Understanding Volcanic Hazards Video/DVD

Living with a VOLCANO in Your Backyard
MOUNT RAINIER

Grade Level: 6-12+

Learner Objectives:

Students will:

- Explain the origin and character of common volcanic hazards
- Understand how each volcanic hazard can affect humans

Setting: Classroom

Timeframe: 45 minutes (video is 25 minutes)

Materials:

- *"Understanding Volcanic Hazards"* video/DVD
- DVD or VHS player
- Television monitor
- Copies of *"Understanding Volcanic Hazards Questions"* student page

Vocabulary: Lava flows, ash falls, volcanic ash, hot ash flows (pyroclastic flows), mudflows (lahars), volcanic landslides, tsunamis, volcanic gases

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Living with a Volcano in Your Backyard-An Educator's Guide with Emphasis on Mount Rainier

Prepared in collaboration with the National Park Service

U.S. Department of the Interior
U.S. Geological Survey

General Information Product 19

Overview

The video ***"Understanding Volcanic Hazards"*** introduces students to the vocabulary and character of hazardous volcanic processes and how they impact people both near and far from a volcano.

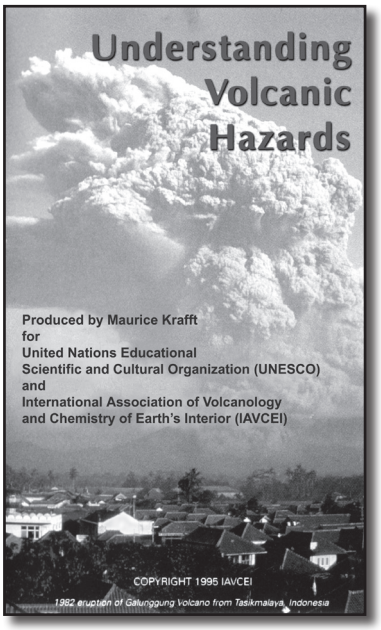
Skills: application, interpretation, listening

Benchmarks:

Please see the Mount Rainier National Park Education Program website for the most recent alignment of these activities with Washington State and nationally approved education standards.

http://www.nps.gov/mora/forteachers/curriculummaterials.htm

Teacher Background



This twenty-five minute videotape features stunning images of erupting volcanoes and graphic depictions of how volcanic activity can affect people, their property, and the land on which they live. The program is neatly divided into segments that focus on seven common volcanic hazards: ***ash falls, hot ash flows (pyroclastic flows), mudflows (lahars), volcanic landslides, tsunamis, lava flows, and volcanic gases.***

What to do Before Class Begins:

- Watch the video and determine if it is appropriate for your students.
- Decide whether to watch the video in full or in segments aligned with each volcanic process in **Chapter 2.**
- Use activities in **Chapter 3** from **Living with a Volcano in your Backyard** to learn more about how to prepare for these types of volcanic processes.

What to do Before Class Begins:

- Obtain the video "***Understanding Volcanic Hazards,"*** from your school or community library, or through the Northwest Interpretive Association. When ordering this video, you may wish to order copies of the two other videos used in this guide: "***Reducing Volcanic Risk"*** and "***Perilous Beauty—The Hidden Dangers of Mount Rainier."***

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The authors advise teachers to preview this video and make a judgment about whether it is appropriate for their students. This video shows photographs of volcanic processes; in several situations, the video shows people and animals injured or killed by the volcanic events. There is potential for students to be overwhelmed by the graphic depictions. Teachers may opt to show the video in segments, or in full with warnings to students. The activity Volcano Processes may be used in lieu of the video, where similar material is presented in a less graphic manner.

A NOTE ON TERMINOLOGY: The general term "mudflow" used in the video describes both lahars and debris flows. At Mount Rainier, scientists and public officials have defined the terms more specifically to reduce confusion between major and minor events. They define lahars as large, far-traveling slurries of rock, mud and water caused by landslides or eruptions, which threaten distant communities. They use the term debris flow for small events initiated by excess rain or glacial meltwater, which seldom move beyond park boundaries. Debris flows are common in river valleys at Cascade volcanoes and happen almost annually at Mount Rainier.

Sidebar 1

Volcanic Processes at Mount Rainier continued...

