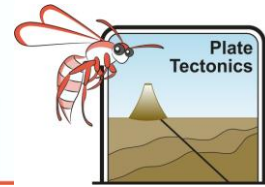


Fracking Simulation – Teacher Notes



Following the decrease in conventional oil and gas production other techniques and other resources are necessary if we continue to support our present high levels of energy usage. We can use geothermal energy from underground by tapping into naturally hot rocks below us. We can also use different methods to release “tight” or “unconventional” oil and gas.

Stimulation and Fracking

A vertical hole is drilled down through the rock and then horizontal holes are drilled out from the base to penetrate surrounding rock. Water or other fluids is injected at great pressure to stimulate fracturing of the rock. Sometimes “proppants”, which can be sand or man made ceramic materials, are injected with the water to hold the fractures open.

Stimulation for geothermal power production

In the Perth Basin we are fortunate to have hot water in our underground reservoirs that can be directly drilled to flow through drill holes to the surface. The water is heated by natural radioactive decay of minerals in granite. The source rock is porous and permeable allowing water to flow through it.

More information can be accessed at: <http://www.greenrock.com.au/assetsWAPerthBasin.php>

However in some places in the world cold water must be pumped down drill holes to be heated by naturally “hot” rocks before it can return to drive turbines. Water must be able to penetrate widely into the surrounding rock to heat up. Rocks such as granite and basalt are made of interlocking crystals, have no pores and must be artificially fractured to permit movement of fluid.

Stimulation for oil and gas production

Muds and silts compact and have very limited permeability. They produce shale and siltstone. Any contained oil or gas is tightly held and difficult to collect. We have vast reserves of this “tight” or “unconventional” oil and gas in our five great sedimentary basins.

To simulate the effect of introducing pressure in rock, students blow down straws that are set into firm, damp (**not wet**) and compacted soils or sands. They may recall the effort it takes to dislodge a few centimeters of sand when they have buried their legs in wet at the beach.

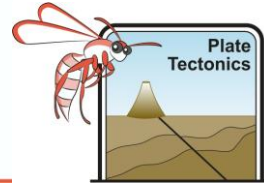
NOTES

- If the sand/soil is too wet, it will splutter and students will suddenly develop freckled faces
- If the sand is too dry it will not appear to fracture but reassemble as grains separate.
- If the beaker is too full of soil students will be unable to blow hard enough to dislodge soil upwards.
- Students with breathing difficulties should be discouraged from blowing hard

Vertically dislodged soil



Fracking Simulation – Teacher Notes



AIM To simulate fracking

Materials per student or group

- Newspaper to protect bench or table
- Small beaker (200mL) or clear plastic drink cup
- Enough sand or soil to half fill the beaker/cup
- Water
- Plastic drinking straw
- Paper towel

Method

1. Cover the working surface with newspaper
2. Place the beaker in the centre of the paper
3. Hold the straw upright in the beaker with its end touching the base
4. Pack the soil/sand round the straw to a depth of about 3 cm
5. Add water to soil to dampen it. Keep adding water until no more can permeate the soil.
6. Gently tap the base of the beaker onto the paper to bring excess water to the surface
7. Mop up excess water with towel
8. Lift the straw until it lies just above the base of the beaker
9. Blow firmly down the straw.
10. Tamp down the soil and repeat

Observation

The soil/sand should rise as a mass and collapse. This simulates how pressuring rock can create fractures.

Points for consideration

1. Rock is stronger than damp sand because it has been compacted and cemented
2. Rock becomes increasingly pressurised at depth
3. Different rocks will react differently
4. Pressure from blowing is markedly less than produced during stimulation or fracking

Discussion

Why is stimulation or fracking used?

To create fractures in impermeable rock

What is injected into the rock at pressure?

Water and manmade ceramics

Name two different energy sources which may require use of fracking.

Geothermal power and hydrocarbon/oil and gas/tight gas/unconventional gas

We already use geothermal power in Perth to heat swimming pools, air condition buildings and create electricity. Did this require fracking?

No. The rock was already permeable.

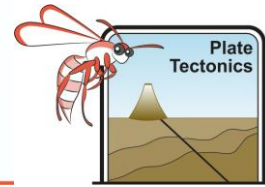
What is meant by “tight” oil and gas?

Tight hydrocarbons are oil and gas reserves that are held in poorly permeable rocks.

Why are we moving from conventional oil and gas as energy sources to “tight” hydrocarbons and

An initiative supported by Woodside and ESWA

Fracking Simulation – Teacher Notes



geothermal power?

We are using up conventional sources.

Interesting information - Western Australia has immense reserves of unconventional or tight oil and gas in five of our major sedimentary basins.