



1-2021

## Glacier Peak Infographic Usability Report

Rachel Volentine

*University of Tennessee, Knoxville*

Follow this and additional works at: <https://trace.tennessee.edu/userx>



Part of the [Geology Commons](#), [Glaciology Commons](#), and the [Graphics and Human Computer Interfaces Commons](#)

---

### Recommended Citation

Volentine, R. (2021, January). Glacier Peak Infographic Usability Report. User-Experience Laboratory, Center for Information and Communication Studies, University of Tennessee. GlacierPeak V2 UXReport.pdf

This Report is brought to you for free and open access by the Communication and Information at TRACE: Tennessee Research and Creative Exchange. It has been accepted for inclusion in User eXperience Lab by an authorized administrator of TRACE: Tennessee Research and Creative Exchange. For more information, please contact [trace@utk.edu](mailto:trace@utk.edu).



# Glacier Peak Infographic Usability Report

January 2021



Prepared for:  
**Cascades Volcano Observatory**  
Joe Bard  
Carolyn Driedger

Prepared by:  
**Rachel Volentine**  
User-eXperience Lab Manager

**User-Experience Laboratory**  
Center for Information and Communication Studies  
University of Tennessee  
[uxl@utk.edu](mailto:uxl@utk.edu)  
865.974.9865

# Contents

- Executive Summary..... 3
- Methodology..... 5
  - Outreach & Screening..... 5
  - Participant Profiles..... 5
  - Testing Setup & Post-Test Questions..... 5
- Results..... 7
  - Overall Concept..... 7
  - Areas of high and low risk..... 8
  - Decision-making..... 9
  - Timing..... 10
  - Additional Information ..... 11
- Usability Issues..... 12
  - General..... 12
  - Areas of high and low risk..... 12
  - Decision-making..... 12
  - Timing..... 12
  - Additional information..... 13
- Recommendations & Action Items ..... 14
  - General..... 14
  - Area of high and low risk ..... 14
  - Decision making ..... 14
  - Timing..... 15
  - Additional information..... 15
- Appendix A. Usability Test ..... 17
- Appendix B. Responses: What did you like?..... 19
- Appendix C. Responses: What could we improve? ..... 19

# Executive Summary

The User-eXperience Lab at the University of Tennessee in partnership with the Cascades Volcano Observatory conducted a moderated usability study via Zoom December 7-15 2020. The moderated usability study was designed for the usability researcher to actively engage with the participant, guiding the user through a series of questions and answering questions and replying to their feedback in real time.

This is the second usability study in a project to evaluate the usability of map-based risk and hazard communication products to develop a new methodology for evaluating map-based communication products implemented by USGS and its partners and stakeholders. The first usability study was completed in August 2020, and changes were made to the Glacier Peak infographic based on the feedback, including reducing the amount of text, reorganizing the map's legend, and showing only one volcano. The second study evaluated how the revised infographic (image 1) meet the needs of Washington emergency managers. We received feedback from 13 members of the Washington Tsunami Emergency Managers mailing list.

**Are You Ready for An Eruption?**  
GLACIER PEAK IS AN ACTIVE VOLCANO, AND WHILE AN ERUPTION OR A LAHAR MIGHT NOT HAPPEN IN OUR LIFETIME, BEING PREPARED IS OUR BEST DEFENSE.

**Ready, Set, Go!**

**LIVE SAFELY**

- Look at the map. Assess the hazards where you live, work, and commute.
- Higher-risk lahar zones may need to evacuate for days to weeks during volcanic unrest.

**Make an evacuation plan**

- Assemble emergency supplies and a plan where to reunite if separated while evacuating.
- Share your plans with family, neighbors, and friends.

**USGS volcano monitoring networks can provide warning**

- Future eruptions will be preceded by days, or more, of increased earthquakes and, possibly, by measurable swelling of the volcano, and by increased emission of volcanic gases.

