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Before the
Committee on Natural Resources
Subcommittee on Energy and Mineral Resources
U.S. House of Representatives

Chairman Stauber and Ranking Member Ansari, thank you for the opportunity to speak about three bills: the National Earthquake Hazards Reduction Program (NEHRP), the National Volcano Early Warning System (NVEWS) and the National Landslide Preparedness Act (NLPA). These bills, and the programs they support, are interrelated. As such, I applaud the committee for considering them together.

I have personal experience and expertise with all three bills. In my role as State Seismologist at the Alaska Earthquake Center I direct the earthquake monitoring efforts in Alaska. I previously spent 10 years working as part of the Alaska Volcano Observatory. And for the past few years, much of my research time has been devoted to the challenge of monitoring landslides in real-time. My work focuses on Alaska–a state with a disproportionate share of the nation's geologic hazards. I illustrate the impact of this legislation with examples from Alaska. However, these examples are just a few among countless examples nationwide that could be presented to motivate this legislation. I am in daily contact with peers around the country who carry similar responsibilities in their regions. I am certain my testimony reflects the sentiments of the numerous practitioners nationwide. Below I provide brief comments on each bill followed by a discussion of the common themes across them.

National Earthquake Hazards Reduction Program

NEHRP is one of the most successful pieces of natural hazard legislation in existence. It has been a model for other legislation including the volcano and landslide bills. Created by Congress in 1977, the NEHRP program establishes coordination across federal agencies, state agencies, academia, and the private sector. This coordination has led to advances in seismic monitoring, building codes, engineering practices, and public education. It has saved lifes and saved billions of dollars. NEHRP is an example of good government, leveraging the strengths of different agencies instead of duplicating one another. Under NEHRP, the National Science Foundation (NSF) brings fundamental new insights in earthquake science and engineering. The U.S. Geological Survey (USGS) makes seismic monitoring possible, while also quantifying the nation's specific earthquake hazards. The Federal Emergency Management Agency (FEMA) identifies the risks and earthquake vulnerabilities and then works with communities to mitigate these risks before they occur. And the National Institute of Standards and Technology (NIST) provides coordination across these efforts while ensuring that research and lessons learned are translated into specific codes and building practices.

Investing in seismic monitoring lowers long-term costs by guiding smarter decisions before and after earthquakes. Reliable ground motion data from seismic networks supports better building codes and retrofitting standards. These reduce damage to infrastructure and cut repair costs after a damaging earthquake. Real-time monitoring allows engineers and emergency managers to focus resources where they are most needed, avoiding unnecessary inspections and shutdowns. For businesses, rapid damage assessments minimize downtime, keeping commerce moving and reducing overall economic losses. Transportation systems, pipelines, ports, and utilities use seismic data to assess whether it is necessary to stop operations, and how to resume safely. During the recovery phase of a major earthquake the detailed shaking data can help guide repairs and replacements that are safer and more cost-effective. Every dollar spent on seismic monitoring yields significant savings by reducing direct damages, speeding recovery, and limiting disruptions to businesses and public services.

A foundation of NEHRP's success has been the Advanced National Seismic System (ANSS), a comprehensive network of seismic instruments and data centers coordinated by the USGS in partnership with earthquake centers in each region of the country (USGS, 2017). These centers provide expertise on the unique seismic hazards of their areas, from Alaska to California to the Central and Eastern U.S. The monitoring networks they operate maintain dense sensor coverage where it is most needed, ensuring that earthquakes are assessed quickly and ground shaking is measured accurately. Seismic network operators understand local geology, infrastructure, and community needs, allowing them to provide high-quality data and targeted information to emergency managers, engineers, and the public. This local capability feeds into the national system, maintained by the USGS, making ANSS both comprehensive and responsive. Without strong regional networks, national earthquake monitoring would be slower, less accurate, and less effective in protecting communities.

One of NEHRP's clearest deliverables is the National Seismic Hazard Map (Petersen et al., 2023). Led by the USGS, this map shows the expected level of ground shaking from future earthquakes. It combines data on past earthquakes, faults, and ground motion models to estimate the likelihood and intensity of shaking in different areas. This map is the scientific basis for building codes, helping engineers design structures to withstand expected earthquakes, while also helping to avoid costly mitigation strategies where they are not needed. It guides infrastructure planning, insurance rates, land use decisions, and emergency response. States and cities use it to identify high-risk areas and prepare accordingly.

