

**Activity Name: Shake, Rattle, and Liquefy**

**Author: Stu Grove and Kate Fraser, based on a lesson by Washington Division of Geology and Earth Resources**

**Target Subject:** Earth and Space Science

**Purpose:** We know that flat river-valley bottoms are prone to flooding, but we think of them as being geologically stable. This experiment demonstrates what happens to sandy soils when they liquefy. You will create a model river valley, then observe how and why houses get damaged or collapse during an earthquake in seemingly stable geologic environment.

**Background Information:** The effects of an earthquake commonly are amplified in areas of sediment deposited along river valleys. When such sediments become filled with water, they lose their structure and strength. During earthquake shaking, the individual grains of sand within a deposit collapse on each other. Any structure built on sandy sediments can sink or collapse. Picture a container of balls of different sizes – baseballs, golf balls, and marbles. If they were transported by water into the container and then deposited, they would settle with spaces in between them. Some of the spaces would be filled with water and some with air. When you shake the container, the balls settle against each other, and the water and air are forced to the surface. That is exactly what happens in a sediment-filled valley. The valley is a large “container” holding gazillions of “balls” or grains of sand. Rocking or shaking the container simulates an earthquake.

**Materials:**

- Plastic container about 12x7.5x4.5 inches.
- Enough dry sand to fill pan 1-2 inches deep
- Adapted ruler
- Different sized balls
- A few toys houses, wooden blocks, or Lego structures
- Water
- Wikki Stix™



**Preparation:** None needed

**Procedure:**

1. Gather your materials and put on lab safety gear such as goggles, apron, and gloves.
2. Prepare a model river valley by placing a layer of different sized balls in the bottom of the pan.
3. Evenly pour a layer of sand into the plastic bins or baking pans (about 1.5 or 2 in. deep). Mark the level of sand on the side of the bin with Wikki Stix™.
4. Place your model houses or buildings gently on the surface of your model river valley. Examine the surface of the “river valley”.
5. Slowly add water until about two-thirds of your sand is saturated with water but the top remains dry.
6. Create an Earthquake! Place a pencil or small tube underneath your pan and rock the container up and down. You might also use a mallet to tap.
7. Feel the top surface of your model river valley. Is it still dry or has water risen to the surface?
8. Observe what has happened to the houses. How were they affected by the quake?
9. Note where the surface is after the quake in relation to your original level marker. How has the surface been affected? Feel the surface, how has it changed in texture and quality?

**Variations:**

Try the experiment using clay or gravel to separate sand layers and represent different types of sedimentary layers. Feel what happens to the water and the surface of your model of a river valley. Compare what happens to the water when using different materials.

**Resources:**

Ohio Division of Geological Survey "HANDS ON EARTH SCIENCE" Webpage. Modified by the California Geological Survey a.

<http://www2.ohiodnr.com/geosurvey/publications-maps-data/free-downloads/hands-on-activities>

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