**STAY INFORMED**

**Listen to official sources**

- Monitor Federal, State, and county emergency alert systems and broadcasts.
- NDA Weather Radio All Hazards broadcasts official Weather Service warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week. <https://www.weather.gov/hqn/news>
- U.S. Geological Survey Volcano Notification Service (USGS VNS) provides information about volcanic unrest and activity. <https://volcanoes.usgs.gov/vns2/>

**WHEN A LAHAR WARNING IS ISSUED**

**Evacuate hazard zones**

- Move off valley floors that could be at risk.
- Evacuate by vehicle or on foot to high ground 50 feet or more above valley floors.
- If you are safe from lahars and ash is falling, seek shelter in a building or vehicle.

**During an eruption or unrest**

- Expect lahars and the possibility of substantial ash fall.
- Reduce risk by staying clear of hazardous areas!

**LAHAR EVACUATION: QUICKLY GO TO HIGH GROUND ABOVE THE VALLEY FLOOR.**

**Get More Information**

There are 5 active volcanoes in Washington State. Be prepared. Get more information and learn about volcano hazards that might affect your family.

[washington.gov/2884/Volcano-Preparedness](https://washington.gov/2884/Volcano-Preparedness)    [mt.wa.gov](https://www.mt.wa.gov)  
[dnr.wa.gov](https://www.dnr.wa.gov)    [usgs.gov](https://www.usgs.gov)  
[wa.gov](https://www.wa.gov)    [wa.gov](https://www.wa.gov)  
[wa.gov](https://www.wa.gov)    [wa.gov](https://www.wa.gov)  
[wa.gov](https://www.wa.gov)    [wa.gov](https://www.wa.gov)

**GLACIER PEAK VOLCANO HAZARD ZONES**

**LAHAR HAZARD ZONES**

- Lahars are volcanic mudflows caused by melting of ice and snow. They travel away from the volcano in their valleys that begin on the volcano's slopes.
- Fast-moving lahars can reach the closest populated areas within one hour.
- Lahar risk is greatest in steep, narrow valleys nearest to the volcano. Risk decreases in the downstream lowlands, as valleys become flat and broad.

**NEAR-VOLCANO HAZARD ZONE**

- During unrest or an eruption, the flanks of the volcano are subject to all hazards.
- Hazards include ash, lahars, lava, pyroclastic flows, falling rocks from steep slopes (ballistics), and landslides.
- During unrest or an eruption, this is the highest risk zone. Stay clear! Hazards can occur with little to no warning within this zone.

**VOLCANIC ASH HAZARD**

- All areas on the map could be affected by ash fall depending on the weather conditions during an eruption.
- Ash is transported by wind and can be carried hundreds of miles before falling to the ground.
- Even ash from a small eruption can clog air and ground transportation and dust downstream areas with gritty rock fragments.

Image 1. Infographic used in usability study.

This usability study was conducted over Zoom, a video conferencing platform. The usability researcher shared the revised Glacier Peak infographic and led the participants through a similar series of questions as the first usability study. The study was designed to evaluate the infographic's usability by assessing how the infographic presents information and how the users use the information.

The study found several key findings:

1. Many participants thought the green, yellow, and red colors in “Ready, Set, Go” were related to the red and yellow of the lahar hazard zones on the map. This created confusion, and needs to be addressed to improve the usability.
2. Many users, especially tourists, may not be familiar with lahars. Providing a definition of a lahar closer to its first mention will help users understand the infographic.
3. The colors in the map legend that represent near volcano hazards are discolored on the map. People had a hard time identify the near volcano hazards because of this inconsistency.
4. Emergency managers are interested in timing information, evacuation routes, and safety areas. While all this may not be able to be represented on the map, including this information in the Ready, Set, Go area could address these concerns.
5. While both versions of the Glacier Peak infographic meet user expectations, this version received less negative feedback about the amount of information displayed.

92%

said the infographic meet their expectations.

This report includes the details of how we conducted our research, the results we found, and a list of recommended changes.

