

BACKGROUND

Petroleum engineers and geologists have developed technology to increase exposure of an oil and gas reservoir by drilling horizontally or at an angle. This method of drilling can produce three to five times more oil and gas than vertical drilling.

Perforation refers to a hole punched in the casing, or liner, of an oil well to connect it to a reservoir of oil or gas. These holes in the horizontal well casing allow oil and gas to flow easily into the wellbore, increasing production of a reservoir.

This activity models the differences in production of a perforated and non-perforated well casing. After the activity, discuss with students the model limitations and ways to improve the experiment.

QUESTION

How do you think adding holes to a well casing will influence the amount of petroleum or natural gas that a well can produce?

MATERIALS

- 2 Kitchen sponges, the same size & shape
- Flexible straw
- Push pin
- Shallow tray (for sponges)
- Sandwich plastic bag
- 100 mL Graduated cylinder
- Masking tape
- Water

INSTRUCTIONS

1. Place both sponges in the sandwich bag. (Horizontally)
2. Make a hole on the side of the sandwich bag between the sponges where you will insert the flexible straw. The diameter should be about the same size as the straw.
3. Insert the straw in the hole between the sponges so that the elbow is outside of the sandwich bag. Make sure that the straw is at least 3 cm inside the bag and between the sponges. (see diagram).
4. Cover the hole with tape ensuring that there are no gaps for possible leaks. You will need good engineering skills to avoid any leakage (oil spills).
5. Place the bag with the sponges onto the tray.
6. Pour water into the bag via the open end until the sponges are saturated with water. Please make sure that you measure and note how much water was added to saturate the sponges.
7. Close the top of the bag and fold it over the sponges.
8. Close any open spaces by taping them to prevent any further water leakage.
9. Place the plate on the edge of the table and bend the flexible straw into the measuring cylinder (which should be below the table edge)
10. Press down on the sponges to try and get as much water out via the straw as possible. Only water that comes from the straw into the measuring cylinder should be measured.
11. Measure and record the amount of water collected in the measuring cylinder.
12. Disassemble the sandwich bag, sponges and straw and remove all the water from the sponges and plate.



Perforated Well Casing

- Using a push pin, poke several holes about 3-5 mm apart on both sides of the straw. (If straws are striped, use the stripes as a guide).
- Now you are going to repeat steps 1-11 with the newly perforated straw.** Be sure to add the exact same amount of water as was done in step 6.
- Record and compare measurements between the perforated and non-perforated straw.

CONCLUSIONS

- How did perforating (poking holes in) the straw change the amount of water you collected?

- Using your observations, explain how perforating the well casing would be beneficial in a drilling scenario.

