LOCAL HAZARD RESOURCE

Volcano Preparedness

Learning Objectives

- Students will be able to explain what causes a volcano eruption.
- Students will be able to describe what happens during a volcano eruption and the risks involved.
- Students will learn the best ways to stay safe during a volcano eruption.

Key Facts for Presenters

- A volcano is a vent at the surface of the Earth where lava or ash is erupted. This vent opens downward to a reservoir of molten rock, called *magma*, below the surface of the earth. When pressure from gases coming out of the magma drives it to the surface, the volcano erupts and the magma accumulates as lava and ash. Over time, this accumulation of lava and ash can build up to become a mountain.
- Volcano eruptions can be quiet or explosive, and can produce lava flows, mudflows, pyroclastic flows, flying rock, poisonous gases, flattened landscapes, and widespread ashfall. Volcano eruptions can be accompanied by earthquakes, landslides, flash floods, wildfires, and tsunamis.
- Lava flows burn and crush everything in their path, but most are slow moving and can be avoided.
- Volcanic mudflows (also called *lahars*) are formed when water combines with falling ash and soil to create a wet-concrete-like mixture that flows down river and stream channels at speeds up to 40 miles per hour and as far as 50 miles from the volcano, engulfing everything in its path.
- Volcanic ash is pulverized bits of rock and magma (less than 2mm in size) that can travel hundreds of miles downwind from an eruption. Ash can cause respiratory problems, clog and damage machinery, and can cause roofs to collapse when it piles up on them.
- There are approximately 169 active volcanoes in the United States. Most are located in Alaska, where an eruption occurs almost every year, or in the Cascade mountain range that runs from northern California into western Canada. Other volcanoes occur in Hawaii, where the Kilauea volcano has been erupting almost continuously since 1983, and in the Commonwealth of the Northern Mariana Islands, a U.S. territory in the western Pacific.
- Scientists monitor volcano activity and provide warnings of eruptions. When a volcano warning is issued, people should listen to the news and leave home immediately if an evacuation is ordered by local authorities.
- Evacuate by a route that avoids areas downwind of the volcano and river valleys downstream from the volcano, in order to avoid ashfall and mudflows. If you hear the roar of an approaching mudflow, move immediately to higher ground. Mudflows can destroy buildings and bridges.
- During an ash-generating eruption, if an evacuation order is not given by local authorities, it is still best to stay indoors, with the windows and doors closed to prevent ash from entering the home.
- During and after a volcano eruption, protect yourself from ashfall by wearing a long-sleeve shirt and long pants, goggles, and a dust mask – or hold a damp cloth over your nose and mouth. Adults should avoid driving, because volcanic ash can stall the engine. If possible, adults should remove ash from roofs to prevent their collapse.
- Water supplies can be contaminated by volcanic ash, so it is important to have a supply of clean drinking water in the home for each person as a preparedness measure.

PRESENTER NOTES	SCRIPT
Be sure to look up the names of two active volcanoes in your region. *Use the talking point appropriate for your region and refer to the Hazards Map poster.*	**Ask** students: ➔ *Does anyone know the names of any volcanoes in our region?* **Call** on 1-2 students for a response. **Explain** why volcano preparedness is important in your region: ➔ *That's right! _____ and _____ are both active volcanoes. In fact,…* ➔ *Alaska has more active volcanoes than anywhere else in the U.S., and there is an eruption somewhere in the state almost every year.* ➔ *The Hawaiian Islands were created by volcanoes, and Kilauea on the Big Island has been erupting almost continuously since 1983.* ➔ *The Northern Mariana Islands were formed by volcanoes, like the ones on Pagan and Anatahan, which have both erupted in recent years.* ➔ *There are volcanoes all along the Cascade Range, and while they don't erupt very often, they can be very destructive, like Mount St. Helens in 1980.* ➔ *So it's important for everyone in our region to learn about volcanoes and find out how to stay safe when an eruption occurs.*
Some volcanoes also produce devastating pyroclastic flows, currents of hot gas (1000°F) that reach speeds moving away from the volcano of up to 450 mph.	**Ask** students: ➔ *Can anyone tell us what causes a volcano eruption?* **Call** on 1-2 students for a response. **Explain** what happens during a volcano eruption: ➔ *That's very good! Volcanoes start out as an opening in the ground called a vent. Down below the vent, far below the surface of the Earth, there is a pool of hot, melted rock called magma, and when gases in the magma push it up through the vent, that's a volcano eruption. After the magma reaches the surface, it cools into solid rock, which builds up around the vent until, over time, the volcano can form a mountain.* ➔ *A volcano eruption can be what scientists call "quiet" – mostly a steady, slow-moving flow of hot, melted rock that's called lava. Or the eruption can be "explosive," producing lava, flying rock, and a cloud of very fine rock dust, called volcanic ash, that can travel hundreds of miles downwind from the volcano.* ➔ *The lava from any erupting volcano can cause wildfires, and volcano eruptions also cause mudflows – that's when water mixes with volcanic ash and dirt to create a muddy mixture that looks like wet concrete. Mudflows move fast, up to 40 miles per hour, rolling downhill along rivers and streams, and they can travel as far as 50 miles away from the volcano, causing floods and crushing anything in their path.*
	Tell students how to be prepared for a volcano eruption: ➔ *Anyone who lives near a volcano, like us, should be prepared to get away whenever the volcano is ready to erupt.* ➔ *Scientists monitor all volcanoes in the United States and provide warnings when a volcano is getting ready to erupt, usually days or weeks in advance.* ➔ *During a volcano warning, local authorities evacuate people who live in the likely path of lava flows or mudflows, and people who live downwind of the volcano, where they will likely be covered by volcanic ash.*

