

National Volcano Early Warning and Monitoring System Advisory Committee Meeting Summary Notes

Dates: June 3–4, 2026

Times: 9:00 a.m.–5:00 p.m. EDT each day

Location: Main Interior Building, North Penthouse, Washington, D.C. & virtual

Table of Contents

Attendees.....	4
Day 1 — Wednesday, June 3, 2026	4
Opening & Welcome (Applegate and Luthiger)	4
Approval of the 2025 NVEWSAC Report.....	5
State of the USGS Volcano Hazards Program (VHP).....	5
NVEWSAC Member Report Outs	6
Karen Shelton-Mur — Federal Aviation Administration (FAA)	7
Ariel Stein — NOAA Atmospheric Modeling & VAAC Operations	7
Casey Hanell — Washington Department of Natural Resources (WA DNR)	8
Brian Terbush — Washington Emergency Management Division (WA EMD)	8
Matthew Pritchard — Cornell University	9
Christy Till— Arizona State University	9
Leif Karlstrom — University of Oregon	9

Jennifer Wade — National Science Foundation (NSF)	10
Summary remarks	10
Monitoring & Evaluation (M&E) — VHP Initiative.....	10
State of the Volcano Science Center (VSC)	12
NVEWS / NVIS (Systems & Data) Update.....	13
Subcommittee Updates.....	15
Distributed Volcanism / Hydrothermal Explosions.....	15
Volcano Threat Level Reassessment.....	16
Volcanic Ash and Fumes Act (FUMES) Updates & Collaboration.....	17
FAA Briefing on Aviation and Volcanic Ash — Karen Shelton-Mur.....	17
NOAA/USGS NVEWS Collaboration Update — David Kochevar.....	18
USGS Volcanic Ash Activities — David Schneider.....	19
Public Comments.....	21
Day 2 — Thursday, June 4, 2026	21
Group Working Session I: Monitoring & Evaluation (M&E).....	21
Geothermal	21
DOE Office of Geothermal — Lauren Boyd	21
USGS Geothermal Science — Shaul Hurwitz.....	23
VHP Priority Focus Areas.....	24
Monitoring Partnerships	24
Subduction Zone Science	24
Critical Minerals.....	25
Artificial Intelligence and Machine Learning.....	25
Hazard Ready Nation (HRN).....	26
Reporting.....	26

Value of Information (VOI)..... 27

Committee Working Session focused on Recommendations 27

2026 Advisory Committee Recommendations (rough draft) 29

Public Comments..... 30

Adjournment..... 30

Attendees

Advisory Committee Members

- Casey Hannell, Washington Geological Survey
- Leif Karlstrom, University of Oregon (co-chair)
- Matthew Pritchard, Cornell University
- Karen Shelton-Mur, Federal Aviation Administration, International Aviation Weather Program
- Ariel Stein, NOAA Air Resources Laboratory
- Brian Terbush, Washington State Emergency Management Division
- Christy Till, Arizona State University
- Jennfer Wade, National Science Foundation (co-chair)

U.S. Geological Survey Agency Employees

- Gari Mayberry, Volcano Hazards Program (Designated Federal Officer)
- David Applegate, Natural Hazards Mission Area
- Andria Ellis, Volcano Hazards Program
- Jake Lowenstern, Volcano Science Center
- Seth Moran, Cascades Volcano Observatory
- Wendy Stovall, Volcano Hazards Program

USGS Water & Science Guests

- Mike Espy, public policy professional
- Peter Luthiger, Senior Advisor to the Assistant Secretary

Public Attendees

- Eric Avila, National Air Traffic Controllers Association
- Antonio Cancelliere, Federal Aviation Administration
- Grace van Deelan, American Geophysical Union
- Linda Rowan, Congressional Research Service
- Rachel Teasdale, National Science Foundation

Invited Guest Speakers

- Lauren Boyd, Department of Energy
- Shaul Horwitz, U.S. Geological Survey
- David Kochevar, National Oceanic and Atmospheric Administration
- David Schneider, U.S. Geological Survey

Day 1 — Wednesday, June 3, 2026

Opening & Welcome (Applegate and Luthiger)

Senior Advisor to the Assistant Secretary for Water and Science, Peter Luthiger, opened the meeting by reaffirming the Department's strong commitment to NVEWS. He emphasized growing public attention to volcanic activity, the importance of sustained partnerships with state and local agencies, and continued coordination with NOAA and FAA. Luthiger noted that the 2019 NVEWS authorization

remains a clear roadmap for progress and thanked the VHP for recent accomplishments, including the completion of the Mount Rainier Lahar Detection System.

He highlighted support from prior and current DOI leadership on monitoring permits and reflected on the Deputy Secretary's recent visit to Hawai'i, where seeing freshly erupted Kīlauea lava underscored the importance of volcano monitoring. Luthiger acknowledged the health and infrastructure risks posed by volcanic ash, recognized past support from the 2018 Disaster Supplemental, and reiterated that—despite tight budgets—NVEWS remains a departmental priority aligned with Administration goals for preparedness, scientific readiness, and community safety. He also noted ongoing Senate discussions on renewing NVEWS authorization and recent DOI statements underscoring the continued relevance of volcano monitoring.

USGS Chief Scientist and Acting Associate Director for the USGS Natural Hazards Mission Area, David Applegate, thanked Luthiger for his remarks and for sustained support from Department leadership. Applegate underscored the essential role of NVEWSAC and the broader hazard advisory committees in shaping national hazard science and services. He highlighted progress on key NVEWS components, including development of the 24/7 “watch office” concept, improvements in data management, and planning for the external grants program, which will complement NSF and other partner investments.

Applegate emphasized the central importance of interagency coordination—especially with NOAA for volcanic ash information—and noted strong alignment between Natural Hazards Mission Area priorities and Administration directives on preparedness and resilience, including recent FY27 guidance from OMB and OSTP. He acknowledged ongoing achievements across the volcano observatories and emphasized the overarching goal of ensuring that scientific information is delivered in the form stakeholders need to build a “Hazard Ready Nation,” supported through close collaboration with NOAA, FEMA, and other partners.

Approval of the 2025 NVEWSAC Report

Chair-led review concluded with no amendments. Motion to approve by Casey Hanell; seconded by Matthew Pritchard; approved unanimously.

State of the USGS Volcano Hazards Program (VHP)

Gari Mayberry summarized VHP mission scope, observatory operations, and FY25–FY27 budget context. Key points included flat funding since FY23, the proposed budget reductions affecting FTEs, and program priorities aligned with federal preparedness and resilience policy guidance. Discussion covered impacts of potential FTE reductions, the status of NVEWS grant and watch office components (authorized but not yet appropriated), and ongoing reauthorization timelines.

The update covered the overall structure and mission of the USGS Volcano Hazards Program (VHP). VHP continues to support national volcanic risk reduction through its five observatories, extensive partnerships, and coordinated monitoring and hazard-assessment work.

An overview of NVEWS emphasized its goals of building interoperable monitoring networks, aggregating real-time data via the National Volcano Information Service (NVIS), establishing 24/7 operational capability, and supporting research through an external grant program—though the grants remain unfunded due to lack of appropriations. Full implementation remains a top need. Recent volcanic activity underscored ongoing monitoring challenges and successes, with elevated unrest at Mount Spurr, Mount Adams, Kīlauea, and Mount Rainier during FY25.

Budget constraints were discussed extensively. Funding has remained flat for four years, reducing purchasing power amid rising equipment and operations costs. The FY27 President's Budget proposes a 21% reduction (~ \$8M) and a loss of six federal FTEs, with similar cuts appearing in the draft House appropriations report. These reductions would limit observatory capacity, constrain hiring, and force prioritization of core activities, likely affecting cooperative agreements and external support.

