Dear Chairman Westerman and Ranking Member Huffman,

Historian Will Durant wrote that "civilization exists by geological consent, subject to change without notice". Earthquakes and volcanic eruptions threaten much of the United States from the Pacific Northwest to the Mississippi Valley, and from California to Alaska. Great earthquakes in the U.S. are rare but devastating, with their long term cost averaging $14.7 Billion per year[1]. The total cost of buildings exposed to earthquake risk for the nation is approximately $107.8 trillion. While we cannot prevent earthquakes or release the pressure in magma chambers, we can employ state of the art technology and decades of investment in research to forecast and reduce the risk from these inevitable events. Indeed, thanks to past congressional support for the National Earthquake Hazards Reduction Program (NEHRP) and National Volcano Early Warning System (NVEWS) we have made great strides in quantifying risk from natural hazards and designing resilient buildings and infrastructure.

We are writing to urge continued support of the National Earthquake Hazards Reduction Program (NEHRP) and the National Volcano Early Warning System (NVEWS), as vital elements for national safety, preparedness, and national security. Studies show that every $1 spent on earthquake mitigation efforts equals $11 saved in response and rebuilding costs[2].

The Threat

Earthquake and volcanic hazards are a nationwide problem: 230 million Americans live in regions where strong to violent shaking is possible, with 82 million buildings at risk from earthquake damage[1]. It is in America's strategic national interest to minimize damage to military bases, airfields, ports, or other facilities that could jeopardize national security.

The 2011 Magnitude-9 Tohoku, Japan earthquake and tsunami serve as a stark warning of potential devastation in the Pacific Northwest from a great Cascadia subduction zone event. The Tohoku event left 20,000 dead and $360B in economic losses. A similar tsunami inundated the Oregon-Washington coast in AD 1700, and could strike again. But thanks to NEHRP, the west coast is guarded by a tsunami warning system that will provide a precious few tens of minutes of warning to the coastal population.

The Hayward fault, which runs through the city of Oakland, California, and other East Bay communities is another disaster in waiting. A magnitude-7.0 earthquake on the Hayward fault is estimated to kill over 800 people and injure 18,000, with economic losses exceeding $44B[3]. Geologic research reveals that major earthquakes on the Hayward fault occur 150 years on average, with its last major quake 157 years ago.

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[1] FEMA, 2023, Hazus Estimated Annualized Earthquake Losses for the United States, FEMA 366, Washington, D.C., https://www.fema.gov/sites/default/files/documents/fema_p-366-hazus-estimated-annualized-earthquake-losses-united-states.pdf

[2] https://www.nibs.org/files/pdfs/ms_v4_overview.pdf

[3] https://www.usgs.gov/programs/science-application-for-risk-reduction/science/haywired-scenario#publications

The ShakeOut scenario simulated a magnitude 7.8 earthquake on the southern San Andreas Fault. It galvanized public awareness, informed preparedness strategies, and fostered collaboration between scientists, emergency managers, and policymakers. The scenario projected catastrophic impacts: approximately 1,800 fatalities, 50,000 injuries, and economic losses totaling around $213 billion. The scenario estimated that between 10,000 and 100,000 landslides and approximately 1,600 fires could be triggered resulting in the destruction of 133,000 single-family homes.

The intermountain west and central US have annualized losses of roughly one billion dollars per year. The Wasatch Fault runs through Salt Lake City, Utah. The estimated short-term economic losses of a M 7 Wasatch fault earthquake exceeds $33B, with 2,000 to 2,500 deaths and over 7,000 injuries[4]. The New Madrid Seismic Zone, which suffered large earthquakes in 1811-1812, affects eight states in the central U.S. and represents a significant component of the national risk, in part because its older, weaker building stock would increase the damage. A magnitude-7.5 New Madrid shock is estimated to cause over $29B in damage[5].

Even modest volcanic eruptions can lead to tens of thousands of fatalities. A small eruption of volcano Nevado del Ruiz in 1985 generated a volcanic mudflow that killed more than 23,000. Mt. Ranier has generated similar and even larger flows in the past, threatening greater Seattle. Relatively simple monitoring networks can warn residents downstream of Ranier.

U.S. aircraft ferry about 300,000 passengers and hundreds of millions of dollars of cargo near active volcanoes each day. Dilute volcanic ash clouds pose acute risks to jet aircraft, even hundreds of miles from eruptions and invisible to pilots. There are two documented cases of 747's losing power on all four engines after flying through volcanic ash. Fortunately neither plane crashed, yet other eruptions have led to costly flight disruptions. We have the capability of mitigating this hazard with combined ground and space-based monitoring.

Recent Successes

A stunning example of successful forecasting occurred in Hawaii in 2018, when USGS scientists accurately predicted the various stages of the eruption that ultimately led to the destruction of 700 homes and $800 million in economic losses. Importantly, they also accurately stated that the probability of an explosive eruption was low, minimizing disruption.