I have witnessed the impact of NEHRP first hand, most notably during the magnitude 7.1 Anchorage Earthquake in 2018 (West et al., 2019). This earthquake was deeply impactful to the region and was responsible for hundreds of millions of dollars in damage. Thousands of homes and buildings were damaged. But remarkably, not a single building collapsed entirely. As a result, no one died during the earthquake. This success can be attributed almost entirely to NEHRP. Because of decades of research and implementation, modern seismic building codes were in place across much of south-central Alaska, significantly reducing structural damage despite violent shaking. Seismic hazard models, developed through NEHRP support, had helped guide construction practices. NEHRP investments in seismic monitoring enabled real-time data collection and rapid post-event analyses, assisting state agencies and emergency responders in assessing infrastructure impacts. Public education campaigns and preparedness initiatives, championed by NEHRP partners, ensured that schools, businesses, and residents knew how to "Drop, Cover, and Hold On," reducing injuries. The Anchorage earthquake is an example of how NEHRP's long-term, research-based approach directly enhances community resilience and public safety.

The work of NEHRP is not done. Alaska experiences more large earthquakes than any other state, yet it does not have access to the ShakeAlert Earthquake Early Warning system. ShakeAlert, and other earthquake early warning systems, uses real-time data to provide seconds of warning before strong shaking arrives. This response time provides people time to take protective actions and allows critical systems to shut down safely. The ShakeAlert system was prototyped in California, Oregon, and Washington states with the plan to roll out these capabilities more widely once it was fully operational. The build out in these three states is now complete. In January 2025, the USGS published the ShakeAlert implementation plan for Alaska (Wolfe et al., 2025). Other states are in the process of developing ShakeAlert plans as well. NEHRP is critical to these expansions. NEHRP provides the framework for national coordination, and authorizes the resources needed to continue to expand the implementation of ShakeAlert. The geophysical network built to support earthquake early warning has the dual benefit of strengthening tsunami warning capabilities. Dense seismic and GPS sensor coverage allows the rapid assessment of offshore earthquakes that can generate tsunamis. Rapidly measuring the style of faulting makes it possible to issue faster, more accurate tsunami alerts. Investing in earthquake early warning networks creates shared infrastructure that supports both fast ground shaking alerts and timely tsunami warnings, protecting coastal communities from multiple hazards.

National Volcano Early Warning System

The National Volcano Early Warning System (NVEWS) reduces the risks and costs of eruptions through a mix of early detection, monitoring, and public communication.

The United States is home to more than 160 active volcanoes, many of which pose serious threats to communities, infrastructure, and critical air routes (Ewert et al., 2018). Alaska alone has over 50 volcanoes that have been active in historic times, many located along major international flight paths. As just one example, the 1989 Redoubt Volcano event sent ash clouds into the atmosphere, disrupting air traffic across the Pacific and causing complete engine failure in one commercial passenger jet. Similar risks exist in the Cascades, Hawaii, and other volcanic regions. In Hawaii, the eruption of Kīlauea in 2018 destroyed hundreds of homes and forced large-scale evacuations. Volcanoes in Washington, such as Mount Rainier, pose significant lahar (volcanic mudflow) risks to populations in the Puget Sound region. Eruptions can cause varied hazards, including ashfall, lava flows, landslides, and volcanic gases, that can affect broad areas even away from the volcano. Monitoring helps forecast these events and provide time to prepare.

NVEWS unifies the U.S. volcano observatories into a single, national system. This improved efficiency is coupled with modern instrumentation, real-time data transmission, and advanced forecasting tools. Faster more accurate volcanic warnings reduce the risks to life and infrastructure by giving communities and emergency managers more time to respond. It also protects aviation by detecting ash-producing eruptions that threaten aircraft. Early warnings minimize economic disruption by preventing unplanned evacuations, protecting infrastructure, and reducing the need for disaster response and recovery. NVEWS is a cost-effective way to reduce the human and financial impact of volcanic eruptions.

The recent unrest of Mount Spurr volcano illustrates the success of early warning (Figure 2). Spurr is labeled by the USGS as a very high threat volcano near Anchorage, Alaska that for many months now has been understood to be in a state of unrest. Tiny earthquakes, ground deformation, and gas emissions all point to patterns that are similar to the last few Spurr eruptions. Together this information has allowed the Alaska Volcano Observatory (the Alaska component of NVEWS) to issue regular and well-informed eruption forecasts in recent months. When Spurr does erupt, previous NVEWS efforts will make it possible to warn about individual explosions and forecast ash fall.