Volcanic Ash

Mount Rainier has produced more than 40 layers of volcanic ash since the end of the last ice age, around 10,000 years ago. The thickest and most complete sequence of ash layers exists on the volcano's eastern flank. During these eruptions, Mount Rainier has produced more lava than volcanic ash. In the future, eruptions of ash, commonly will precede or accompany lava flows. While airborne ash will affect aviation regionally, winds generally blow from west to east, and thus, volcanic ash most likely will fall in sparsely populated areas east of Mount Rainier National Park. On at least ten occasions during the past 4,000 years, Mount Rainier's slopes were covered with volcanic ash from eruptions at Mount St. Helens. See also **Tephra Explorer, Volcano Fan Club, Tephra Popcorn, Volcanic Processes** and Chapter 3 activities for maps of hazard potential and safety.

Hot Ashflows (Pyroclastic Flows)

At Mount Rainier, hot ashflows (pyroclastic flows) form occasionally during explosive eruptions but most of the time by the disintegration of lava flows on the mountain's steep slopes. Scientists expect that future pyroclastic flows will flow only as far as the lower slopes of the volcano. The snow and ice melted by pyroclastic flows are a principal source of mudflows. See also in this chapter, **Lava-Building Blocks, Rock Stars, Fire and Ice, Earth Blocks, Volcanic Processes** and Chapter 3 activities about hazard potential and safety.

Volcanic Mudflows (Lahars and Debris Flows)

An abundance of loose rock and surface water makes Mount Rainier an ideal environment for the formation of lahars and debris flows (see Teacher Tip above regarding terminology). Since the end of the last ice age approximately 10,000 years ago, mudflows repeatedly inundated the floors of the White, Puyallup and Nisqually river valleys at Mount Rainier to distances of up to 100 kilometers (60 miles) from the volcano. The melting of snow and ice by ash flows (pyroclastic flows) during eruptions forms the great majority of lahars; landslides have been the origin of others. Debris flows happen almost annually along some river drainages at Mount Rainier. Debris flows move sediment and raise the elevation of streambeds.

Mudflows (lahars) are the most serious volcanic threat to people near Mount Rainier. People can best avoid lahars and debris flows by becoming aware of conditions that generate lahars and moving from the valley floors to higher ground when necessary. See also in **Lahar in a Jar,** and **Chapter 3** maps of hazard potential and safety information.

Sidebar 1

Volcanic Processes at Mount Rainier continued...

Volcanic Landslides at Mount Rainier

Volcanic landslides are more likely to occur during eruptive times and less likely during non-eruptive times. Water contained in the landslide and water from melting snow and streams mixes with landslide rocks to produce lahars that travel tens of kilometers from the volcano. Lahars formed by landslides most commonly derive from rocks that have been hydrothermally altered and are now water saturated. Landslide-driven lahars most often occur during periods of volcanism, though they can form at other times, too. See **Lahar in a Jar** activity and Chapter 3 activities for information about safety around volcanic landslides.

Tsunami

While lahars may enter reservoirs and cause a rise of water levels, there is little threat of lahars causing tsunamis in major water bodies in the vicinity of Mount Rainier.

Lava Flows at Mount Rainier

Hundreds of thin overlapping lava flows form the volcanic cone of Mount Rainier. Some lava flows traveled along the cold margins of ice-age glaciers for tens of kilometers (tens of miles) and formed long ridges. Today, the large ice-age glaciers are gone, but a radiating pattern of lava flow ridges spread outward from the volcano like spokes on a wheel. Few lava flows have traveled beyond current park boundaries. Scientists expect that future lava flows will not travel farther than those of the past. See the **Lava-Building Blocks**, **Fire and Ice**, and **A Journey Back in Time** activities, and **Chapter 3** activities for maps of hazard potential and for safety tips).

Volcanic Gases

Water vapor, carbon dioxide and sulfur gases are the principal volcanic gases present during eruptive activity. These gases mix readily with the atmosphere and are not a health concern for visitors and communities near Mount Rainier.

Procedure

Learning about Volcano Processes

1. Discuss with students their present knowledge about volcanic processes.
2. Distribute the ***"Understanding Volcano Hazards—Questions"*** student page.
3. View the video in full or in segments.
4. Instruct students to answer questions on the student page.
5. Initiate a discussion of the answers.

Extensions

- Students draw a picture of one or more of the hazards and label each process.
- Students research and write a report about each of the volcanic processes discussed in the video.

Teacher Tips

Volcanic Processes ***is an excellent follow-up assessment activity to this video.***

Assessment

Use the video questions to assess students' current knowledge of Mount Rainier volcanic processes and hazards. You may wish to use the same questions at the end of your study of volcanoes as a post-assessment activity.

References

Myers, B., Brantley, S.R., Stauffer, P.H., and Hendley II, J.W., 1997, What are volcano hazards? (revised July, 2004): U.S. Geological Survey Fact Sheet 002-97, 2p.