The Program also reviewed alignment with administration priorities, including directives emphasizing risk-informed planning, energy and minerals initiatives, and service to communities. A recent OMB/OSTP memo highlighted the national importance of preparing for geophysical hazards, reinforcing VHP's role in providing actionable science.

Updates on NVEWS reauthorization efforts noted the potential extension of authorization to 2033, differences between House and Senate versions, and a requirement to establish an implementation committee with broad agency participation. New committee member nominations are progressing through federal approvals, and the charter renewal process is underway to ensure continuity.

Several ongoing and pending actions were highlighted, including continued NVEWS buildout, hiring monitoring and evaluation contractors, assessing options for expanded watch capabilities, strengthening tribal engagement, and addressing stalled external grants due to lack of funding. Looking ahead, program priorities include strategic development of NVEWS and NVIS, completing volcano hazard assessments, advancing geothermal and critical minerals collaborations, and increasing engagement in the Southwest with new hazard-overview products. Feedback from the committee was invited, especially regarding coverage of southwest volcanic fields and monitoring approaches.

NVEWSAC Member Report Outs

NVEWS Advisory Committee members in attendance provided concise operational and research updates from federal partners, state agencies, emergency management, and academia to inform NVEWS implementation and near-term coordination needs.

Karen Shelton-Mur — Federal Aviation Administration (FAA)

Key Points:

- International Airways Volcanic Watch (IAVW): Focus on improving volcanic-ash products and future-oriented capabilities. FAA provides advisory input to the U.S. meteorological panel.
- Standards & Annex 3: Within ICAO, work centers on Annex 3 compliance—ensuring a designated Meteorological (Met) authority and aligned service providers. In the U.S., FAA serves as the Met authority; NOAA issues SIGMETs and VAAs; USGS provides VONA. Implications for NVEWS: Clarified lines of authority help streamline cross-agency workflows during eruptions, especially for ash advisories and flight safety.

Ariel Stein — NOAA Atmospheric Modeling & VAAC Operations

Key Points:

- VAAC coverage: Washington VAAC is backing up Anchorage VAAC due to staffing constraints, ensuring continuity of service.
Modeling advances:
- HYSPLIT segmented runs: Operational implementation enabling segmented emissions updates without full re-runs, yielding faster concentration updates aloft.
- QVA enhancements: Quantitative Volcanic Ash outputs to estimate ash mass/quantities in airspace—intended to support airline risk decisions (e.g., fly/no-fly).
- Edge representation: Gaussian mixture models to smooth ash boundaries in analyses.
- Satellite integration: Ongoing incorporation of emission observations to improve initialization and verification.
Strategic research:
- Earth radiation balance/stratosphere monitoring: Project to detect changes in the stratosphere, including potential weather-modifying activities (e.g., silica/sulfate releases). The same monitoring/early-warning architecture (with work by Alice Crawford) could support volcanic activity detection.

Implications for NVEWS: Near-real-time, segmented modeling and QVA can sharpen NVEWS ash advisory timeliness and consistency across FAA/NOAA/USGS roles identified by ICAO Annex 3.

- Reorganization: NWS is undergoing changes aimed at warning-process unification and redundancy across regions.
- Operational impacts: Expected minimal effect on ash/aviation activities, but notable impacts for broader weather forecasting.
- Staffing realities: Loss of operational forecasters has been significant; many are reluctant to return to former roles.

Implications for NVEWS: Reinforced redundancy in warning issuance may benefit volcanic hazard messaging; staffing constraints remain a shared risk.

Casey Hanell — Washington Department of Natural Resources (WA DNR)

Key points:

- State Geological Survey (“Geology for a safe and prosperous Washington”) engages extensively with WA EMD, USGS, FEMA, and others to connect science to applications across hazards (landslides, earthquakes, volcanoes, etc.).
- The 2026 Mount Adams unrest event provided an opportunity to practice partner coordination and risk communication around potential volcanic unrest. Risk remained low, but messaging emphasized potential for additional unrest; coordinated calls with state EMD and USGS were valuable.
Strategic interest:
- With renewed state legislative support for geothermal investigation and advancing technologies, DNR is initiating community engagement to socialize opportunities and address skepticism. Overlap with volcano monitoring is anticipated.

Implications for NVEWS: Strengthened state-level communication protocols and emerging geothermal initiatives create collaboration points (e.g., monitoring co-benefits, community trust-building).

Brian Terbush — Washington Emergency Management Division (WA EMD)

Key Points:

- The Washington Emergency Management Division has a focus on volcano awareness and preparedness for five active volcanoes plus volcanic fields in Washington State.
- Mount Rainier lahar evacuation drill: Successful multi-agency collaboration; USGS contributed support.
- Volcano Awareness Month (May): Public engagement to remind residents of active volcanoes statewide.
- Working groups: Three volcano working groups (Baker/Glacier Peak; Rainier; Mount St. Helens/Adams) revitalized; recent seminar/workshop (~90 participants) reviewed agency products and clarified roles/responsibilities during activity changes.

Implications for NVEWS: Mature local preparedness and clear product-expectations provide a strong foundation for NVEWS messaging and action-item alignment during unrest.

Matthew Pritchard — Cornell University

Key Points:

- NASA NISAR: Reported launched July 2025; publicly available data expected to significantly aid volcano monitoring in the Cascades (historically difficult for other satellites). Anticipated petabyte-scale annual volume; emphasis on cloud computing and analysis-ready products via the Alaska Satellite Facility (ASF) to reduce latency.
- USGS engagement: Multiple USGS attendees (e.g., Sally Sennert, Marco Bagnardi) noted; USGS/VDAP plans extensive use. NISAR will provide global, always-on coverage—no tasking required.

Implications for NVEWS: Paradigm shift toward routine, rapid interferometric products for deformation monitoring and situational awareness.

Christy Till— Arizona State University

Key Points:

- Research is focused on magma processes and geothermal links.
- South Sister (OR): Recent inflation detected; limited InSAR coverage to date. Investigating magma accumulation and eruption triggers, with evidence that magma mixing precedes eruptions by months.
- Newberry Volcano: Parallel investigation of current magma storage conditions and intersections with geothermal interest.
- Global eruptive flux: Quantifying total erupted volumes for subduction-zone stratovolcanoes worldwide.
- Cascades compilation: Classifying eruption triggers (mixing, intrusion from depth, etc.) to identify Cascades-specific patterns.

Implications for NVEWS: Trigger-mechanism insights and geothermal crossovers can inform readiness indicators and public communication.

Leif Karlstrom — University of Oregon

Key Points:

- USGS Powell Center digital twins: Team (Kyle Anderson, Michael Poland, Brandon Schmandt [Rice]) advancing data-assimilation workflows to unify geodetic and seismic imaging at specific volcanoes.
- SZ4D steering committee: Cross-hazard coordination in subduction-zone regions.

- Field trip (late July): Co-leading Mount Hood excursion on sediment cascades (surge deposits, reworked sediments in White River and Columbia River Gorge).
- SZ4D MSRI multihazard array: Planning instrumentation that would augment NVEWS (and Chile deployments).
- SZ4D proposal (forecasting/hindcasting): Studying model performance for eruption prediction; funding request to a private foundation.

Implications for NVEWS: Digital-twin assimilation and expanded arrays could provide next-generation situational awareness and model validation.

Jennifer Wade — National Science Foundation (NSF)

Key Points:

- Earth Sciences has lost about 50% of its staff, with rapid hiring only now starting. The Directorate for Geosciences still exists after the agency reorganization, but divisions have been removed, and the Office of Polar Programs now sit within the Office of Research Infrastructure. All volcano-related work has been consolidated into a single NSF program to improve coordination.
- OMB proposals that could affect all granting agencies are being watched closely. FY26 is expected to be flat at the agency level, but program-level cuts are likely, with numbers still uncertain. Cross-cut opportunities tied to critical minerals may shift toward Engineering or Technology & Partnerships.
- NSF currently has no Director; Brian Stone is performing the duties, supported by the Chief Management Officer and the Chief Science Officer (from BIO). Earth Science section leadership includes Dena Smith, Paul Cutler.