Even though earthquakes and volcanic eruptions initiate far from the earth's surface, the U.S. science and engineering community has made major strides in mitigating the risk to people and structures. The USGS National Seismic Hazard Model integrates the best available geologic and geophysical data to estimate the likelihood of exceeding a specified level of ground shaking

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4 https://hazards.fema.gov/hazus-loss-library/details?id=250&hazard=earthquake&analysisType=deterministic&sort=a-z

5 https://hazards.fema.gov/hazus-loss-library/details?id=250&hazard=earthquake&analysisType=deterministic&sort=a-z

everywhere in the country. Engineers harness this model to design homes, offices, schools and hospitals, bridges and overpasses able to withstand this shaking. Private sector engineers work with foundations, academics and federal agencies to update building codes to enhance resilience to earthquakes and other natural hazards.

• **Fault and Seismic Swarm Detection**. Networks of seismometers collaboratively operated by USGS and universities detect earthquakes which, when combined with new machine learning methods can discover hidden but lethal earthquake faults.

• **Earthquake Early Warning**. Detection of weak, early arriving waves can provide advanced warning of the stronger shaking to follow, which can allow people to move to safer locations, alert first responders and even shut down industrial and transit systems.

• **Tsunami Early Warning.** These systems combine rapid, automated determination of earthquake magnitude and location with deep ocean and coastal wave height measurements provide accurate forecasts of tsunami arrival time and severity.

• **Volcano Eruption Forecasts**. Coordinated ground and satellite measurements provide timely warning of volcanic eruptions. Even the bare-bones network monitoring the Alaskan-Aleutian volcanic arc has furnished invaluable information to meteorological and aviation authorities responsible for issuing Significant Meteorological Information and Notices To Airmen.

• **Maps of Potential Shaking, Soil Liquefaction, Tsunami inundation, and Landslides.** These have proven invaluable to city and county emergency preparedness officials and planning departments.

• **Annual Great ShakeOut Earthquake Drills and volcano preparedness.** These have helped educate tens of millions of U.S. citizens on how to minimize their personal risk from earthquakes, volcanoes and tsunami. The USGS Volcano Science Center conducts exercises in Hawaii and evacuation drills around Mt. Rainier.

• **Monitoring Human-induced Earthquakes.** Quakes caused by injection of wastewater associated with the shale gas revolution and geothermal energy production have surged in the last decade. US researchers have enabled state regulators to develop strategies to mitigate the occurrence of induced quakes and improved national energy security.

• **Development of Modern Building Codes**. NEHRP-funded research and coordination efforts have led to the formulation and continual improvement of seismic provisions in building codes, enhancing the structural integrity of buildings and infrastructure nationwide.

• **Promotion of Functional Recovery rather than only Life Safety**. Recognizing the importance of the rapid post-earthquake economic recovery, NEHRP has advocated for functioning buildings immediately after earthquakes to ensure community resilience.

Need for Continued Support of NEHRP and NVEWS

The collaboration of the USGS, NSF, NIST, and FEMA, under NEHRP has advanced earthquake science, quantified risks, and led to the construction of safer buildings and infrastructure, all of which are crucial for safeguarding lives and reducing economic losses.

Similarly, NVEWS has vastly improved volcanic monitoring and early warning capabilities, essential for timely evacuations and risk mitigation. By capitalizing on new advances in machine learning, AI, and innovative technologies such as Distributed Acoustic Sensing (DAS), these programs will augment our protection from and resilience to natural hazards.

The NEHRP and NVEWS agencies work synergistically with the academic community, geotechnical and engineering firms, and emergency response providers. State agencies and the private sector augment and contribute to risk reduction. Yet no company—regardless of its size—could serve as the trusted source of authoritative hazards information, operate seismic and geodetic monitoring networks and their associated fault-tolerant low-latency telemetry, or could afford to conduct the research that makes Earthquake, Tsunami and Eruption Early Warning possible. Instead, these federal functions and data streams benefit and promote private industry, enabling them to operate efficiently and profitably.

Although we have been fortunate to avoid large earthquakes or volcanic eruptions in the past three decades, this lull should not lead to complacency. It is only a matter of time before such events occur, and with these vital programs, we have the means to prevent these events from being catastrophes.

Despite NEHRP's manifest accomplishments, challenges remain. Many communities, particularly those with older infrastructure and buildings, continue to face significant seismic risks. Continued investment in NEHRP is essential to enhance the resilience of these assets, address outstanding vulnerabilities, advance research, and implement mitigation strategies that protect lives and property.

In conclusion, we strongly urge your support for reauthorization of the National Earthquake Hazards Reduction Program (NEHRP) and National Volcano Early Warning System (NVEWS).

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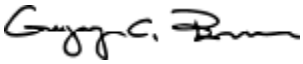

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