PRESENTER NOTES	SCRIPT
	➔ *If your household is told to evacuate, leave immediately. Try to take a route that avoids rivers and streams that could become filled by a mudflow. And try to stay upwind from the volcano, to avoid the ash.* ➔ *Even if you are not told to evacuate, it's smart to stay indoors when a volcano is erupting, with your windows and doors closed tight to keep ash from getting inside.* **Note:** *If time permits, talk about "sheltering in place" and review the school's plan for sheltering during a volcano threat. Be sure to coordinate with the school first.*
Use the Workbook (page 11) to have students calculate how much clean drinking water they would need for everyone in their household.	**Explain** how to avoid risks from mudflows and volcanic ash: ➔ *No matter where you are when a volcano erupts, you should be on the alert for mudflows. Remember, mudflows can travel up to 50 miles away from a volcano, and they move fast! They make a roaring sound as they speed down a river or stream bed. If you ever hear one roaring toward you, get out of the way immediately by heading for higher ground. Mudflows can knock over buildings and bridges, so the only safe place is up on higher ground.* ➔ *And be on the alert for volcanic ash. Remember, volcanic ash can travel hundreds of miles downwind after an eruption. So even if you live far away from a volcano, you should be prepared to protect yourself from falling ash.* • *First, stay inside as much as possible. Keep doors, windows, and any other openings in your home closed to prevent ash from getting inside.* • *If you do go out, wear a long-sleeve shirt, long pants, and sturdy shoes (not sandals) to keep ash off your skin. Try to have goggles and dust masks for everyone in your household, to keep the ash out of your eyes and lungs. If you don't have a dust mask, cover your mouth and nose with a damp cloth.* • *Ash can get sucked into a car engine and cause it to stall, so remind grownups to avoid driving. And when ash piles up, it can cause a roof to collapse, so grownups should brush it off the roof whenever possible.* • *Ash can also contaminate the water supply, so be prepared with enough clean drinking water for everyone in your household.*
	Lead students in one of the Practice Activities below. ➔ *So, are you ready to **practice** what we've learned about being prepared for volcanoes?*
	Lead students in one of the Sharing Activities below. ➔ *Now let's **share** what we've learned.*

PRESENTER NOTES	SCRIPT
	Wrap-up with a review: ➔ *What should you do when there is a volcano warning?* **A:** *Leave home immediately if you are told to evacuate.* ➔ *What should you do if you hear a mudflow roaring toward you?* **A:** *Get out of the way by heading for higher ground.* ➔ *What should you do to protect yourself from volcanic ash?* **A:** *Wear a long-sleeve shirt, long pants, goggles, and a dust mask, or breathe through a damp cloth.*
	Transition: ➔ *So, now you're better prepared for a volcano eruption. But remember, you need to share what you've learned to help everyone be prepared. So later today, remind someone that, around here, we all have to be prepared for a volcano eruption. Even better, when you go home, share what you've learned and make a plan to stay safe if there's a volcano warning!*

Volcano Practice Activities

• Practice Dash

Divide students into teams of 5-6 for a takeoff on "Jeopardy." Explain that you will read an answer and that the student teams will compete by having one team member race toward you for the chance to give the correct question. The first student to arrive gives the question and wins a point for his/her team if correct, or loses a point if incorrect. Encourage students to figure out the correct question as a team before sending their runner toward you. Example answers and questions:

1. Melted rock below the surface of the Earth	What is magma?
2. Lava	What is magma called when it flows onto the Earth's surface?
3. Pulverized bits of rock the size of sand and silt that form during a volcanic eruption	What is volcanic ash?
4. Hundreds of miles downwind from a volcano	How far can volcanic ash travel?
5. A mixture of vocanic ash, dirt, and water that looks like wet concrete and moves fast downhill along rivers and streams	What is a mudflow?
6. Get to higher ground	What should you do to escape an approaching mudflow?
7. Wear a long-sleeve shirt and long pants, and stay inside as much as possible	What should you do to protect your skin from volcanic ash?

