

Lesson Plan submitted by E. Shannon at Indiana University's 2003 PEPP summer workshop.

The following activity has been designed for ninth grade earth/space science students. It addresses Indiana Earth Science Standard 1.23: Explain motions, transformations, and locations of materials in Earth's lithosphere and interior. This activity can be conducted for an entire class, particularly if the stated objective of the lesson is the first objective stated below. It also can be a small group research project. Students should be familiar with the interior structure of earth.

Objectives:

1. Students will differentiate between energy waves transmitted from a quarry or mine as opposed to energy waves transmitted by an earthquake (either regional or distant).
2. Students at a particular location (Crown Point, IN) will analyze seismograms of blast events from at least two quarries or mines. The energy waves recorded at Crown Point will be compared to the seismograms of identical events received at other stations.

Procedure:

1. Using a slinky and rope, demonstrate the motion and speed of primary and secondary waves as they travel through earth's interior. Stress that waves may slow down or speed up depending upon the type of material they encounter inside the earth.
2. Compare seismograms from both earthquakes and quarries or mines. Illustrate that energy waves from an earthquake have a signature distinctive from energy waves originating from a quarry or mine. In order for students to become adept at recognizing earthquakes or blasts, allow them to examine a number of different paper seismograms as well as computer programs like Winquake.
3. Students will contact nearby mines or quarries to request blast event times as well as the amount of explosive used for each blast. Blast times are needed in order to accurately identify the source of the seismic waves. Students will request that this data be provided for a period of one month. If blasting is infrequent, data will be requested for a longer period of time. At least two mines or quarries should be used to determine if the different sources result in energy waves that are distinctly different.
4. Once blast times are known, analyze the appearance of each event as they appear on Crown Point High School's PEPP seismograph.
5. Compare the seismograms at Crown Point to other seismograms of identical events received at other PEPP stations.

Questions:

1. Does the seismogram received at Crown Point from a specific blasting location have a readily identified "signature" or can they merely be identified as originating from a blast?

2. Do the waves from one event have a distinctively different appearance in Crown Point as opposed to waves recorded at other PEPP stations?
3. Can the magnitude of the blast be determined from the seismogram?

It is possible that nearby mines and quarries are unwilling to provide blast times. Such an event need not interfere with the activity. Provided blast times are known for a mine or quarry and the energy waves at specific events are recorded at two PEPP stations, students at Crown Point can still attempt to answer the questions stated above.