Unlike Mt. Spurr, many high-threat volcanoes in the U.S. still lack modern instruments and real-time monitoring. Fully implementing NVEWS would close those gaps and provide more universal coverage. It would allow for earlier detection of unrest at sites that currently pose blind spots. The system would also strengthen coordination between federal and state agencies, ensuring faster, unified responses. By giving communities and infrastructure managers more time to act, NVEWS reduces the cost of emergency response and recovery. Investing now lowers the economic risk and avoids more expensive disaster impacts later.

National Landslide Preparedness Act

Landslides pose a persistent and costly threat across the United States. Though national loss estimates for landslides are generally lacking, the National Landslide Preparedness Act (NLPA) helps address this by providing better systems for tracking and assessing landslides. Even twenty years ago, however, the annual costs were estimated to exceed two billion dollars (Spiker and Gori, 2023). These hazards are widespread, affecting nearly every state (Luna et al., 2025). They are especially common in regions with steep terrain, heavy rainfall, or wildfire burn scars—such as Alaska, the Pacific Northwest, California, and Appalachia. The 2014 Oso landslide in Washington, which killed 43 people and destroyed dozens of homes, remains a poignant example of the risks posed by large slope failures. More recently, intense storms in California in 2023 triggered dozens of damaging debris flows and slope collapses along unstable hillsides. Extreme rain events, wildfire, and glacial retreat make slopes more vulnerable. These factors appear to be increasing the frequency, and possibly the severity, of landslides.

Landslide hazards are geographically widespread but unevenly monitored and poorly mapped in many parts of the country. A national approach helps close these gaps. It also makes it possible to standardize data and support consistent hazard assessment across state lines. Without federal coordination, many high-risk regions—especially rural—lack the tools to assess landslide susceptibility and lack the ability to issue meaningful warnings. The USGS approach outlined in the NLPA is designed to complement and strengthen state and local efforts by providing data, technical expertise, and coordination tools that many jurisdictions cannot develop on their own. State agencies are the primary source of local knowledge, field data, and public outreach networks. Federal support helps the states to implement early warning systems, prioritize mitigation projects, and respond more effectively to landslide events. This two-way collaboration ensures that federal tools and science reach the communities that need it most, while empowering states to lead the risk reduction efforts.

The National Landslide Preparedness Act empowers the U.S. Geological Survey to coordinate a strategy to identify, map, monitor, and respond to landslide hazards nationwide. This legislation is particularly vital for states like Alaska, where steep terrain, heavy precipitation, seismic activity, and thawing permafrost contribute to heightened landslide risks. The NLPA facilitates collaboration between federal agencies and state entities to develop detailed landslide inventories and susceptibility maps, and to implement monitoring systems in high-risk areas like Prince William Sound and Southeast Alaska. By providing funding, technical expertise, and interagency coordination, the

National Landslide Preparedness Act strengthens local capacities to mitigate landslide risks, protect communities, and enhance public safety across Alaska and the broader United States.

The November 2023 Wrangell landslide in Southeast Alaska exemplifies the challenge. Following days of intense rainfall, a large slope failed, sending a massive debris flow downslope that destroyed homes and claimed the lives of six people. Instability on other nearby slopes prompted evacuations and emergency monitoring that demonstrated the event was part of a broader sequence of failures across the region. Nearly the same event occurred a year later in Ketchikan (Figure 3). These tragedies illustrate several priorities of the NLPA. These include the need for high-resolution hazard mapping, real-time landslide assessment, and coordinated federal-state response capabilities. The NLPA framework makes it possible for the U.S. Geological Survey to partner with the Alaska Division of Geological and Geophysical Surveys and the Alaska Earthquake Center to install remote sensors, expand landslide inventories, and develop early warning tools. By supporting these activities, the NLPA can help prevent similar events in vulnerable communities in Alaska and elsewhere.

Just as national coordination has improved earthquake and volcano hazard mitigation, a similar model is needed to reduce landslide losses and protect public safety.

Themes common to all bills

The programs supported by these three bills share a set of proven strategies. They rely on strong federal–state–academic partnerships, robust instrumentation networks, and sustained observation and research programs.

Each program captures long-term data that make it possible to discern the geophysical and geological patterns unique to each hazard. Years of these baseline data often make it possible to know when a hazard is developing. Often these data enable forecasts of specific impacts, making it possible for individuals and communities to prepare.

Each program also formalizes collaboration between federal agencies, universities, and state geological surveys. This approach harnesses local expertise and knowledge, while providing national standards and economies of scale.