Myers, B. and Driedger, C., 2008, Geologic hazards at volcanoes: U.S. Geological Survey

Refer to **Internet Resources Page** for a list of resources available as a supplement to this activity.

Student Page

Name _____

Understanding Volcanic Hazards - Questions

Instructions: *View the video and answer the questions.*

1. List several reasons why people choose to live near volcanoes in spite of potential dangers.

ASH FALLS

2. An erupting volcano throws rock debris tens of thousands of feet into the air. Which answer best describes how far fine, dust-size fragments, called volcanic ash, can travel? Circle your answer.

   a. The slopes of the volcano.
   b. Volcanic ash can travel up to one kilometer from the volcano.
   c. Volcanic ash can be carried by winds around the Earth.

3. Describe at least three effects that ash falls can have on people and property.

4. Falling ash generally is not as life-threatening as some other volcanic hazards, but it can disrupt lives for long periods of time. Is this true or false?

Student Page

Name _____

Understanding Volcanic Hazards - Questions

HOT ASHFLOWS (also called Pyroclastic Flows)

5. A hot ashflow: (circle all that are true)

a. Moves very slowly.
b. Moves at high speed down the slopes of a volcano.
c. Is an avalanche of hot ash, rock and gas.
d. Is rarely dangerous to people at a distance from the volcano.
e. Burns, asphyxiates, and flattens everything in its path.

6. What volcano in Washington displayed the powerful force of an ashflow during the 1980s?

7. A human can outrun an ashflow. Is this true or false?

MUDFLOWS (also called lahars, an Indonesian word for volcanic mudflow)

8. A volcanic mudflow: (circle all that are true)

a. Is a fast-moving flood (mixture) of water, mud, sand, rocks, and trees.
b. Behaves like flowing wet concrete.
c. Travels not more than 5 kilometers (3 miles) from the volcano.
d. Destroys and buries all that lies in its path.

Name _____

Understanding Volcanic Hazards - Questions

9. How could villagers in Colombia have protected themselves from the deadly mudflows at volcano Nevado del Ruiz?

VOLCANIC LANDSLIDES

10. Which of the factors below makes many volcanoes susceptible to rock fall and landslides? (Circle the best answer below.)

a. Volcanoes are made of many layers of lava and volcanic ash.
b. Some rocks are weak and unstable.
c. Volcanic slopes are steep.
d. Rising magma can force collapse of part of the volcano
f. All of the above

11. What processes caused the northern slope of Mount St. Helens to bulge outward and collapse in 1980?

12. Where did the missing part (top and northern slope) of Mount St. Helens end up?

Student Page

Name _____

Understanding Volcanic Hazards - Questions

VOLCANIC TSUNAMI

13. Describe what causes a tsunami.

14. Describe the effects of a tsunami.

15. What actions can people take to protect themselves in the event of a tsunami?

LAVA FLOWS

16. Describe a lava flow and how it can affect people and property.

17. Most lava flows move slowly enough for people to outrun. What actions can people take to protect themselves when they are near a lava flow?

Student Page

Name _____

Understanding Volcanic Hazards - Questions

VOLCANIC GASES

18. Every active volcano releases gases. (True or False)

19. Water vapor (steam) is the most common gas released from an erupting volcano, followed by carbon dioxide and sulfur dioxide. (True or False)

20. Volcanic gases: (circle all that are true)

- **a.** Are released from cracks or vents in a volcano or from crater lakes.
- **b.** Are generally invisible and some are odorless.
- **c.** Generally become diluted before they reach populated areas and become only an irritation.
- **d.** In high concentrations, can suffocate animals and humans.
- **e.** Can corrode metal.
- **f.** All of the above are true.

CONCLUSION

21. Describe why it is important to understand the dangers associated with volcanoes.

Teacher Page

Understanding Volcanic Hazards - Answers

Instructions: *View the video and answer the questions.*

1. List several reasons why people choose to live near volcanoes in spite of these dangers.

   ANSWER: ***Student responses could be any one of the following: Volcanoes are quiet most of the time, so people forget that they are capable of erupting. Volcanoes provide rich soils for crops. People are attracted to volcanoes because they are prominent features on the landscape and are symbolic of beauty, power and life.***

ASH FALLS

2. An erupting volcano throws rock debris tens of thousands of feet into the air. Which answer best describes how far fine, dust-size fragments, called volcanic ash, can travel? Circle your answer.

   a. The slopes of the volcano.
   b. Volcanic ash can travel up to one kilometer from the volcano.
   c. Volcanic ash can be carried by winds around the Earth.

