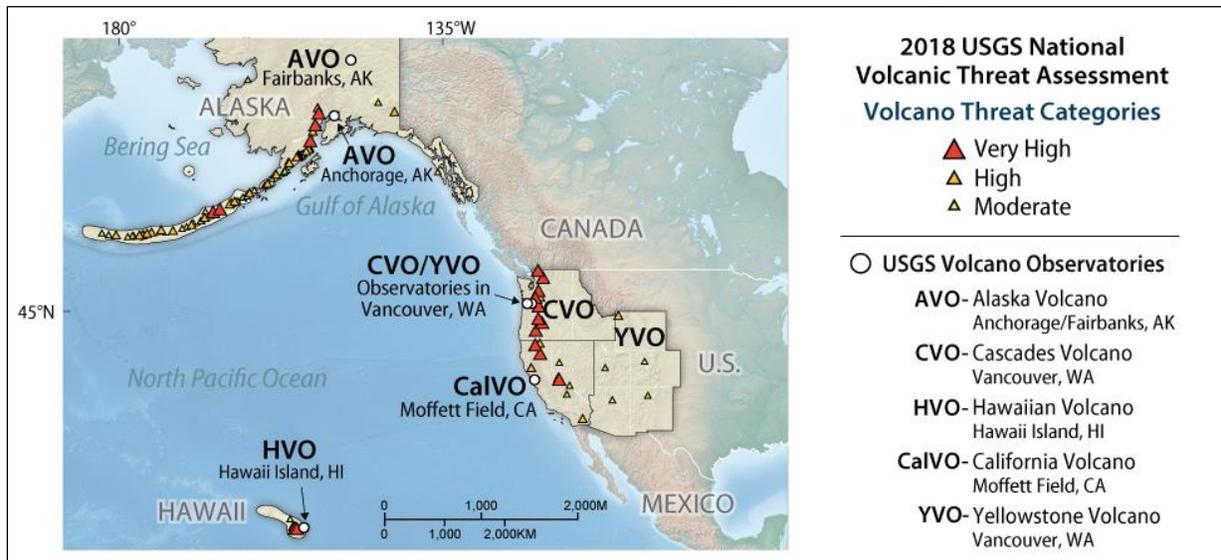
ranked as the highest threat is Kilauea, the Hawaiian volcano whose 2018 intense eruptions were accompanied by destructive lava flows and earthquakes.

The USGS asserted that many of the very-high- and high-threat volcanoes are not monitored well enough to provide adequate warnings. Congress authorized the USGS to remedy these monitoring gaps and enhance warnings by establishing NVEWS. NVEWS is to be organized within the USGS 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 in other countries).

NVEWS Authorization

The 2019 law authorizes NVEWS and specifies that the system’s objective is to monitor U.S. volcanoes at a level commensurate with the volcanic threats. 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 inter-operative 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/ofr20211092>.

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. The light tan shaded areas with black line borders mark the areal coverage of each observatory and show the locations of threatening volcanoes that these observatories are responsible for monitoring. The CVO and YVO labels mark the area of coverage for these observatories, meaning CVO monitors volcanoes in Washington, Oregon, and Idaho and YVO monitors volcanoes in Yellowstone National Park, Utah, Colorado, New Mexico, and Arizona.

Section 5001 of P.L. 116-9 authorizes three system components for NVEWS: (1) a 24-hour, 7-day-a-week operational national volcano watch office; (2) a national volcano data center (NVDC); and (3) an external grants program to support volcano research. The law establishes 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 authorizes the Secretary of the Interior to enter into cooperative agreements with academic institutions and state agencies as volcano observatory partners. In addition, the law requires 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 authorizes the USGS to modernize monitoring systems at existing volcano observatories to incorporate emerging technologies, such as digital broadband seismometers, real-time Global Navigation Satellite Systems (GNSS) receivers, radar interferometry, and spectrometry to measure gas emissions from volcanoes. These technologies are intended to provide accurate and real-time measurements of volcanic activity, enabling better assessments of the timing and location of volcanic eruptions.

Status of Implementation

The USGS submitted a five-year plan for establishing and managing NVEWS to Congress 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 calls for improved monitoring for these volcanoes. In addition, the plan called for establishing a NVDC with watch capabilities, launching an external grants competition, standing up an NVEWS advisory committee, and implementing cooperative agreements with states and universities.

In May 2022, the USGS submitted its second annual NVEWS report to Congress describing activities to implement NVEWS from March 2020 to September 2021 (the first annual report covering activities from March 2019 to March 2020 was brief and highlighted the completion and submission of the five-year plan). The USGS indicated that about \$13.5 million of \$30.3 million in FY2021 VHP appropriations were spent on NVEWS-related activities. The USGS considers these activities to be “foundational” to the NVEWS volcano monitoring system. During the reporting period, the USGS continued the development and installation of the next-generation lahar detection system on Mount Rainier (a lahar is a mix of water and rock that flows down a volcanic slope and can cause damage). Other activities included upgrading the telemetry for 27 stations at Alaska volcanoes; improving the monitoring networks at Cascades volcanoes in Oregon and Washington; upgrading the monitoring network on Kilauea Volcano in Hawaii; and establishing a cooperative agreement regarding GNSS stations for monitoring California volcanoes.

The NVEWS report noted that the NVEWS implementation committee continues to guide the management and

development of NVEWS, establish an NVEWS advisory committee (anticipated by FY2023), plan for a NVDC, and prepare performance metrics for volcano monitoring. Congress appropriated \$33.3 million for VHP in FY2022 (according to the explanatory statement accompanying Division G of P.L. 117-103), which included \$2.2 million to begin NVEWS implementation and \$1.8 million for an Early Warning System. The USGS aims to use the \$2.2 million to establish the NVDC and the \$1.8 million to further develop and install the next-generation lahar detection system at Mount Rainier.

In addition to annual appropriations for VHP, Congress has previously provided the USGS with supplemental appropriations to repair volcano monitoring networks damaged in natural disasters. For example, Congress provided supplemental appropriations in FY2019 (P.L. 116-20) for VHP, including \$73.4 million for repairing the volcano monitoring network and establishing and building new HVO facilities after HVO facilities and monitoring were damaged by intense eruptions at Kilauea Volcano in Hawaii in 2018. Congress provided \$4.3 million for improving the Alaska Volcano Observatory facilities and monitoring network after the damaging magnitude 7.1 earthquake near Anchorage, AK, in 2018.

Issues for Congress

P.L. 116-9 authorized appropriations of \$55 million for FY2019 through FY2023 for NVEWS. Congress appropriated \$2.2 million for NVEWS implementation and \$1.8 million for the Mount Rainier lahar detection system in FY2022. The magnitude and sufficiency of appropriations to support volcano early warning systems is an area of congressional interest. Appropriations for the VHP support a variety of efforts, of which early warning is one component. Congress has both authorized and appropriated funding for volcano early warning, though at different levels, raising the issue of what constitutes sufficient investment and the extent to which such funding should be targeted specifically to early warning. The USGS five-year plan provided a cost estimate for the establishment plus operations and maintenance of NVEWS of \$55 million over five years. According to the USGS, without sufficient funds, some or all of the 34 threatening volcanoes may remain under monitored and the USGS may not be able to provide sufficient warning of volcanic activity at under-monitored locations.

The Administration did not request FY2023 funding for NVEWS at the level authorized by Congress. The FY2023 President’s Budget requested \$34.5 million for VHP, which included \$1.5 million for NVEWS to further NVDC improvements. In addition, the President requested \$29 million under the USGS Facilities line item to provide additional funds toward the new HVO facilities and a new field station at the volcano summit.

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