Summary remarks

- A standing “state of the group” update was requested for future meetings to keep NVEWSAC apprised of organizational status.
- A November/December 2026 meeting will be scheduled to vote on the 2026 report and recommendations, ensuring formal adoption and follow-through.

Monitoring & Evaluation (M&E) — VHP Initiative

Wendy Stovall presented an update on the joint VHP and USGS Office of Risk and Resilience (ORR) effort to develop a comprehensive monitoring & evaluation (M&E) plan for the USGS VHP. This initiative, supported jointly with the Hazard Ready Nation project, enabled the hiring of specialized contractors to assess program effectiveness and evaluate the impact of USGS volcano

notifications. Contractors conducted extensive interviews with stakeholders from every observatory and numerous partners to inform the process.

The primary goals of the M&E initiative are to assess and improve VHP's monitoring and evaluation processes, create a robust M&E plan with clear evaluation methods, evaluate the use and effectiveness of volcano notifications, and deliver phased findings culminating in a final plan. The rationale for M&E within VHP is to systematically collect and review outputs and progress, examine effectiveness and impacts, and refine strategy—ultimately helping to meet congressional mandates and communicate program achievements. The approach draws on best practices from VDAP's M&E process and aims to support both internal improvement and external accountability.

Draft objectives for the M&E plan focus on four key areas, each with measurable indicators:

- **Strengthen Volcano Monitoring:** Track the number of monitoring stations installed or upgraded.
- **Increase Operational Relevance of Research:** Measure publications, hazard assessment components, implementation of research-derived tools and models, and partner adoption of research in operational plans.
- **Expand Outreach and Communications:** Count outreach events, communication products, stakeholder meetings, VNS subscribers, and social media engagement.
- **Enhance Internal Preparedness and Coordination:** Document internal exercises, event trees, cross-observatory meetings, staff trainings, after-action reports, and operational response plans.

Additional input from committee members included suggestions to add training and intern support, and to align with Volcanic Ash Operations plans for FAA, NOAA, and USGS, with planned revisions via AVO experts. The importance of standardized reporting requirements for external assistance was discussed, with the committee noting that a VHP-specific Notice of Funding Opportunity (NOFO) would formalize these expectations and support consistent M&E measures across all observatories.

A key component of the evaluation was the analysis of the Volcano Notification Service (VNS). A survey sent to over 50,000 subscribers achieved a 14% response rate, well above expectations. Results indicated strong satisfaction: 3,849 respondents rated the service “Much better than expected,” while only five rated it “Much worse than expected.” Qualitative feedback is being analyzed, with many respondents requesting “No change, please.” Results from Hawaii and Alaska showed consistent satisfaction, and event-driven notifications were particularly well received.

Discussion

The committee discussed the benefits of a formalized, minimally burdensome M&E framework, including dashboards, consistent indicators, and impact metrics, as well as alignment with cooperator reporting cycles and publicly shareable summaries. Members were invited to provide recommendations on finalizing and adopting the M&E plan, requiring cooperators to report NVEWS-relevant information in a standardized format, and sharing information about the M&E plan, its

development, and VNS survey results publicly. The discussion concluded with interest in offering suggestions in a formal recommendation format at a later date.

State of the Volcano Science Center (VSC)

Jake Lowenstern provided an overview of the status of the Volcano Science Center (VSC), summarizing staffing trends, organizational constraints, scientific capabilities, and major program activities. He noted that VSC funding comes from multiple USGS programs—primarily VHP, with additional support from the State Department, Energy Research Program (ERP), Earthquake Hazards Program (EHP), Landslides Hazards Program (LHP), Coastal and Marine Geology Program (CMGP), and National Cooperative Geologic Mapping Program (NCGMP)—and explained that staffing levels at the Cascades Volcano Observatory (CVO) are higher than the Alaska Volcano Observatory (AVO), California Volcano Observatory (CalVO), and Hawaiian Volcano Observatory (HVO) because personnel from other programs are stationed at CVO. Overall staffing has declined from 177 employees on January 1, 2025, to 153 currently, with 138 positions funded by VHP. Significant staffing gaps persist in hydrology, GIS/cartography, geodesy, geologic mapping (especially at CalVO), FEIT/IT support, outreach and communications, and several VMAP functions, including binational exchanges, satellite/clearance processes, and daily volcanic activity report (DVAR) support. Bi-national exchanges continue to be a valuable mechanism for sharing lessons learned between U.S. and international observatories following major volcanic events.

Lowenstern also described ongoing administrative and operational constraints, including a Department-wide hiring freeze requiring critical-needs approval for new positions, and the consolidation of DOI administrative services, which has reduced local USGS control over Human Resources, employee relations, international travel, contracting, desktop support, and communications. Purchasing authority will soon be restored for about half of VSC staff, and travel cards will no longer be automatically deactivated, although contracting and external assistance requests will face increased scrutiny. Supervisory changes remain difficult because of OPM approval requirements, and VSC management emphasized the importance of positioning staff for future leadership despite challenges in reassigning personnel across observatories. He noted that five Alaska-based staff are currently assigned to landslide monitoring focused on tsunami-generating hazards, work that benefits multiple VSC groups even though it is not specifically centered on volcanoes.

A coordinated effort to systematize and accelerate volcano hazard-assessment updates is underway, building on more than a decade of previous work. A newly designated project lead will focus on ensuring cross-observatory consistency, establishing best practices, and managing dedicated funding to support both ongoing assessments and future updates. All observatories have now implemented the updated Volcano Observatory Notice to Aviation (VONA) communication format, with HVO being the first worldwide to issue notifications using the redesigned structure. Each VONA now includes a clear synopsis statement. To meet ICAO requirements on issuance frequency tied to alert-level changes, VONAs and Volcano Activity Notices (VANs) have been decoupled to eliminate

redundant “no change” notices. In Hawai‘i, ashfall advisories are being closely coordinated with HVO during current eruptive activity.

Facility updates highlighted two newly funded DOI buildings in Hawai‘i—a field station, now operational, and a shared office space on the UH Hilo campus with PIERC that is being built. Ongoing staffing shortages raise questions about long-term operations, maintenance needs, space allocation decisions, and funding responsibilities.

Scientific and monitoring highlights were also shared from across the observatories. At Kīlauea, the current eruption has continued for 527 days with 48 effusive episodes, with eruption forecasting supported by tilt observations and the tracking of overflow activity through Real-time Seismic Amplitude Measurement (RSAM), where 40–80 overflow events typically precede major fountaining. Machine-learning tools are being applied to estimate fountain heights in near-real time. Ash and aviation work includes integrating radar data to quantify ash production, using Ash3D for NWS support, and incorporating public reports from the “Is Tephra Falling?” tool to validate ash-dispersion models. Research on eruptive processes and magma dynamics indicates that changes in melt composition and crystal cargo correspond with pulsed magma inputs and fluctuating fountain heights, while Yellowstone studies continue to show tightly clustered effusion episodes over the past 50,000 years. Global initiatives include ongoing development of the Daily Volcanic Activity Report (DVAR), in partnership with the Smithsonian, to compile worldwide volcanic activity data, as well as the use of cross-polarized SAR to characterize new deposits. Updates to the Rainier Lahar Detection System were also highlighted, including the integration of laser range finders for water-level measurements and improvements in combining seismic, infrasound, and flow-monitoring data to strengthen early-warning capabilities.