   ANSWER: ***c***

3. Describe at least three effects that ash falls can have on people and property.

   ANSWER: ***Possible answers could be any of the following: breathing may become difficult and vision affected; forests, orchards and field crops can be destroyed; pastures can be rendered useless for livestock; water may be unsuitable for drinking, communication and electrical systems can be damaged; buildings may be destroyed by the weight of ash; driving may become dangerous from the haze creating poor visibility; roads can be buried under ash; ash is destructive to aircraft.***

4. Falling ash generally is not as life-threatening as some other volcanic hazards, but it can disrupt our lives for long periods of time. Is this true or false?

   ANSWER: ***True***

Teacher Page

Understanding Volcanic Hazards - Answers

HOT ASHFLOWS (also called Pyroclastic Flows)

5. A hot ashflow: (circle all that are true)

a. Moves very slowly.
b. Moves at high speed down the slopes of a volcano.
c. Is an avalanche of hot ash, rock and gas.
d. Is rarely dangerous to people at a distance from the volcano.
e. Burns, asphyxiates, and flattens everything in its path.

ANSWER: b, c, d & e

6. What volcano in Washington displayed the powerful force of an ashflow during the 1980s?

ANSWER: Mount St. Helens

7. A human can outrun an ashflow. Is this true or false?

ANSWER: False

MUDFLOWS (also called a lahar, an Indonesian word for volcanic mudflow)

8. A volcanic mudflow: (Circle all that are true)

a. Is a fast-moving flood (mixture) of water, mud, sand, rocks, and trees.
b. Behaves like flowing wet concrete.
c. Travels not more than 3 miles from the volcano.
d. Destroys and buries all that lies in its path

ANSWER: a, b, d

9. How could villagers in Colombia have protected themselves from the deadly mudflows at volcano Nevado del Ruiz?

ANSWER: They could have headed for higher ground.

Teacher Page

Understanding Volcanic Hazards - Answers

VOLCANIC LANDSLIDES

10. Which of the factors below makes many volcanoes susceptible to rock fall and landslides? (Circle the best answer below.)

a. Volcanoes are made of many layers of lava and volcanic ash.
b. Some rocks are weak and unstable.
c. Volcanic slopes are steep.
d. Rising magma can force collapse of part of the volcano
e. All of the above

ANSWER: ***e***

11. What processes caused the northern slope of Mount St. Helens to bulge outward and collapse in 1980?

ANSWER: ***Molten rock (magma) forced its way into the volcano and the north flank was pushed outward; this eventually resulted in collapse.***

12. Where did the missing part (top and northern slope) of Mount St. Helens end up?

ANSWER: ***At the bottom of a river valley.***

VOLCANIC TSUNAMI

13. Describe what causes a tsunami.

ANSWER: ***They are caused by the displacement of water during volcanic eruptions, initiated by volcanic earthquakes, submarine landslides or entry of volcanic flows into a body of water.***

14. Describe the effects of a tsunami.

ANSWER: ***Buildings and other structures in the community can be destroyed. As tsunami waves retreat they sweep people and debris out to sea, As they come ashore they carry people and debris inland.***

Understanding Volcanic Hazards - Answers

15. What actions can people take to protect themselves in the event of a tsunami?

ANSWER: ***People should head for higher ground and leave coastal areas when a tsunami approaches.***

LAVA FLOWS

16. Describe a lava flow and how it can affect people and property.

ANSWER: ***A flow of molten rock that pours rapidly or slowly from a volcanic vent. Everything that lava encounters is burned, buried or otherwise destroyed.***

17. Most lava flows move slowly enough for people to outrun. What actions can people take to protect themselves when they are near a lava flow?

ANSWER: ***Keep a safe distance from the leading edge of moving lava flows.***

VOLCANIC GASES

18. Every active volcano releases gases. (True or False)

ANSWER: ***True***

19. Water vapor (steam) is the most common gas released from an erupting volcano, followed by carbon dioxide and sulfur dioxide. (True or False)

ANSWER: ***True***

20. Volcanic gases: (circle all that are true)

- **a.** Are released from cracks or vents in a volcano or from crater lakes.
- **b.** Are generally invisible and some are odorless.
- **c.** Generally become diluted before they reach populated areas and become only an irritation.
- **d.** In high concentrations, can suffocate animals and humans.
- **e.** Can corrode metal.
- **f.** All of the above are true.

ANSWER: ***f***

Teacher Page

Understanding Volcanic Hazards- Answers

CONCLUSION

21. Describe why it is important to understand the dangers associated with volcanoes.

ANSWER: ***Sooner or later, people living near a volcano will experience the dangers of an erupting volcano. Studying past volcanic disasters can prevent future disasters and tragedies.***