## Methodology

### *Outreach & Screening*

Participants were members of the Washington Tsunami Emergency Manager mailing list. Brian Terbush sent an email invitation to their listserv. Thirteen members participated in the usability study, which is within the range of what you want for a usability study.

### *Participant Profiles*

Most of the participants considered themselves to be only somewhat familiar with volcano hazard maps (Table 1). Only one participant considered themselves “very familiar”. They had a variety of job descriptions from emergency managers, geologists, and planning coordinators.

*Table 1. Participant profiles*

<b>USER #</b>	<b>COUNTY</b>	<b>FAMILIARITY WITH VOLCANO HAZARD MAPS</b>	<b>JOB DESCRIPTION</b>	<b>STUDY DURATION</b>
<b>1</b>	Pierce	Somewhat familiar	Emergency Manager	23:07
<b>2</b>	King	Familiar	Hazard Mitigation Strategist	25:06
<b>3</b>	King	Somewhat familiar	Professor Emeritis in Mathematics	27:14
<b>4</b>	Grays Harbor	Not at all familiar	Mayor of Cosmopolis	24:44
<b>5</b>	King	Somewhat familiar	Planning and outreach coordinator	28:05
<b>6</b>	Kitsap	Not at all familiar	Harbor Master	30:24
<b>7</b>	Pierce	Somewhat familiar	Environmental project manager	21:37
<b>8</b>	King	Familiar	Emergency manager	15:18
<b>9</b>	King	Not familiar	Emergency manager	19:40
<b>10</b>	Snohomish	Familiar	Preparedness/Risk Analysis coordinator (FEMA)	36:27
<b>11</b>	King	Somewhat familiar	Emergency manager	16:35
<b>12</b>	King	Somewhat familiar	Geologist	24:56
<b>13</b>	King	Very familiar	Geologist	27:20

### *Testing Setup & Post-Test Questions*

The User-eXperience Lab at the University of Tennessee in partnership with the Cascades Volcano Observatory conducted a remote usability study December 7-15, 2020. The study was conducted virtually through Zoom, a video conferencing software. The study was a moderated

usability study where the usability researcher shared the infographic and asked the participant a series of questions about the infographic layout and content. The researcher provided guidance and clarification throughout the study to better understand the user experience. Additionally, members of the Cascades Volcano Observatory and other USGS observatories observed the usability study and had the opportunity to ask questions at the end of the session.

Participants were asked 10 questions, including locating an area of high hazard risk on the map, ranking communities from high hazard to low hazard zones, and for their overall thoughts, including likes, dislikes, and what else they would want to see on a hazard map to help design an evacuation plan. The full usability study can be found in [Appendix A](#).

## Results

Each participant's session was recorded. The User-eXperience Lab manager reviewed the recording and analyzed the participants' comments. The findings are organized into four categories for discussion:

1. [overall concept](#), questions related to the entire infographic, including purpose, expectations, likes, and dislikes.
2. [areas of high and low risk](#), questions related to identifying areas on the map and their hazard zone.
3. [decision-making](#), questions that asked users to apply the information, including making next steps and designing an evacuation plan.
4. [Timing](#), questions related to lahar timing, including how to represent it on a hazard map.
5. [additional information](#) covers information users would like to see on hazard maps.

### *Overall Concept*

The study started by showing the user the infographic and asking them to think out loud and discuss where their attention is first drawn and any other first impressions. Participants were first drawn to either the map (n=6) or the red, yellow, and green banner for Ready, Set, Go (n=6). Only one participant mentioned first looking at the graphic of the man running uphill.

As they were reviewing the infographic, many of them mentioned that they liked that this infographic was similar to other hazard maps, such as those for wildfires. Overall, their first impressions were positive, and they thought the map would “catch the eye of any resident.”

**“Visually**  
consistent with things you’d  
expect to see related to  
hazards.”

We then asked them to describe the purpose of the infographic in a sentence or two. All of their responses revolved around the infographic informing people about volcano hazards and what to do if there is an eruption.

