

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 the models limitations and ways to improve the experiment.

Materials

- 2 Sponges of same size and shape
- Flexible straws
- Push pin
- 2 Shallow trays (for spongers and collection from straws)
- Cling film
- Few heavy books or weights
- 10ml Measuring cylinder



Instructions

1. Place one sponge in a shallow tray.
2. Lay cling film out across your tray. Lay a straw on the sponge so the elbow is beyond the edge of the sponge. If necessary, trim the straw so the end of it is inside the end of the sponge by at least 3 cm (see diagram above).
3. Lay the other sponge on top of the straw/sponge combination so the edges align with the first sponge. Pour water on the sponges so they are saturated but almost no water is leaking out.
4. Wrap both sponges in cling film to seal and reduce water leaking out.
5. Put the other shallow dish beneath the straw protruding from the sponges.
6. Gently lay a heavy book on top of the sponges and observe the volume of water that comes from the straw.

7. Add another book to the first, and continue until no water comes from the straw. Try using your arms to provide more mass, if needed.
8. Record observations. Measure the volume of water in the collecting dish by pouring it into the measuring cylinder.
9. Disassemble the stack of books, sponges and straw.
10. 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).
11. Replace the straw in the stack of sponges and rewet the sponges as before.
12. Repeat steps 5-8.
13. Record observations.

Results

Volume of water before perforation (ml)	
Volume of water after perforation (ml)	

Calculate the efficiency of the extraction methods used by measuring the total amount of water in the sponges and showing the water extracted as a percentage of that total.

Assessment Questions:

1. How did perforating (poking holes in) the straw change the volume of water you collected?

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

3. How is this model different to the real world? And can it be improved?
