When we remove fossil fuels, we are extracting them from or under Earth’s surface. A variety of methods are used to extract different fossil fuels. As you read about each method, try to identify some of the environmental challenges.

**EXTRACTING COAL**

Coal is extracted through mining. Where coal is found close to the surface, strip mining is used to extract it. In some cases, the tops of mountains are blasted away using explosives (Figure 8.8), allowing miners to access the coal underneath. This is mostly done in the Appalachian mountain range in the United States. Mountaintop removal mining permanently changes the landscape. It also releases dust and toxic materials into the air.

Other coal deposits are found deep below Earth’s surface. In these cases, the coal is extracted through underground mining. Mine shafts are dug into the mountain to access the coal. The coal is then separated from the surrounding rock. The waste rock, called tailings, is usually dumped into large piles, often creating large hills.

**EXTRACTING OIL AND GAS ON LAND**

On land, oil companies drill holes or wells into the oil and gas deposits. At first, the weight of the overlying rock layers forces the oil out of the wells. Eventually the pressure drops so that oil and gas no longer flow out of the well. Pumps are then used to extract the fuels. Pipelines carry the gas and oil to storage tanks and for processing.

**FRACKING**

One way of extracting natural gas from the ground is called hydraulic fracturing, or fracking for short. Fracking involves injecting a mixture of water, sand, and chemicals thousands of metres below Earth’s surface. The pressure causes small cracks in the rock and the sand keeps the cracks open. Natural gas seeps out of the cracks and into a well. The gas is then pumped to the surface. The fracking process is repeated until all the natural gas is extracted. Many people criticize this method because it uses a lot of water. There is also a risk of groundwater contamination and even a risk of land instability. Supporters argue that natural gas is cleaner than oil and releases fewer greenhouse gases.
EXTRACTING OIL AND GAS AT SEA

Some oil and gas deposits are located under the ocean floor. Extracting them is more difficult. Drilling rigs must be kept steady during drilling. Some other types of drilling platforms sit on the ocean floor (Figure 8.9). Drilling under the ocean carries a greater environmental risk than drilling on land. For example, the Deepwater Horizon drilling rig exploded in the Gulf of Mexico in 2010 causing the largest marine oil spill in history. Both humans and wildlife died as a result.

FIGURE 8.9 The Troll A drilling platform in the North Sea is one of the largest ever built. It is 472 m tall.

I wonder what happens to the platform after there is no more oil to be extracted?
Recall what you read at the beginning of the chapter about oil sands. Oil sands are areas of sand mixed with oil. They are found around the world. Canada has a particularly large deposit in Alberta. Other countries with large oil sand deposits are Kazakhstan, the United States, Russia, and Venezuela.

The oil in these deposits is called bitumen. It is thick and will not flow unless it is heated. The normal methods of drilling for oil simply will not work for bitumen.

Companies first remove large areas of forest and then use surface or strip mining to extract oil sands from the ground. Strip mining involves removing shallow strips of Earth’s surface. In most cases, oil sands are located less than 200 m below the surface. Vast amounts of hot water and chemicals are added to the sand to separate out the oil. After the oil is removed, the water is dirty and contains oil and other chemicals (Figure 8.10). This waste water is also a form of tailings, or waste produced from extraction. It sits in tailings ponds until the water separates from the other materials and can be reused in the separation process. Even so, chemicals and other pollutants can seep from the ponds into the surrounding land. Companies monitor the tailings ponds to detect any leaks. They also try to deter birds from landing in the tailings ponds.

**EXTRACTING OIL FROM OIL SANDS**

**bitumen** a thick, sticky form of crude oil

**FIGURE 8.10** Vast amounts of water are needed to extract bitumen from oil sands. The waste is then pumped into a tailings pond, such as this one in Alberta. The dirty water in this photo used to be fresh water.