During the discussion of their first impressions, participants noted several things that made the infographic confusing or hard to understand. Below are their concerns:

- Black text on the lahar zone map legend is hard to read..]
- If the user is not familiar with this area, they may not know it is in Washington or its relationship to the larger Cascades region.
- The color of the near volcano hazard zone legend does not match the color that is used in the map.
- It is not clear if the colors of the Ready, Set, Go correlate to the colors of the map.
- How much time does a user have at the “Go” stage of the information?
- What supplies should be in an emergency kit?



At the end of the study, we asked several final questions to assess the participants' overall thoughts on the infographic, and if this infographic meets their expectations for a volcano hazard map. Five participants said the infographic "completely" meets their expectations and 7 participants said it mostly meets their expectations for what they would see on a volcano hazard map.

Users liked many things about the infographic. Most participants mentioned they liked the Ready, Set, Go visual because it was similar to wildfire hazard wording, it was "eye-catching", "easy to remember", and "intuitive". Participants also liked the map running uphill graphic because it helped get the information across in a visual way that did not rely on text. Their full responses can be found in [Appendix B](#).

**"The Kinetic visual**  
of the man running uphill gives people multiple points of understanding a point, which is good."

While overall participants liked the infographic, they had a few suggestions for what they would change or improve. Their suggestions included:

- Specifying this is Washington state.
- Better identifying near-volcano hazards because the colors in the map do not match the legend.
- Fixing the colors in ready, set, go and the colors in the map so they do not create a false connection.
- Shorten the legend descriptions.
- Better represent ash hazard on the map.
- Include timing information.

Their full responses can be found in [Appendix C](#).

### *Areas of high and low risk*

We asked the participants several tasks designed to examine how users interpreted the map and its legend. We wanted to examine how users identified areas of risk, distinguished between color variants, and if the city and community markers were clear. We first asked them to identify an area that is at high risk of lahar if Glacier Peak were to erupt. Users identified areas, like Darrington, and other areas in red or dark orange as having the highest hazard. While proximity to the volcano played a role in the hazard level, the users also used the map legend to identify high hazard areas.

We then asked participants what community would be safe from lahar if Glacier Peak were to erupt. All participants, except one, said Marysville and Granite Falls. One participant said La Conner and areas close to the water. While Marysville and Granite Falls may be safe from lahar, the participants still thought they would need to be aware of ash hazard (n=10) and transportation and travel issues (n=4).

Next, we asked them to, “Rate these communities from high hazard to low hazard zones.” They were given 3 communities (Sauk-Suiattle Indian Tribe, Arlington, and Marblemount).

Since this was a discussion, participants tended not to voice the hazard solely on a scale from high hazard to low hazard but to discuss the aspects of hazard related to each area. All participants considered Arlington to be at a lower risk than Darrington or areas in red, but still considered it at risk because of lahar, debris, ash, and trickle down affects like transportation and evacuation routes.

Participants considered the Sauk-Suiattle Indian Tribe to be in a high hazard zone (n=5) or moderate risk (n=4), and others commented that they would be “seriously concerned if I was them” and the timeframe, transportation, and communication resources would make it hard to evacuate.

Marblemount is outside the lahar hazard zone presented on the map and while all participants thought the town had minimal to no risk they still thought the risk of isolation, ash, and “ripple effect impacts” would still impact how emergency managers would prepare in a town such as Marblemount.

“Marblemount

would quickly become isolated. They have minimal amount of resources, and highway 20 is impassable in the winter.”

Participants did not seem to have any issues identify areas of high, moderate, and low hazards, but emergency managers seem to think of hazard on a multi-point scale, and while the hazard map may not show a direct impact, they were still evaluating the hazard based on other information (such as geography and roads) in order to accurately prepare for a volcano eruption.

### *Decision-making*

Beyond identifying areas on the map, we also examined how people would use the information to make decisions. We asked participants to “Imagine you live or work within one of the hazard zones presented on the map, what next step(s) would you take after reading this map?”

