




Designed for Safety

We build resilience through wise decisions in how we use land as well as how we engineer structures. Hurricanes, tornadoes, volcanoes, and earthquakes are all natural hazards. We can't stop them from happening. We can, however, stop some natural hazards from causing so much damage, if we can improve existing ideas or find new and innovative ways to build homes and cities.

Here are some ideas that engineers have come up with to help protect people from the damage caused by hurricanes, tornadoes, and earthquakes:

HAZARD	DAMAGE	PROTECTION
 Hurricanes	<ul style="list-style-type: none">Strong winds destroy buildingsRain and ocean water floods towns	<ul style="list-style-type: none">Innovate engineering to use concrete and steel to make buildings that resist wind damageBuild away from the ocean or raise buildings up above flood waters
 Tornadoes	<ul style="list-style-type: none">Strong winds destroy buildings	<ul style="list-style-type: none">Innovate engineering to use concrete and steel to make buildings that resist wind damageBuild deeper into the ground or underground so that buildings are not exposed to as much windConstruct a "Safe Room" that will resist wind damage inside homes and businesses
 Earthquakes	<ul style="list-style-type: none">Shaking knocks down buildings and power lines, breaks water and gas pipes	<ul style="list-style-type: none">Put "shock absorbers" under buildings to lessen the effects of shakingInnovate engineering to use materials that twist and stretch for power lines and pipes

You've learned a lot about these three natural hazards. Use what you know to come up with your own ideas for protecting people from the damage that **one** of these hazards can cause. Try to think of a new way to build homes and cities that will protect them from that hazard. If you want, you can use ideas from the chart above. Draw or describe your ideas for a hazard-safe building here, or use the back of this sheet if you need more room. You can also work with your teacher to help research your design. Here are some websites to get you started: **<https://pubs.er.usgs.gov/publication/fs16795>**, **www.ready.gov/tornadoes** (for Safe Room), and **<http://webcoist.momtastic.com/2011/04/22/disaster-proof-architecture-13-super-strong-structures>**.

My Safe Design for:

☐ Hurricane

☐ Tornado

☐ Earthquake

After you have finished your design, share it with your whole class. Ask your classmates for ideas to make your design even better.

Be Prepared

Until everyone lives in a home that's built to protect them from natural hazards, it's important to learn how to stay safe when a natural hazard happens. You can find out how to be prepared for all kinds of hazards at the American Red Cross website. Visit **redcross.org/prepare/disaster** to learn about hazards that can happen in your state and how everyone in your home can stay safe if one occurs.

Dear Educator,

Thank you for taking part in The Pillowcase Project, an American Red Cross initiative that aims to bring emergency preparedness education to every community in the United States.

The Pillowcase Project started in New Orleans, where the Red Cross chapter leader learned about some students who had used pillowcases to carry their belongings during an emergency. The chapter began using pillowcases to teach children about preparedness, and The Pillowcase Project soon spread to Red Cross chapters in other states. Now, the Red Cross is distributing pillowcases to children across the country and the world, and teaching them to share what they have learned about emergency preparedness with everyone in their homes.

With this teaching kit, *The Science of Safety*, you can bring The Pillowcase Project into your classroom as well. The teaching kit includes three classroom activities that provide students with a scientific perspective on four natural hazards represented on the Hazards Map poster included in your packet — hurricanes, tornadoes, earthquakes, and volcanoes. These activities support the Next Generation Science Standards' conceptual shift toward having science education reflect the interconnected nature of science as it is practiced and experienced in the real world.

You can also download these lesson plans and additional hazard worksheets at **redcross.org/pillowcase**. We hope that you will share *The Science of Safety* with other teachers in your school. Although the materials are copyrighted, you may reproduce them for educational purposes.

We are interested in your feedback. Please let us know your thoughts about the presentation, these tools, and what improvements could be made in the future by completing a survey at **redcross.org/pillowcase**.

The American Red Cross

Target Audience

This teaching kit is designed for use with students in grades 3-5 as a supplement to the science curriculum.