NVEWS / NVIS (Systems & Data) Update

Seth Moran provided an update on the status of NVEWS and NVIS activities, noting that progress since last year has been incremental and that many of the remaining tasks involve complex, remote, or weather-challenged locations. The NVEWS system buildout continues to be tracked through manual polling and spreadsheets, with an average progress rate of roughly 1% per year. In 2025, recalculations to account for overlapping stations resulted in a 1% reduction for that year, and additional review of gas instrumentation required updates to the target numbers. In 2026, the team incorporated the increased number of instruments installed between 2024 and 2026. The slide deck showed updated figures, including changes at YVO where denominators increased due to hydrothermal explosion considerations and the inclusion of seismo-acoustic stations with gas components. Current projections suggest full buildout by approximately 2070, reflecting the fact that most of the remaining sites are exceptionally difficult to access.

Staffing limitations continue to constrain installation capacity. HVO’s networking group is significantly understaffed and unable to implement new sites, despite high priorities such as Mauna Loa. AVO

and CVO are operating near maximum capacity and can make only modest progress, while CalVO and YVO have the ability to install only a small number of new stations per year. The Volcano-Monitoring Instrumentation Database (VMID) effort is advancing toward automated completion. A completion rate of 56% was calculated by hand count, and 46% was calculated based on VMID system numbers; a discrepancy related to incomplete Station Information System (SIS) integration. The transition from legacy, homegrown observatory databases into a unified SIS framework remains a substantial undertaking. While SIS now captures seismic, infrasound, and GNSS data, it still lacks sensor types for some infrasound and gas assets, partly due to EarthScope's separate metadata practices. There is also currently no unified system for gas, tilt, or webcam data, and achieving full interoperability will require continued, long-term effort across observatories.

In discussion of derived products, Leif asked about workflows such as earthquake catalogs. It was explained that cooperative partners typically manage these products, with the exception of HVO, and that the ultimate goal of interoperability is to ensure observatories can support one another by sharing methodologies and systems. Work at Rainier, including RSAM and infrasound products, is being designed so outputs can be shared broadly rather than remaining siloed within VSC.

Cost estimates for full NVEWS implementation were also reviewed. The gross construction estimate is approximately \$27M, with observatory-level breakdowns provided in the accompanying slides. Annual operations and maintenance are projected at an additional \$8–14M in 2024 dollars. Significant cost increases for batteries, digital components, and telemetry were noted. The estimates do not include cache equipment, site maintenance, new technology development, or staff time. An update was provided on the threat-rescoring “tiger team,” which aims to finalize its work by the end of 2026. Collaboration with GVP is underway to refine Holocene volcano lists and descriptions, and an in-person meeting at CVO this fall will support report writing. A question was raised about communicating changes to volcano counts and when VHP should begin using updated numbers. The group discussed the importance of coordinating with emergency managers and state surveys, and waiting to adopt new numbers internally until the list is fully solidified.

Additional updates were provided on NVIS activities. An AI working group was established to bridge communication between scientists and technology specialists, focusing on appropriate use cases, limitations, and areas requiring caution. Access to AI tools and available development bandwidth remain limited. Cloud migration efforts continue through collaboration with VSC and DOI cloud teams, although cost-benefit evaluations are still uncertain. A state of health assessment is moving toward a unified, cloud-based platform. Multimedia management continues to be a challenge due to diverse, homegrown systems. Potential solutions include the USGS Water Mission Area's webcam system, which lacks flexibility for field photos, and the NPS “NPGallery system”, a certified archival platform that may offer a maintainable, off-the-shelf option if customization needs—such as keyword control—can be met.

The session concluded with a discussion of ongoing challenges, including persistent understaffing, reduced purchasing power for equipment, the heavy workload associated with interoperability, frequent turnover among external partners, and uncertainties surrounding AI and cloud adoption. In follow-up questions, an advisory committee member asked about long-term total costs and maintenance; estimates of \$28–30M for full buildout and \$8–14M annually were reiterated. Another question was asked about incorporating new hazard scenarios or instrumentation needs; the current plan covers only a single scenario, and additional needs—such as Yellowstone hydrothermal hazards or Rainier no-notice lahar detection—will require future updates. NVEWSAC co-chair noted the potential role of edge computing in derived-product workflows, and it was emphasized that automated catalogs still depend on well-maintained reference catalogs. Cloud mandates and interagency lessons learned were also asked about, and the group discussed both the DOI push toward cloud migration and the importance of maintaining local fail-safe capabilities. Another co-chair inquired about hiring memo approvals and the potential use of IPAs (Intergovernment Personnel Act), and Gari and Jake noted that although IPAs have been used less frequently in recent years, they may again be a viable mechanism, particularly for software development roles integrated into observatory operations.

Subcommittee Updates

Distributed Volcanism / Hydrothermal Explosions

Leif Karlstrom introduced the topic of past NVEWSAC discussions about hydrothermal and distributed volcanic hazards, emphasizing existing monitoring gaps, scientific needs, and opportunities for broader integration within NVEWS. He highlighted recent and historical examples—including the July 23, 2024, Black Diamond Pool hydrothermal explosion (Yellowstone National Park), lessons from the 2019 Whakaari/White Island eruption (New Zealand), phreatomagmatic activity at Blue Lake Crater, and hazards within the Auckland and Boring volcanic fields—to illustrate the ongoing and varied nature of these threats. New age constraints on monogenetic eruptions suggest some fields may be younger and more active than previously recognized, and the broader YVO region was noted to encompass multiple distributed centers across the Southwest U.S. The discussion underscored that hydrothermal hazards remain insufficiently incorporated into NVEWS, as demonstrated by challenges during the development of YVO response plans following the 2024 Biscuit Basin explosion.

Key decision points included the need to formally recognize hydrothermal hazards within NVEWS and to better represent distributed volcanic fields, which are difficult to classify due to uncertain dating, long eruptive intervals, and non-traditional hazard footprints. Suggestions included conceptualizing the Southwest U.S. as a single volcanic system for planning purposes. Committee questions focused on overlooked hazard types, opportunities for academic and agency partnerships, and the need to expand NVEWS hazard scenarios beyond stratovolcano models—similar to how lahar monitoring has been incorporated into Mount Rainier’s network. Emergency management

representatives stressed the importance of clearly communicating impacts, probabilities, and rationale behind alert-level changes, noting that downgrades also require careful coordination.

The group discussed several collaboration opportunities, including expanded academic partnerships for dating, groundwater studies, hazard modeling, and field investigations, as well as a proposed white paper outlining research needs and potential impacts. Additional challenges identified included determining which volcanic fields should be part of NVEWS, evaluating the feasibility and cost of expanded monitoring, and considering how hydrothermal systems could be incorporated into future threat-level reporting to Congress.

Volcano Threat Level Reassessment

Leif Karlstrom also provided an update on NVEWSAC subcommittee discussions about the Volcano Threat Level Reassessment subcommittee meeting. The reassessment was initiated at the direction of the Volcano Hazards Program Council to maintain the new five-year update cadence established after the 2018 assessment. As noted in prior subcommittee documentation, this effort is a targeted update rather than a full methodological overhaul, focusing on revising the list of U.S. volcanoes included in the assessment and refining the definitions of hazard, unrest, and exposure factors. The seven-member team meets for one hour every two weeks, completing homework assignments between sessions and consulting broadly with VSC staff and external subject-matter experts. Their methodology begins with the Smithsonian Global Volcanism Program database and applies approaches detailed in Ewert et al. (2005, 2018), with the Alaska Volcano Observatory website serving as the definitive Holocene record for Alaska volcanoes. Default geologic data come from the Smithsonian Institution Global Volcano Program 2025 dataset, with exceptions documented as needed. The group is nearing completion of an updated volcano list and refined factor definitions, consistent with progress described in earlier minutes

The proposed volcano list is expected to include 153–158 centers, compared to 161 in 2018, with anticipated changes including two to five additions, three removals due to re-dating to the Pleistocene, one volcanic center split into two, and five to six combinations. Regional examples include adding a Southeast Alaska volcanic field; splitting Yunaska Island into two centers; combining Atka and Korovin, Mount Katmai and Novarupta, and Makushin with the Wide Bay cone; creating a combined Santiam–McKenzie volcanic field in the Cascades; adding Malumalu in American Samoa; removing the Golden Trout Creek volcanic field in California; and favoring the combination of several Idaho lava fields into a single volcanic system. These updates mirror themes previously discussed in annual reports and meeting materials addressing list adjustments and lumping/splitting decisions.