Four participants said they would next look up evacuation routes and figure out safe zones. Connected to that response, four other participants said they would find out their local community information on warnings and evacuation plans. Two participants would prepare a

“Go” bag, and two participants said they would go to higher ground. One participant said he was not sure what he would do.

We then asked if the level of hazard would affect how the next steps they would take. A few participants said the level of hazard would not affect their next steps, but most said it would because they would have less time (more urgent) if they lived in the higher hazard zone.

We also examined the user’s ability to interpret the information to perform an action during a volcano eruption. We asked, “For this task imagine you live in Darrington. You need to develop an action plan in case the volcano erupts and a lahar is expected. What action should a responsible plan include?” All of the participants said they would move to higher ground if they lived in Darrington. They also talked about the importance of knowing the main and secondary roadways for evacuation and knowing how far or high they would need to evacuate.

### *Timing*

We did not ask about timing in the first usability study, but this study we wanted to gather some information about how the users perceived lahar timing and how they thought we could best represent timing on a hazard map.

We first posed to them, “if it takes a lahar an hour to reach Darrington from Glacier Peak, what assumptions could you make about how long it would take to reach further towns like Arlington?” The purpose of this question was to get people thinking about timing and how geography could affect timing. Most users thought timing would be impossible to accurately guess because of geography, season, temperature, etc., and they seemed to recognize the complexity of the question. Other users (n=3) guessed it would take roughly the same amount of time to reach Arlington from Darrington as it took to reach Darrington.

Complicated in the timing issue, users also thought traffic and evacuation routes would affect timing, so even if residents should have enough time based on lahar speed, other factors that affect evacuation speed would be important considerations.

### “Knowing

how much time you have is such a big factor...how much time you have would affect what decision you make, whether you walk, drive, or which direction you go”

We next asked users if they had any input or ideas for how to represent lahar timing on a map. Their ideas included:

- Table, timeline, or scale that is presented outside the map but could be applied to the map (n=5)
- Contour lines (n=4)
- Tic or hash marks (n=2)
- Include timing information in the hazard color coding
- Overlay figure like with hurricanes

## *Additional Information*

We ended by asking participants what other information they would like to see on a volcano hazard map and “if you needed to design an evacuation plan for your organization, what else would you want to see on this hazard map?”

Many of their responses hit on previously discussed topics. Six participants said they would want timing information either in the map or in the infographic somewhere. Participants also wanted good evacuation routes (n=4), marked safe areas (n=3), and population densities (n=2). They also thought ash hazard was downplayed on the infographic, and they thought ash impact could be better identified (n=3). The final thing participants thought they would need to develop an evacuation plan was more local information, from local radio frequencies to overlaying their important data (e.g., electric infrastructure) on the map.

“Ash

would severely impact drivability, which would affect how you would evacuate.”

## Usability Issues

Below is a list of the usability issues identified during the study.

### *General*

- Users, especially tourists, may not be familiar with lahars. The term is first mentioned in the upper subtitle but the definition is provided in the lower right map legend. It will be difficult for users to connect the definition to the term.
- Red, yellow, and green are used in the Ready, Set, Go area, and red and yellow are used in the hazard map. Users were not sure if the colors were intentional and the Set and Go information was correlated with the hazard zones. This could create confusion as users try to understand the infographic.
- The infographic does not identify its location within the United States or within Washington state. Users not familiar with this area of the Cascades mountains may not know what area is being shown. The infographic is only identified as Washington in the “Get More Information” and does not mention the Cascades region.

### *Areas of high and low risk*

- Near-Volcano hazards are represented in a pinkish color in the map legend, but on the map the near-volcano hazards are laid on top of the lahar hazard zones so the user cannot distinguish the near-volcano hazards. A large portion of the map legend is dedicated to the near-volcano hazards but that information is not useful because of how the map is currently presented.
- In the map legend, higher risk and lower risk are written in the color gradient of the lahar hazard zones. There is not enough contrast between the black font and the red hazard color and users will have difficulty reading it.