Standards Alignment

This program supports Next Generation Science Standards for Grades 3-5. For details, visit **redcross.org/pillowcase**.

Program Objectives

- Introduce key terms and science concepts for common meteorological and geological hazards
- Help students understand what to expect and how to stay safe during extreme weather and other emergency situations
- Familiarize students and their families with the emergency preparedness information available from the American Red Cross at **redcross.org**
- Promote science learning through collaborative research, conceptual modeling, and engineering design

Program Components

- This one-page teacher's guide
- Three reproducible student activity sheets
- The Hazards Map poster included in your packet
- A survey form accessible online at **redcross.org/pillowcase**.

Using the Program Components

- Make copies of the activity sheets for all of your students. Provide master copies of the program to other teachers in your school.
- Use the Hazards Map poster to introduce your students to some of the natural hazards that occur in the United States. Point out the hazards common to your region and talk about hazards that occur where students have relatives and friends. Explain that students will be learning about four natural hazards — hurricanes, tornadoes, earthquakes, and volcanoes — and how to stay safe when these hazards cause emergency situations.

Activity 1: Storm Watch

This small-group activity guides students through a collaborative research project using a variety of online resources (webpages, maps, animations, and videos). Assign some groups to research hurricanes and others to research tornadoes. When they have completed their research, have each group report its findings in a class discussion. Use a chalkboard, whiteboard, or butcher paper to create a chart comparing

the location, causes, and safety facts for these two types of violent storms. (Note: You can download a larger map for the location part of this activity at **nationalmap.gov/small_scale/printable/images/pdf/outline/states.pdf**.)

Activity 2: On the Edge

This activity introduces students to the science of plate tectonics and explains how the movement of tectonic plates creates the conditions for earthquakes and volcanoes. Students then conceptualize a very basic model that shows these geologic forces at work and collaborate in small groups to create a working model to share with the class. For modeling ideas, see **<https://sites.up.edu/totle//?s=earthquake+machine>** and **<http://volcano.oregonstate.edu/volcano-models>**.

Activity 3: Designed for Safety

This activity challenges students to come up with engineering ideas that could reduce the damage to homes and cities caused by hurricanes, tornadoes, and earthquakes. The activity sheet briefly reviews some design concepts that engineers have explored already. For added inspiration, take students to **<http://webcoist.momtastic.com/2011/04/22/disaster-proof-architecture-13-super-strong-structures>** and **<https://pubs.er.usgs.gov/publication/fs16795>**.

Emergency Preparedness

Conclude the program by reviewing the emergency preparedness information provided on each activity sheet and on the Red Cross website at **redcross.org/prepare/disaster**. For hazards that happen in your state, practice the protective actions recommended by the Red Cross, and encourage your students to share what they learn about being prepared for emergencies with everyone in their home.

Resources

- CDC, **cdc.gov/learning**
- FEMA, **ready.gov/kids**
- NFPA, **firewise.org**
- NOAA, **www.noaa.gov/education**
- USGS Education, **education.usgs.gov**
- American Red Cross, **redcross.org/prepare**
- Monster Guard: Prepare for Emergencies, **redcross.org/monsterguard**



The Pillowcase Project

Learn. Practice. Share.



The Pillowcase Project

Learn. Practice. Share.

Storm Watch

Can you tell the difference between a hurricane and a tornado? Both are storms that spin around in a circle – what weather forecasters call *cyclones*. And both can destroy whole communities with their strong winds. So what makes them different?

Get together with a small group of classmates to answer that question. Your teacher will have your group gather information about hurricanes or tornadoes. Use the research guide below to organize what you discover. Then present your findings in a class discussion. By working together, you'll learn the difference between hurricanes and tornadoes, and how to stay safe when these two different kinds of storms happen.

Our Research Topic: ☐ Hurricanes ☐ Tornadoes

Where the storm happens

Use the Hazards Map poster to find out where your type of storm is most likely to happen in the United States. You can also use the online maps at maps.redcross.org/website/maps/ARC_Map_Links.html. Mark the locations on this map.