• Lahar in a Jar

"Lahar" is a Javanese word describing volcanic mudflows and debris flows. Tell students the origin of the word, then explain that you are going to make a 'lahar in a jar' to show them how it takes relatively little water mixed with a dry material like volcanic ash to produce a mudflow. You can use pancake mix, plaster of Paris, or dry spackle for this demonstration, pouring in a small amount of water and stirring each time until the dust transforms from a clotted mixture into a batter-like fluid that flows easily. For a more scientific demonstration, prepare a mixture ahead of time that is 1 part driveway gravel, 1 part garden soil (a high clay content works best), 1.5 parts sand, and .5 parts potters clay powder (available from a pottery supply store).

Volcano Sharing Activities

Coping Skills Activity

Use the following story to set up your transition to the Coping Skills part of the presentation. Read the story aloud and ask for ideas on what Sara could teach Henry to help him handle his worries about what might happen during a volcano eruption. Use the answer list below and/or the Coping Skills poster to generate ideas. Then continue on to the Coping Skills part of the presentation by using the poster to define "coping skills." (Note: If time permits, you can use the Sharing Activity worksheet at the end of this Resource to have students discuss this situation in small groups on their own and then share their ideas in a follow-up discussion.)

• Visiting a Volcano

Sara and her family live in a town where people have to be prepared for a volcano eruption. They check the news every day for a volcano warning, and they know the best roads to get away fast in case they are told to evacuate. But this summer, Sara's cousin Henry is coming to stay for a few weeks, and Henry has only seen volcanoes in the movies. He's worried about what might happen if the volcano erupts while he is visiting. He has already asked Sara what it's like to see fire exploding from the mountain. Luckily, Sara learned a lot about volcano preparedness from The Pillowcase Project. "We even talked about feeling worried," she told Henry. "Lots of people feel worried or scared when they think about what might happen in an emergency, even grownups. But there are ways to handle those feelings – they're called *coping skills* – and you can figure out good coping skills BEFORE an emergency happens!"

What could Sara teach Henry to help him cope with his thoughts and feelings about what might happen if the volcano erupts?

Answer:

- Taking slow breaths to calm down when you feel worried or scared.
- Sticking with a buddy so you don't feel alone.
- Singing a favorite song or picturing a favorite story, so you don't think so much about feeling scared.
- Reminding yourself how sticking together helps everyone get through a tough situation.
- Reminding yourself of what you have done to get through tough situations in the past.
- Remembering that Sara's family is prepared for a volcano eruption and will show Henry what to do if there is a volcano warning.
- Listening to grownups for other ways to help each other feel safe.

Note: Some students may suggest "giving thanks" as a coping skill (e.g., Be thankful that you are OK), but this reaction can sometimes inhibit successful coping by masking the real impact of an emergency. Acknowledge this suggestion, but do not push students in this direction.

Volcano Sharing Activities (continued)

Problem-Solving Activity

Divide students into small groups and distribute the Sharing Activity worksheet. Read the activity aloud and have students brainstorm ideas in their groups. Call on each group to share its ideas, then lead a whole group discussion based on the answer provided below.

• Why Be Prepared?

Stillwater is a town located about 15 miles from a volcano. But no one who lives there has ever seen a volcano eruption. Scientists say that the volcano erupted 2,000 years ago and created a mudflow ten feet deep that roared down Stillwater Valley. Since then, nothing except little rumblings that the scientists measure with their instruments, but no one in Stillwater can feel them. So why should the kids in Stillwater have to learn about being prepared for a volcano eruption?

Work with your group to come up with an answer to this question. What would you say to the kids in Stillwater to help them understand why they should be prepared?

Answer:

Stillwater's history proves that a volcano eruption can be devastating, and scientists have evidence that another eruption could happen at any time. Even though Stillwater might be safe for hundreds of years, everyone who lives there should know what to do in case the volcano erupts again. The risk is too great to ignore.

REPRODUCIBLE WORKSHEET

Volcano Preparedness

Sharing Activities

Read the activity assigned to your group. Talk with each other about how you could answer the question, and take notes in the space provided. Be ready to share your ideas with the class. Then join in the discussion to decide on the best way to answer the question.

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