### *Decision-making*

- Many users said they would want to know evacuation routes or safe areas on a volcano hazard infographic. They thought users might know to get to higher ground but be unsure at what elevation they are safe.
- Even though Version 2 reduces the amount of text, remember that users typically do not read but scan information.

### *Timing*

- Almost all participants said timing is important in helping them with evacuation planning. This is important information that needs to be addressed.

### *Additional information*

- Many of the participants next steps including finding specific information about the local area, including radio channels, evacuation plans, and evacuation routes.
- While this infographic shows lahar hazards and discusses general preparedness, participants felt like the cascading or “trickle down” hazard issues (e.g., isolation, transportation or service disruption, connecting loved ones) needed to be better addressed.
- Participants thought the infographic downplayed the ash hazards. Ash hazards are only mentioned in the lower far right corner of the map legend, and participants thought this location made it seem like an afterthought.

## Recommendations & Action Items

### *General*

- Define lahar closer to its first mention. An image of a lahar with a brief definition could be placed in the upper right corner. The image could convey the meaning in addition to the text to help all users understand the content.
- Replace the green, yellow, and red associated with Ready, Set, Go with other color options or remove the color all together.
- Add details to the infographic to identify its location. This could include:
  - Add “Glacier Peak is an active volcano *in Washington.*” In upper title.
  - Add a map insert identifying where this region sits in the larger Cascades mountain region (*optional*).
  - Add the National Park boundaries around Glacier Peak to help people identify the ruggedness/isolation of the area.

### *Area of high and low risk*

- The Near-Volcano hazard color is very similar to the lahar hazard colors. Consider using a dash or hash marks to identify near-volcano hazards rather than color.
- Replace the black text in the lahar hazard zone legend to either white text or move the text outside the colors.

### *Decision making*

- Remember users rarely read, so you want all information to be clear as they scan it. There are a few usability recommendations that could address the usability issues addressed in this decision-making section.
  - Each bullet point should be one action. For example, in the “make an evacuation plan” section, “assemble supplies” and “plan where to unite” are one bullet point. Those should be two separate bullets since those actions are not related.
  - Consider other ways to reduce the amount of text. Some possibilities include:
    - Could “family, neighbors and friends” be replaced with “loved ones”?
    - Could “USGS volcano monitoring networks can provide warning” be replaced with “USGS can provide warning?” I do not think volcano monitoring networks provide value to the average user.
    - Could the phrase “24 hours a day, 7 days a week” be removed under NOAA Weather Radio All Hazards broadcasts in the Set section?
    - Could the phrase “could be at risk” be removed from “Move off valley floors” in the Go section?
  - Life Safely is one of the first phrases the user sees in that section, but there is not a clear meaning behind what it means. Consider a heading that has more inherent meaning, for example, “Get prepared”.

- Focus the text on action statements. One participant referred to it as “the goal is to empower not to scare.” Verbs like move, evacuate, listen, and seek all imply an action so the meaning of the sentence is clear from the start. Users do not have to read the entire sentence to understand the meaning.
  - For example, replace “if you are safe from lahars and ash is falling, seek shelter in a building or vehicle” with “seek shelter in a building or vehicle if ash is falling and you are safe from lahars.”
  - Under “Set” is there a way to phrase the NOAA and USGS services as “Sign Up” or another action verb rather than just listing them?
- This infographic would be most useful if associated with local or regional maps. When possible, pairing a broad infographic, such as this one, with local maps with more details on evacuation routes, safe zones, etc. would benefit users.

### *Timing*

- Testing identify several ways timing could be represented. Additional usability testing is recommended to evaluate the usefulness of different timing representations.
- Participants presented several ways to incorporate timing information on a hazard infographic:
  - Contours on the map to represent timing. This was the most suggested method.
  - Table that lists major cities and gives approximate times.
  - Provide a key or legend (like the mileage scale) that users can use to estimate timing along the hazard zones.
  - Add timing approximations next to city names.
  - Add a statement about timing in the Go section.