How the storm happens

To learn about tornadoes, visit www.nssl.noaa.gov/education/svrwx101/tornadoes. To learn about hurricanes, visit <http://spaceplace.nasa.gov/hurricanes/en>. Or watch the videos at <http://video.nationalgeographic.com/video/101-videos/tornadoes-101> and <http://video.nationalgeographic.com/video/101-videos/hurricanes-101> Use this space or a separate sheet of paper to take notes on the facts you plan to share with your classmates.

How to stay safe

What should you do if a hurricane or tornado is headed your way? Are there different safety precautions for these two kinds of storms? Visit the American Red Cross website to find out. Go to [redcross.org/prepare/disaster](https://www.redcross.org/prepare/disaster) and click on Hurricane or Tornado. Use this space or a separate sheet of paper to write down the safety facts you plan to share with your classmates.

Plan how your group will present what you have learned to the class. You might want to use pictures or videos that you have found on the Internet, or create your own diagrams and charts to explain your kind of cyclone and how to stay safe when one happens.

On the Edge

Look for earthquakes and volcanoes on the Hazards Map poster. You'll see, generally, that in the United States both happen along the Pacific Ocean. Why?

Tectonic Plates

Geologists are scientists who study how the Earth is put together. They have discovered that the surface of the Earth is made up of gigantic slabs of rock, called *tectonic plates*, that fit together like the pieces of a puzzle. As you can see, the continental United States is part of the North American Plate, but the North American Plate bumps up against the Pacific Plate along the west coast. That's one area where earthquakes and volcanoes can happen.

Unlike the pieces of a puzzle, tectonic plates move and shift position, and that causes the edges of the plates to be pushed together or pulled apart. This usually happens so slowly that we can't feel it, but when the edges get caught on each other, pressure builds up at that spot until, one day, the two edges break free. When that happens, we feel an earthquake.

Magma

The rock underneath the tectonic plates is very hot – so hot that it has melted into a thick fluid called *magma*. In some places, the magma pushes up through the surface of the Earth, and that's the start of a volcano. A volcano is a mountain that has been built up by magma flowing to the surface of the Earth, where it then hardens into solid rock.

As you have probably figured out, the cracks between the tectonic plates make a good place for magma to find a path to the surface. That's why most of the world's volcanoes are located along the edges of tectonic plates. But sometimes the magma finds a soft spot away from the edges where it can push through. That's how the Hawaiian Islands were formed in the middle of the Pacific Plate – they are actually the tops of volcanoes that built up from the bottom of the ocean.

Show What You Know

Can you think of a way to show how an earthquake or a volcano happens?

- Start by thinking about what you could use to show how two gigantic slabs of rock push together and then slip against one another to cause an earthquake. Could you show what happens with blocks? Clay? Sponges?
- Or start by thinking about what you could use to show how magma pushes up to the surface of the Earth to make a volcano. Could you show what happens with a tube of toothpaste? A can of soda? A jelly donut?

Use the back of this sheet to draw or describe how you would make a model to show how an earthquake or a volcano happens. To learn more, you can visit *Earthquakes for Kids* at earthquake.usgs.gov/learn/kids, or *Volcano Hazards* at volcanoes.usgs.gov/index.html.

After you have designed your model, get together with some classmates who have come up with their own ideas for a model like yours – one that shows how an earthquake or a volcano happens. Compare ideas and decide on the best way to make your model. Then work together as a team to create a model that you can share with the whole class.

Earthquake and Volcano Safety

Visit the American Red Cross website to find out how to stay safe during an earthquake or when a volcano is ready to erupt. Go to [redcross.org/prepare/disaster](https://www.redcross.org/prepare/disaster) and click on Earthquake and Volcano. Learn how to “Drop, Cover, and Hold On” when an earthquake happens, and practice this safety drill in class. If you live near a volcano, ask your teacher to tell you about your town's plan to get everyone far away if the volcano ever erupts.