Key refinements include clarifying hazard, unrest, and exposure definitions; consolidating lahar-related factors; and removing historical fatalities and evacuations from exposure scoring to avoid double counting and maintain alignment with Ewert-based methodology. Methodological updates also include using kernel-density polygons rather than uniform buffers for distributed

volcanic fields and applying a standardized recurrence-rate workflow to improve reproducibility. In preparation for rollout, the subcommittee plans to develop a fact sheet, ensure consistency of published scoring numbers across observatories, and reinforce that high or very-high threat designations do not indicate imminent eruption. They also anticipate producing a white paper, coordinating with State Geological Surveys, and considering implications for NVEWS implementation metrics—particularly those tied to instrumentation and staffing, consistent with the broader reporting expectations for NVEWSAC activities.

Discussion

During the discussion on subcommittees, the DFO emphasized the importance of raising any topics discussed in non-public subcommittee meetings during the public Advisory Committee meeting to ensure transparency and compliance with FACA requirements. The group reflected on which subjects should be prioritized for deeper exploration in future subcommittee sessions, including feedback needs related to Southwest volcanic fields. Members considered whether the committee should recommend the development of white papers even when staffing constraints may limit what the USGS can accomplish, noting that articulating goals remains valuable and helps clarify why certain actions may or may not be feasible. There was interest in identifying how the committee might support proposed research-focused efforts—such as a white paper on distributed volcanism—and in assisting with scoping and recommendations. Discussion also highlighted that committee recommendations can influence broader program-level deliberations and long-term planning, even if not all suggestions can be implemented immediately. Members noted that many research opportunities exist across volcanic and hydrothermal systems, and that contributions from the academic community remain essential. The conversation also acknowledged conceptual challenges—such as defining exposure factors for distributed volcanic fields and addressing limitations in current NVEWS scoring approaches—while recognizing the potential need for a more holistic assessment framework in the future.

Volcanic Ash and Fumes Act (FUMES) Updates & Collaboration

FAA Briefing on Aviation and Volcanic Ash — Karen Shelton-Mur

Karen Shelton-Mur provided an overview of the history of aviation encounters with volcanic ash and the ways these events have shaped current international procedures and aviation-safety practices. Early incidents underscored the severe hazards posed by ash clouds, including the 1982 British Airways 747 event over Indonesia in which all four engines failed at 37,000 feet before three were successfully restarted, and the December 1989 KLM Flight 867 encounter with Redoubt Volcano, AK ash, which similarly resulted in a complete loss of engine power before recovery during descent. During the 1991 Mount Pinatubo eruption, eighteen aircraft reported ash-related impacts over four days, ranging from engine vibration and electrical discharge to SO₂ odors, window abrasion, and turbine damage, producing substantial financial losses despite no fatalities. These experiences contributed to the 1998 establishment of nine ICAO Volcanic Ash Advisory Centers (VAACs), which

monitor ash clouds and issue advisories to Meteorological Watch Offices; in the United States, these are operated by the National Weather Service in Anchorage, Honolulu, and Kansas City.

The briefing also addressed the significant disruption caused by the 2010 Eyjafjallajökull eruption, which prompted ICAO to convene the International Volcanic Ash Task Force (IVATF) from 2010 to 2012. This group—including FAA, NOAA, USGS, and major U.S. airlines—reviewed global guidance, developed contingency plans, assessed detection technologies, and advanced work on volcanic-ash concentration thresholds. Follow-on efforts included engine-performance degradation testing between 2011 and 2015, and the development of new ash-concentration thresholds proposed in 2020, followed by the creation of a Quantitative Volcanic Ash (QVA) product in 2021. The International Airways Volcano Watch (IAVW) Work Stream continues to refine volcanic-ash forecasting tools and enhance product quality.

The FAA's responsibilities as the United States' meteorological authority were also outlined, including its obligations under ICAO Annex 3, which is a key regulatory document that governs the provision of meteorological services for international aviation, ensuring that air traffic operations worldwide receive consistent, reliable, and timely meteorological information to maintain safety and efficiency in flight operations. All ICAO member states must designate a meteorological authority and a service provider, and updates emerging from the IAVW process may lead to amendments to Annex 3. When such amendments are approved, the FAA issues requirements letters summarizing changes and effective dates. Recent updates to VONA procedures fall into this category.

Looking ahead, QVA products are expected to provide higher-resolution, quantitative ash-cloud forecasts that allow operators to optimize flight routing. Endorsed by the ICAO MET Panel in 2021, these forecasts are already operational at the London and Toulouse VAACs, with the remaining VAACs (including NOAA's) anticipated to adopt QVA in the coming years.

The briefing concluded with an overview of ongoing interagency coordination. The Volcanic Ash Coordination Group, comprising of members from FAA, USGS, and NOAA, continues to support collaborative work on ash hazards. Additional efforts are underway with USGS and NOAA to develop mechanisms for distributing Volcano Observatory Notices for Aviation (VONAs) through the Aeronautical Fixed Service, improving the reliability and integration of aviation-focused volcanic hazard communication.

NOAA/USGS NVEWS Collaboration Update — David Kochevar

David Kochevar, a Warning Coordination Meteorologist at the NOAA/NWS Anchorage Volcanic Ash Advisory Center, provided an overview of responsibilities and ongoing initiatives related to airborne volcanic ash hazards in Alaska's airspace. The center issues Volcanic Ash Advisories (VAAs) and SIGMETs for the region and has played a key role in developing the NOAA implementation plan following the integration of NVEWS through the Volcanic Ash and Fumes Act of 2022 (S. 3533) .

A USGS and NOAA working group has identified seven priority groups, spanning improvements in services from volcanic smog (vog) and lahars to airborne ashfall hazards, enhanced data sharing, including dispersion modeling, satellite data, and submarine volcanic hazards, and the efficacy of hazard information products. Four of these groups are directly related to ash and aviation, but there is currently no dedicated staffing or funding for these projects; all progress reflects prior job requirements and does not include new Ash and Fumes act related responsibilities.

Priority Group 3 focuses on improving the quantification of airborne ash hazards to aviation, with efforts centered on implementing the new Quantitative Volcanic Ash (QVA) information service by the Volcanic Ash Advisory Centers. This work is designed to meet ICAO requirements and align research with global aviation standards. Collaboration with State volcano observatories is essential for identifying relevant data contributions during eruptive events. The group is also incorporating satellite data into NOAA's HYSPLIT modeling of airborne ash clouds and maintaining active involvement in ICAO volcanic ash working groups. Workshops, including an ICAO modelers' meeting in Buenos Aires in April 2026 and a QVA workshop held September 2025 in Anchorage, are facilitating coordination and knowledge exchange.

Priority Group 4 aims to improve the quantification of ashfall hazards, integrating airborne and ground-level ashfall into regional plans developed with NOAA, USGS, and FAA. Agency roles and responsibilities are being clarified, and collaborative work at Kīlauea is advancing the use of Ash3D output in NWS operations for ashfall warnings and advisories. The USGS Ash3D steering committee is working to improve coordination on eruption source parameters used in ashfall and airborne ash modeling, ensuring consistency across products. Enhanced communication tools, such as NWSChat and Slack, are being established for eruption response collaboration.

Priority Group 7 is dedicated to improving the efficacy of USGS and NOAA hazard information products. Efforts include identifying, documenting, and reviewing all current volcanic hazard information products, differentiating between services, and addressing gaps or duplication. USGS is supporting NOAA's transition from ashfall thresholds to impact-based warning products, leveraging international working group expertise. USGS also contributes to the development of call-to-action statements in NWS ashfall products for Alaska and Hawaii.