### *Additional information*

- Connect users with local information (point them or tell them to contact local groups for emergency information). Under “Stay Informed” include messaging to sign up for local alert system.
- Use QR codes embedded to help people get more information. They are easier than URLs.
- Consider adding a sentence that conveys that there are potential [cascading] risks and volcano effects to many regions outside the lahar hazard zones, and all communities should consider how the volcano could impact them.
- Move ash hazard to the left-hand side of the map legend to bring more focus to ash hazards.



## Comparison of Infographic Version 1 and 2

This study used a revised version (Version 2) of the Glacier Peak volcano infographic based on feedback from the first usability study. Overall, Version 2 had a better user experience than Version 1. Thirty-eight percent of participants thought Version 2 completely meet their expectations and 62% said it meet most of their expectations. Whereas, 36% of participants said Version 1 completely meet their expectations and 64% said it meet most of their expectations. While these numbers are relatively similar, we saw less negative feedback on Version 2. Version 2 mainly received criticism for what was missing in the infographic (e.g., timing, ash, evacuation routes), while Version 1 received criticism for the amount of information on the infographic. Many users in the first usability study said things similar to, “it’s too busy” or “too cluttered,” but in the second usability study many users said positive things about the about the information, such as, “interesting but not overwhelming” and “a lot of information communicated clearly.”

## Appendix A. Usability Test

### Demographics

1. What is your level of familiarity with hazard maps on a scale from 1(not all familiar to very familiar)?
2. What is your job title/job description? \_\_\_\_\_
3. What county are you located in? \_\_\_\_\_

### Tasks

1. I'm going to share my screen and show you an infographic of Glacier Peak volcano. Please think out loud and lead me through where you first look, what draws your attention, and any other first impressions. [share screen]. The infographic can be a little hard to read on the screen, so let me know and I can zoom in and out to different areas where you want to look in more detail.
  - a. Prompts if they don't think aloud:
    - i. Where was your attention first drawn? Why?
    - ii. If confused by something, why/what?
2. Now that you've had time to look at the infographic if you had to describe it in a sentence or two, what would it be? \_\_\_\_\_
3. Could you tell me an area that has a high risk of experience a lahar if the Glacier Peak volcano were to erupt? [move the mouse to the described area and confirm location]
  - a. Prompts:
    - i. why did you select that area? (Location? Proximity? Color?)
4. What community would be safe if Glacier Peak were to erupt? [move the mouse to the described area and confirm location]
  - a. Prompts:
    - i. Why did you select that area? (location? Proximity? color?)
5. If you lived in that community [selected in #5] is there anything you'd need to be concerned about if Glacier Peak erupted?
6. Next, I want to ask you about the hazard level of specific communities.
  - a. Arlington
  - b. Sauk-Siuattle Indian Tribe
  - c. Marblemount
7. Imagine you live or work within one of the hazard zones presented on the map, what next step(s) would you take after reading this map? Please explain.

- a. Prompts:
  - i. What information did you use to make this decision?
  - ii. Ask them to elaborate on their steps.
  - iii. Would the level of hazard affect the next steps?
8. If you live in Darrington and you need to develop an action plan in case the volcano erupts and a lahar is expected, what action should a responsible plan include?
  - a. Prompts:
    - i. Would you seek shelter or move to higher ground?
9. To end, I'd like to get your feedback on lahar timing. Right now we are not showing any timing information, but if I told you that it took about one hour for a lahar to reach Darrington, could you make any assumptions about how long it would take to reach Arlington?
  - a. Prompts:
    - i. What information did you use to make this decision?
10. Do you have any input on how we should represent timing on a hazard map?
  - a. Prompts:
    - i. Ask them to explain their thoughts?
    - ii. If other participants have made suggestions, ask later participants if they agree.

Interview:

1. What were your overall thoughts?
2. What did you like?
3. What did you dislike?
4. Did this meet your expectations for what you'd see on a volcano hazard map? How would you rate it on a scale of 1 (not at all) to 5(yes, completely)?
5. If you needed to design an evacuation plan for your organization, what else would you want to see on this hazard map?