Investments in the monitoring networks that power these programs—whether for earthquakes, volcanoes, or landslides—enable timely warnings, accurate hazard assessments, and cost reduction through mitigation efforts. Updating and reauthorizing the bills that affirm these programs is the surest way to minimize the impact of these events on society and the surest way to minimize the costs of recovery from these infrequent, but often devastating, natural hazards.

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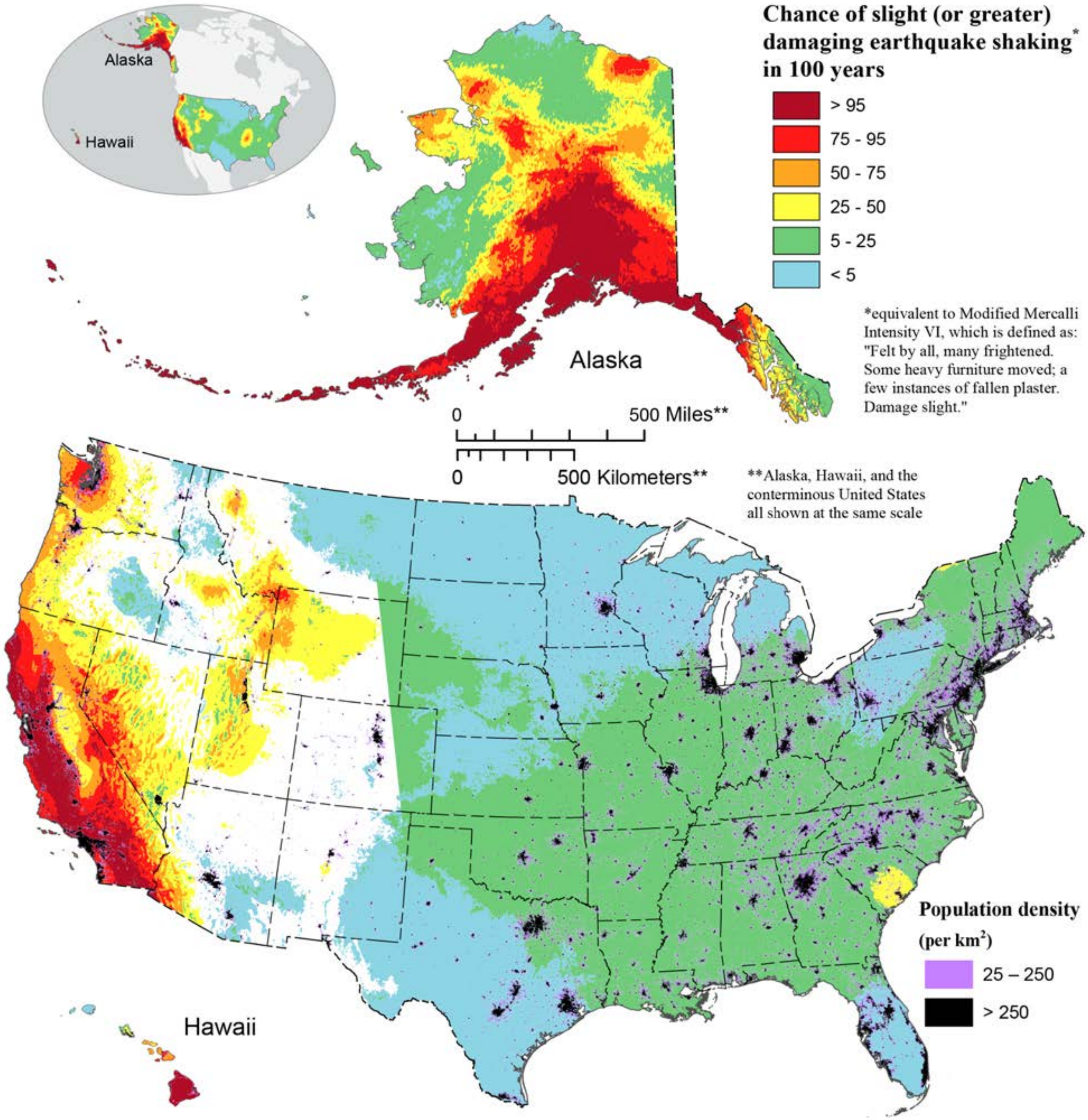

Figure 1. *The 2023 National Seismic Hazard Map. Warm colors show regions where damaging earthquake shaking is mostly likely to occur. From Mark D. Petersen et al. (2025).*