Throughout these initiatives, interagency collaboration and real-time communication tools are helping to streamline operations and improve the quality and consistency of hazard information provided to stakeholders and the public.

USGS Volcanic Ash Activities — David Schneider

David Schneider provided an overview of USGS volcanic ash activities, emphasizing how project tasks are shaped by NVEWS priorities to enhance preparedness, response, and scientific understanding. The VHP ash project focuses on improving quantification of airborne ash hazards for aviation, refining ashfall hazard assessments, and increasing the efficacy of USGS and NOAA

hazard information products. Recent unrest at Spurr, AK prompted the development of ashfall thickness forecasts and new timing estimates for when ashfall would begin affecting communities. Emergency managers and military stakeholders expressed a need for probabilistic outlooks on eruption timing, which the project addressed using ensemble modeling—running multiple scenarios with varying start times and cloud heights to provide likelihood estimates over time.

For Kīlauea, the Ash3D model has been adapted to Hawaii's eruptions, and the "Is Tephra Falling?" website, originally developed for Alaska, now collects citizen reports of ashfall in Hawaii. Probabilistic forecasts, based on lessons from Spurr, have also been applied to Kīlauea in response to community requests. USGS collaborates closely with the National Weather Service (NWS) in both Alaska and Hawaii, using Ash3D outputs to inform ashfall advisories and warnings.

Aviation hazards are a major focus, with USGS participating in international groups such as International Civil Aviation Organization (ICAO), International Airways Volcano Watch (IAVW), Working Group on Meteorological Operations within the ICAO Meteorology Panel (WG-MOG), World Meteorological Organization (WMO), and World Organization of Volcano Observatories (WOVO). USGS helps train US volcano observatories in using the updated VONA format, which became a recommended practice in November 2025 and was fully implemented by March 2026. The new VONA standard features mandatory fields, prescribed aviation language, and dual output formats (text bulletin and machine-readable XML), enabling seamless integration with aviation dispatch systems and automatic evaluation of ash hazards along flight routes.

The Quantitative Volcanic Ash (QVA) initiative, introduced by ICAO in late 2025, provides both deterministic and probabilistic gridded data on ash concentrations. USGS supplies volcanological data for models like HYSPLIT, supporting forecasts for eruptions through seawater, ash and gas emissions in Hawaii, and umbrella cloud scenarios. Volcanic cloud characterization leverages geostationary satellite and NEXRAD radar data to distinguish ash and SO₂ components and to track vertical structure and convection, enhancing situational awareness for USGS and NOAA during eruptions.

The project also supports updates to interagency ash response plans for Alaska, Hawaii, CONUS, and CNMI, with ongoing collaboration to refine ashfall impact language and preparedness guidance. Coordination between Hawaii and Alaska colleagues ensures tailored messaging for specific events, including advisories on exposure, protective actions, and reporting mechanisms for ashfall.

The Volcanic Ash and Gas Impacts Working Group, an international team, develops authoritative guidance based on global experience. Their website hosts case studies and preparedness advice for emergency managers, scientists, and the public, with specialized resources for airport operators, facilities managers, power plant operators, water supply managers, and other stakeholders.

Public Comments

No public comments were heard nor recorded.

Day 2 — Thursday, June 4, 2026

Group Working Session I: Monitoring & Evaluation (M&E)

The group discussed current VHP reporting practices, noting that information is gathered manually for the annual NVEWS report and intermittent data calls, with limited systems to support consistent tracking. A formal M&E framework would improve transparency, communication, and the ability to demonstrate program impact, though it will require upfront effort.

Participants emphasized the value of combining simple count-based metrics with meaningful impact indicators. Existing tools—such as VSC preparedness scoring, NVEWS IT investment metrics, and SIS-based instrumentation tracking—could feed into a more structured system. Flexibility would be essential to adapt to changing administrative reporting needs and observatory differences. The loss of staff supporting IT/data calls was noted as a gap.

A standardized reporting template across observatories was proposed to summarize instrumentation status, issues, and plans, improving consistency and reducing ad-hoc requests. A public-facing dashboard may eventually help inform communities, though constraints on public dissemination remain.

Examples from VDAP, NSF, and other agencies highlighted the importance of intuitive reporting systems and clear expectations. Indicators should be easy to enter, avoid excessive administrative burden, and include measures of readiness, data usage, effectiveness of hazard communications, and major capabilities enabled by monitoring networks. Additional ideas included tracking ashfall-related improvements (e.g., Ash3D), watch-office activation hours, and usage metrics such as external downloads.

The group also discussed the need for better coordination of external contributions during eruption responses, ensuring unified government messaging and clearer delineation between research and operations—while acknowledging that VHP's work spans both.

Geothermal

DOE Office of Geothermal — Lauren Boyd

The briefing began with an introduction to the new Hydrocarbons and Geothermal Energy division within the Department of Energy (DOE), highlighting its extensive leadership experience and its

focus on advancing power production, particularly at the gigawatt scale. The division's strategic goals for 2026 include supporting resource characterization, optimizing geothermal energy production at existing plants, developing thermal energy storage solutions, and improving cooling for data centers. Efforts are concentrated in three main areas: technology research and development (R&D), pilot and demonstration projects—especially enhanced geothermal systems (EGS)—and commercial scale-up, which faces regulatory and permitting barriers.

The Office of Geothermal is actively engaged in pilots and demonstrations, such as the Utah FORGE project, and is working to improve reservoir performance and thermal cycling for energy storage. Technology R&D initiatives focus on advanced geophysical tools, AI-enabled sensing, improved drilling speeds and materials, power conversion, and recovery of critical minerals from geothermal brines. Commercial scale-up efforts aim to streamline permitting, accelerate project approvals, and assess geothermal's contributions to grid reliability and market services.

Several projects relevant to volcanic environments were discussed. The DEEPEN project, with test sites at Hengill Volcano in Iceland and Newberry Volcano in Oregon, aims to improve success rates for geothermal drilling in magmatic systems. This project has validated new geophysical and geochemical exploration methods and developed preliminary Play Fairway Analysis for magmatic environments, strengthening international collaboration and advancing exploration for high-temperature geothermal resources. Mazama's EGS pilot demonstration at Newberry is exploring superhot rock (>375°C) as a massive potential energy source, with technical challenges related to drilling and materials at extreme temperatures. Superhot rock could provide reliable baseload power at lower cost, with just 1% of U.S. superhot rock capable of generating 4.3 terawatt—nearly four times current U.S. electricity capacity.

Regional partnerships for geothermal data are being negotiated, with nine projects underway to provide more data for resource assessment and development opportunities. The division is also advancing “hidden systems” through Play Fairway Analysis, which produces regional, basin-scale maps to reduce uncertainty in geothermal exploration. Innovative projects like INGENIOUS and BRIDGE are focused on discovering commercially viable hidden systems and conducting detailed studies of military lands using airborne electromagnetic methods.

The DOE Geothermal Data Collection Pipeline has amassed significant field data, including over 4,800 line-km of HeliTEM, 100,000+ feet of exploratory drilling, 800+ magnetotelluric stations, and more than 100,000 acres of high-resolution LiDAR. The Geothermal Data Repository (GDR) now houses over 764 TB of project data, enabling research, collaboration, and transparency by providing open access to geothermal information. The repository is continually updated, now featuring an AI tool for easier data access, and has seen over 216,000 downloads in April 2026 and nearly 9.7 million downloads fiscal year-to-date.

International collaboration was also discussed, particularly the partnership with Iceland through the Geothermica program, which brought together funding and expertise from multiple EU countries and national labs. While DOE's involvement in these projects has ended, government and state-owned companies continue to advance collaborative efforts in renewable energy.