## Appendix B. Responses: What did you like?

- Visually appealing. Interesting but not overwhelming.
- A lot of information communicated clearly w/ visuals; Map is most prominent feature; Clear gradient of risk (colors in lahar legend match association of risk e.g. red is high risk)
- Describes the colors clearly--but I don't see any green on the map; likes the person/hill graphic; like the man uphill visual;
- At first glance looks like a lot of info but it feels comprehensive. Covers the basics which is what it needs. "Picture is worth a thousand words" like the uphill man
- Love the map; they are quick glance and good info there; likes ready/set/go--easy to remember; like bolding the key components
- well put together, nicely organized; easy to understand (not sure if it would be for average person);
- Likes ready/set/go; likes photograph of the volcano--found the text sobering;
- ready/set/go is pretty clear; mimics fire evacuation which people would be familiar with since this area also has fire hazard. information is straight forward; likes the map; volcano evacuation sign should be more prominent.
- The color coding is self-explanatory. The ready, set, go is intuitive. Likes the mountain and car showing the need to get to higher ground.
- The map, the volcano hazard zones, ready, set, go. It's colorful and I like the fonts.
- colorful and engaging but not busy; communicates in multiple ways which is helpful; thinks about translation issues (since she has experience with it)--visuals help with multi-languages issues; places to get more information is good
- simple; ready/set/go approach to the topic; uphill graphic is good-->pretty clear
- likes the lahar (?) makes the map easy to see/read; dark blue is pleasing; likes picture of the volcano (maybe even bigger?). Likes the slope of the man running uphill

## Appendix C. Responses: What could we improve?

- Doesn't specify WA state
- Separation of near-volcano hazard and high-risk lahar (should all be displayed in one color, representing high risk); unclear whether red/yellow in ready, set, go is supposed to be related to the red/yellow in lahar hazard legend
- It is not clear if the Ready/Go colors mean anything on the map. At first thought the colors went together. Make it clearer that the map is showing lahar (it's clear to me because I've studied volcanos but for others it may not make sense)
- Legend descriptions is busy

- no value in the car/person graphic; make it more bold that you should go to higher ground.
- Could be alarming for someone with little prior knowledge; level of risk should be quantified and put on map (what's the likelihood something could happen at La Conner?)--I followed up and asked if he thought the public actually cared about the quantitative data behind hazard level but he doesn't really answer it...
- How would people get broadcast/radio--saw NOAA but thought showing a radio in the man uphill graphic to help; graphics would help non-English speakers; wants graphic of a lahar to help define it (she didn't know what it was)- thinks people need to be better informed about exactly what they are running away from; near volcano hazard zones-- it looks purple in legend but doesn't see that on the map.
- coloring could confuse someone if didn't read the map legend. volcano evacuation sign should be more prominent. There is a lot of information on this. outside the large typeset I get lost on where to draw my attention. Just focus on the most important information; make the reference information smaller (or pull it somewhere else so it doesn't mix with the important information)
- On the map, red is the start of the eruption but on ready, set, go, it's at the end (the last step) so that is confusing. Busy at times, especially with the man and dog. The man and dog are distracting. The header is busy and doesn't match the rest of the infographic.
- Include timing information
- The ash hazard and near volcano hazard zone seems out of place because it's not shown on the map; feels like an afterthought; many places will translate things so using plain language is helpful' english isn't always the first language and technical language can get lost in translation.
- ash hazard should be better representative (FEMA did a cloud/cross-hatch overlay but that may not be accessible)
- Could give lat/long ticks to help people locate themselves; could give inset map to show where this section sets in the larger cascades range. Text size, spacing, legend colors. Live Safely is really about planning, which is good. He doesn't think Live Safely really captures the content. Maybe list the links to the local alert system. Would want evacuation zones. What about warning about breathing ash in the air? Ash hazard seems underplayed.