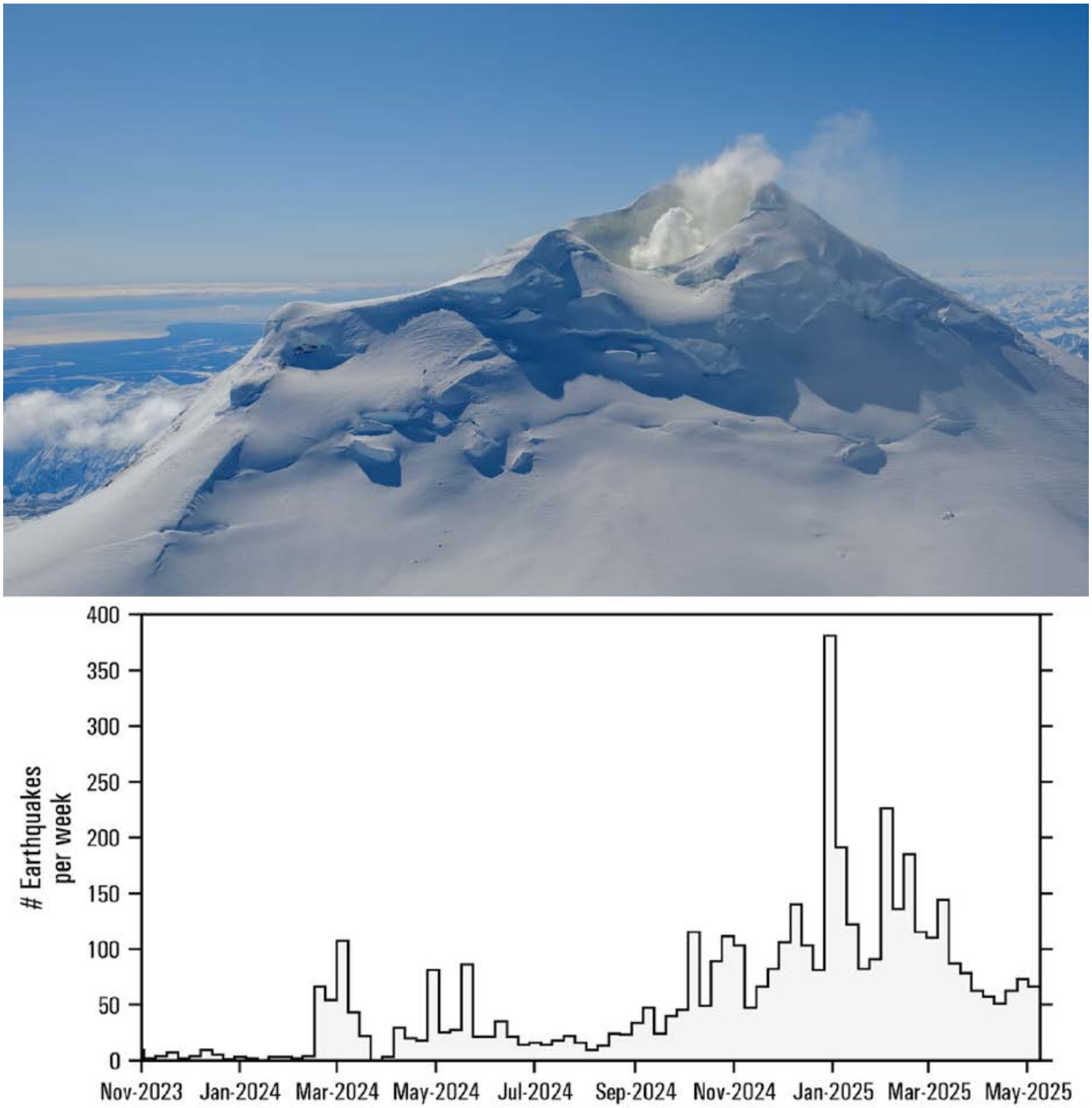

Figure 2. *(Top) Summit of Mt. Spurr, Alaska showing steam associated with recent unrest. Photo taken April 25, 2025 during a gas survey of the summit. Credit: Matt Loewen. (Bottom) Earthquake data demonstrating that the unrest began early in 2024. Both images courtesy of AVO/USGS.*

Figure 3. *Examples of recent landslides in Southeast Alaska. Deadly landslides of this style have happened nearly annually in recent years affecting communities over a vast region. The geographic spread of these events presents a challenge for monitoring and assessment. (Top) 2023 Wrangell landslide. Photo credit: Alaska Department of Transportation and Public Facilities. (Bottom) 2024 Ketchikan, landslide. Photo credit: Travis Watkins, Associated Press.*