USGS Geothermal Science — Shaul Hurwitz

The overview focused on geothermal energy production from U.S. volcanoes, emphasizing both opportunities and associated hazards. Geothermal development requires heat, water, and sufficient permeability, with Enhanced Geothermal Systems (EGS) used where permeability is low by injecting high-pressure fluids to create connected fractures. Although there is limited spatial overlap between major geothermal production and active volcanoes, several U.S. volcanic regions support, or are being evaluated for, geothermal power. Current production occurs at the Geysers and Salton Buttes in California, Kīlauea in Hawai'i, areas around the Snake River Plain, and the low-temperature resource at Chena Hot Springs in Alaska. Exploration is underway at Augustine, Makushin, and Newberry, and EGS projects in distributed volcanic fields may help supply power to data centers. Superhot geothermal systems ($>375^{\circ}\text{C}$) at Augustine, Newberry, and Krafla (Iceland) remain experimental, with no commercial production yet. Planned drilling at Augustine aims to deliver electricity to Anchorage, and recent play-fairway work and exploratory drilling in Hawai'i, along with USGS plans for additional data collection, continue to refine resource assessments.

Newberry Volcano hosts a high-temperature but low-permeability system, where companies plan to pursue superhot-fluid extraction while USGS acquires further data. Across Alaska, additional geothermal prospects include Pilgrim Hot Springs, Makushin Volcano, and Augustine, while in Hawai'i the Puna Geothermal Venture remains the sole producer, supported by ongoing investigations on Lanai, Maui, and Mauna Loa. Regional and national efforts also include thermodynamic database development for superhot systems and expanded geophysical surveys in Alaska and Hawai'i.

Hazards associated with geothermal development were reviewed, including lava flows—such as those that impacted wells at the Puna Geothermal Venture during the 2018 Kīlauea eruption—induced seismicity from EGS stimulation, hydrothermal explosions triggered by pressure decline, and land subsidence documented at several geothermal fields. These risks underscore the need for robust hazard mitigation and monitoring as geothermal development expands. Future growth of EGS in volcanic settings will require expanded seismic networks, improved monitoring of deformation and gas emissions, and greater research investment in distributed volcanic fields. Upcoming drilling at Augustine (AK), Haleakalā and Mauna Loa (HI), and Newberry (OR) presents opportunities to integrate geothermal exploration with enhanced volcanic monitoring. The discussion concluded with recognition that national labs already maintain monitoring in some southwestern regions, and stronger coordination could benefit both geothermal development and volcanic hazard assessment.

VHP Priority Focus Areas

Gari Mayberry summarized partnership models (e.g., AVERT, SZ4D) and the following VHP priority areas: Subduction Zone Science (observations/models; hazard/risk quantification; forecasting/situational awareness), Critical Minerals (linkages to volcanic systems), Artificial Intelligence/Machine Learning (workflow design, InSAR analysis, event detection, cloud/DOI policy), and Hazard Ready Nation (products and stakeholder-focused communication). Details on past and potential Value of Information (VOI) projects to quantify benefits of USGS products (e.g., Mauna Loa eruption scenario, aviation exposure, ash impacts, tourism/public access) was also presented. Members suggested more structured interagency coordination for external collaborations and discussed uncertainty in source parameters for ash models, edge computing prospects, and preparedness metrics.

Monitoring Partnerships

Reviewed several major partnership efforts supporting volcano monitoring. A recent example is the Anticipating Volcanic Eruptions in Real-Time (AVERT) project, led by Lamont-Doherty Earth Observatory with Moore Foundation support (2019–2024), which partnered closely with AVO to install multi-sensor arrays on Okmok and Mount Cleveland. The project successfully met all of its goals, including testing novel instrumentation, demonstrating satellite-based telemetry for near-real-time data delivery, and building a sustainable academic–observatory collaboration. Installed instruments remain operational and are now maintained by AVO. The Subduction Zones in four Dimensions (SZ4D) initiative was also highlighted, which outlines key science and hazard-focused priorities for subduction zones, including major research questions, partnerships, and community infrastructure.

Discussion

Committee members suggested the need for deeper, ongoing conversations about partnership structures, how to sustain them, and how they can support NVEWS and VHP objectives. Participants expressed interest in better understanding long-term coordination among federal, academic, and funding institutions.

Subduction Zone Science

USGS's 2017 plan *Reducing Risk Where Tectonic Plates Collide* outlines priorities for subduction-zone research and hazard reduction. The plan focuses on improved observations and modeling, quantification of hazards and risk, and enhanced forecasting and situational awareness. Past priorities included deciphering paleoevent timing and impacts, with current emphasis on monitoring and warning systems and future priorities on integrated multi-hazard modeling. Examples

of applied work include daily ashfall forecasts for Mt. Spurr, Rainier LDS support for evacuation planning, tsunami-source inventories, and revised geologic maps of volcanic centers.

Discussion

Members emphasized the importance of coordinating with SZ4D and the NHMA subduction zone science group as the USGS plan is being updated. There was agreement that volcano applications—particularly ashfall forecasting, scenario development, and geologic mapping—should remain major components of the next phase of subduction-zone efforts.

Critical Minerals

The group discussed how critical minerals, as defined under the Energy Act of 2020 and the updated 2025 USGS list, intersect with volcanic science. Many essential materials—including copper, nickel, cobalt, lithium, chromium, tungsten, lead, zinc, barite, and rare earth elements—occur in volcanic or magmatic-hydrothermal systems. VHP expertise in igneous and hydrothermal processes positions the program to contribute significantly to assessing mineral potential, improving understanding of formation processes, and guiding exploration. Existing USGS facilities, including an electron probe at CalVO laser facility in Denver, and scanning electron microscopes (SEMs) at AVO and CalVO, provide strong foundations for cross-disciplinary work.

Potential future efforts include formalizing partnerships with the USGS Minerals Resources Program, leveraging shared analytical instrumentation, pursuing DOE collaborations, and developing new cross-disciplinary proposals.

Discussion

Members asked whether this work connects directly to NVEWS; VHP noted that improved understanding of volcanic systems enhances hazard assessments and monitoring capability. If funded by other USGS Programs, this work could free resources within VHP for other priorities.

Artificial Intelligence and Machine Learning

The presentation highlighted rapid advances in AI/ML for volcano science. Recent research at Yellowstone used 15 years of seismic data to produce an expanded catalog of over 86,000 events—ten times more than the routine catalog—revealing relationships among earthquake swarms that may indicate reactivation of dormant fluids. VHP is designing workflows to integrate AI-generated products alongside traditional monitoring streams, evaluating remote-sensing data through AI algorithms, detecting long-period seismic events, and applying statistical and physics-based ML models for forecasting. InSAR analysis is another promising application.

However, constraints remain, including security requirements (firewalls), tool vetting, and limited availability of approved AI platforms. The VSC recently launched an AI working group, and interest continues to grow in adopting AI tools for coding, model development, and operational support.

Discussion

Members noted the tension between rapid AI advances and federal technology constraints. There is widespread interest in responsibly increasing the use of AI, but concerns remain about data security, tool accessibility, and the need for targeted support and training.

Hazard Ready Nation (HRN)

The USGS Hazard Ready Nation (HRN) initiative, modeled after the Weather-Ready Nation approach, seeks to enhance impact-based decision-making across hazard programs. The strategy emphasizes understanding end-user needs, expanding hazard and risk science, developing actionable products, and improving communication. HRN product themes include real-time monitoring and alerts, scenario development, risk communication, stakeholder engagement, training, and integration of technology and data. VHP already contributes substantially through lahar preparedness materials, exposure assessments for distributed volcanic fields, stakeholder engagement at Makushin, Kīlauea, Baker, and Clear Lake, and geochronology and mapping for hazard assessments.

Discussion

Participants asked about governance: there is no dedicated HRN working group yet, but one is expected as ORR advances the effort. Members emphasized stronger coordination with emergency management audiences and ensuring HRN does not add unnecessary workload. VHP clarified that most HRN-aligned tasks already occur organically within its mission.

Reporting

During FY26, VHP requested reporting from Science Centers on effort across priority areas, but results were incomplete due to unclear guidance. The group agreed that a formal monitoring & evaluation (M&E) plan will help clarify reporting definitions, track effort more accurately, and ensure that VHP's work is appropriately represented. The need to balance granularity with burden was emphasized.

Discussion

Participants noted that parsing activities strictly by initiative is difficult, echoing challenges in other agencies such as NSF. An M&E plan could improve consistency, reduce confusion, and strengthen the program's ability to communicate priorities and accomplishments.

Value of Information (VOI)

The presentation reviewed the history of VOI work, including the USGS Science and Decision Center's scenario-based studies initiated in 2017 (Jenkins et al. 2026), which quantified that HVO information yielded an estimated \$2.8 million in benefits during a Mauna Loa eruption scenario. Current plans include re-engaging with SDC to refine VOI methodologies, build repositories of studies, and apply VOI to aviation exposure, ash impacts, tourism/public access, and resource-driven applications such as minerals and geothermal development. VOI projects help validate Volcano Hazards Program allocations and inform both the public and Congress about the return on investment of USGS programs.

Discussion

Members emphasized the importance of identifying data sources, cost considerations, and interagency partnerships (e.g., DOT) to obtain aviation-exposure data without prohibitive subscription fees. The committee also discussed the need to understand budget impacts and update cycles for VOI products.

Committee Working Session focused on Recommendations

The committee held an extended discussion on how best to communicate the critical staffing and budget needs facing the Volcano Hazards Program (VHP). Members agreed that it is appropriate—and necessary—to describe these shortages in the annual report to the DOI Secretary via the USGS Director, provided the language avoids any implication of lobbying or direct requests for funding. The framing should focus on observed consequences of declining staff capacity and the risks posed to fulfilling statutory mandates. Several observatories can no longer install new instrumentation or maintain existing networks at required levels, and the committee agreed this constitutes a critical operational gap worth documenting.

It was noted that the 2025 report already captured many of these issues narratively, but that the recommendations section did not explicitly highlight staffing needs. The committee therefore decided to address the issue in the 2025 Recommendations Report to elevate staffing concerns as a core recommendation and add a statement supporting development of an M&E plan for VHP and NVEWS. A formal vote was held, and the 2025 Recommendations Report was unanimously approved.

The committee then discussed the approach for 2026 recommendations and meeting cadence. Members indicated interest in holding quarterly committee meetings, which would require advance scheduling through the Federal Register, recognizing that dates cannot be changed once published (though meetings can be canceled). Subcommittee meetings may occur more flexibly but cannot issue formal recommendations. Members suggested maintaining a running list of recommendations throughout the year to make the end-of-year report process more efficient, and proposed topical subcommittees focused on partnerships, communication, and forecasting.

A substantive scientific exchange followed regarding volcanic ash model uncertainties. Members noted that while dispersion and transport models are relatively constrained once plume height and source parameters are known, the largest uncertainties arise from eruption source parameters themselves, including injection height and size distribution of particles. These uncertainties are actively studied by multiple interagency groups, and future discussions could benefit from deeper review of current modeling limitations and opportunities for improvement.

The committee also revisited expectations for monitoring & evaluation (M&E), particularly around the role of cooperators. Members supported requiring cooperators to report NVEWS-related information in alignment with normal reporting cycles to minimize burden. It was acknowledged that observatories often assist cooperators in translating scientific work into clear metrics, which helps support evaluation. Discussions highlighted the need to capture individual measures within each objective and the importance of clearly defining the data sources and analytic methods that will feed indicators within the forthcoming M&E plan.

The conversation then shifted to geothermal development and its relationship to NVEWS. Members observed that private-sector geothermal activity continues to expand, creating potential opportunities for shared monitoring infrastructure and improved understanding of geothermal-volcanic interactions. However, USGS involvement in private geothermal projects is currently limited, and many distributed volcanic fields targeted for geothermal exploration are not included in NVEWS instrumentation plans. Members questioned whether tracking NVEWS “completion” should apply solely to very-high and high-threat volcanoes or if broader monitoring goals should be included, especially as satellite-based tools continue to evolve. Concerns were raised about the estimated 44-year timeline for NVEWS completion at current capacity, prompting discussion about whether more adaptive or scenario-based approaches are needed for threat assessment and prioritization.

Members also considered whether preparedness metrics, such as those from the existing preparedness matrix, could be incorporated to help define realistic progress benchmarks. There was broad agreement that NVEWS involves more than instrumentation—it should reflect detection, forecasting, and timely hazard communication. The committee discussed whether evolving technologies (e.g., remote sensing, edge computing, emerging AI methods) might change assumptions about network needs, noting that while experimentation is ongoing, USGS will need to rely on external research communities for leading-edge development.

Additional discussion addressed the potential for expanded Value of Information (VOI) studies. Members emphasized that quantifying benefits—such as avoided impacts to infrastructure, transportation, or aviation—from well-instrumented volcanoes could help demonstrate return on

investment to stakeholders. Examples such as lahar evacuation walking maps, impacts to interstate corridors, and major aviation disruptions were mentioned as potential scenario candidates. Members expressed interest in contributing ideas for useful VOI studies that could inform decisions by emergency managers, transportation authorities, and other partners.

The committee also reflected on the forthcoming Southwest Volcanic Field report and suggested inclusion of exposure-related factors and cascading hazard scenarios. Broader priority-area topics—including critical minerals, subduction zone science, and Hazard Ready Nation efforts—were acknowledged as intersecting with NVEWS in important ways. Members noted that edge computing may soon overlap with NVEWS workflows, and that future discussions should address the role of emerging technologies in hazard forecasting.

To close the discussion, the committee outlined several important topics for future meetings, including early warning concepts, forecasting and ash/aviation modeling, national ash response planning, critical minerals connections, NVEWS prioritization and denominator issues, and preparedness-matrix reviews. The group also identified initial FY26 recommendation themes: full NVEWS implementation, severe staffing challenges, M&E development and cooperator reporting expectations, dissemination of VNS survey findings, and potential VOI studies.

Immediate action items included: coordinating with co-chairs to schedule quarterly meetings; initiating Federal Register Notice preparations (3–4-month timeline); identifying any needed subcommittees; developing a centralized tracker of recommendations on SharePoint; and coordinating subcommittee scheduling. Proposed subcommittee themes include Forecasting, Communication & Partnerships, and Strategic Priority Areas.

2026 Advisory Committee Recommendations (rough draft)

(developed during meeting)

1. Fully implement NVEWS as authorized, including the watch office and grants program, to strengthen national volcanic monitoring and information services.
2. Address staffing gaps across observatories to sustain operations, instrument maintenance, and response capabilities during unrest and eruptions.
3. Develop and adopt a VHP/NVEWS M&E plan, including streamlined cooperator reporting and public-facing transparency (e.g., high-level dashboards).
4. Advance VOI analyses (e.g., aviation exposure, ash impacts) to communicate the benefits and outcomes of hazard information investments.
5. Pursue targeted white papers on distributed volcanic fields/hydrothermal hazards and research opportunities to inform NVEWS scenarios and partnerships.
6. Continue threat level reassessment with clear external communications (fact sheets, stakeholder engagement) emphasizing that threat tiers do not imply imminent activity.

Public Comments

No public comments were heard nor recorded.

Adjournment

The meeting adjourned at approximately 5:00 p.m. EDT on June 4, 2026.

Certified by the NVEWSAC Chairs 07/29/2026

**Jennifer Wade, co-Chair
U.S. National Science Foundation, Directorate for Geosciences**

**Leif Karlstrom, co-Chair
University of Oregon**