How would I assess the environmental impacts of this extraction process?
IMPACTS ON THE NATURAL ENVIRONMENT

Extracting and processing fossil fuels have a huge impact on the natural environment. Mining and drilling permanently changes Earth’s surface. This affects local species and ecosystems. Fracking and extracting oil from oil sands use huge amounts of water. The tailings from extractions are often toxic. They can leak and pollute the groundwater and surface water systems.

OIL SPILLS

Transporting oil also carries risks to the environment. Oil spills pollute the surrounding land and water, affecting all the living organisms in the area. In 1989, the Exxon Valdez oil spill in Alaskan waters killed as many as 100 000 to 250 000 sea birds. The environment still has not fully recovered.

Wars can also affect the natural environment. The 1991 Gulf War led to one of the largest oil spills in history. The Iraqi army invaded Kuwait, a neighbouring country in the Middle East. To slow down American troops, the Iraqi army opened and burned the oil wells (Figure 8.11). This caused severe air pollution. The oil flowed into the Persian Gulf. The effects on wildlife were immense. To this day, some oil can still be found in the area.

AIR QUALITY

Burning fossil fuels, such as coal, for energy releases huge amounts of CO₂. This contributes to global warming and affects climate change. Canada’s processing of oil sands is the country’s fastest-growing source of greenhouse gases. Burning fossil fuels also releases toxic chemicals into the air. This can pollute precipitation, making it fall as acid rain, rain with chemicals. Acid rain can kill trees and other living organisms in the area.

FIGURE 8.11 A firefighter tries to extinguish an oil well fire in Kuwait. It took 10 months for all the fires to be put out. During that time, huge amounts of oil and pollution were released into the atmosphere and surrounding waters and land. Many birds and sea life died (inset).

I wonder how oil spills are cleaned up?

What are some political and economic impacts of extracting fossil fuels and of oil spills?

acid rain rain or other precipitation that is acidic due to chemicals and gases released by human activity or natural causes
IMPACTS ON HUMANS

Extracting and using fossil fuels affects people. We use fossil fuels every day for things such as energy and transportation. The fossil fuel industry is a major source of income for some countries and provides many jobs. However, it can also have negative impacts on people.

TRANSPORTATION RISKS

Transporting fossil fuels is a risk to the environment, but it is also a risk to humans. The 2013 derailment in Lac-Mégantic, Québec, is an example. A 72-car freight train carrying crude oil was left unattended. The train derailed in the town causing a huge, fiery explosion. It killed 47 people. More than 30 buildings in the town’s centre were destroyed. It is the deadliest rail disaster in Canada since the St-Hilaire train disaster of 1864.

HEALTH EFFECTS

Drinking polluted water or breathing polluted air causes health problems. Smog is a type of air pollution from cars and fossil fuels (Figure 8.12). It is a leading cause of lung cancer. It can even cause breathing problems in otherwise healthy people.

In January 2013, there were reports of record high levels of smog in Shanghai, China. The government warned people to stay indoors. Shanghai is a coastal city. It produces smog from burning fossil fuels, mostly coal. China burns more coal than any other country in the world. Winds from the ocean can help to clear its air. So why was the smog in Shanghai particularly bad in January 2013? There was little wind, so the smog hung over the city. There was a drop in temperature, which meant that people were burning more fuel to stay warm. There was the usual high number of cars releasing exhaust fumes. And finally, many factories were burning extra fuel to make products to sell during the winter holidays.
SOCIAL IMPACTS

Countries with large deposits of fossil fuels often extract them and then sell them to other countries. This is usually economically beneficial to the country and to its people. Unfortunately, this is not always the case.

Nigeria is a country in West Africa with large deposits of oil. The country currently produces 2.2 million barrels of oil a day. Nigeria sells most of its oil, so why is the country not wealthy? For many years, Nigeria has suffered from what experts call the “resource curse.” The resource curse is when countries that have a lot of natural resources end up in worse situations than countries with fewer natural resources. The average person in these countries lives in poverty (Figure 8.13). Almost three out of four Nigerians live on less than one dollar a day. Nigeria ranks 153 out of 187 countries according to the United Nations Human Development Index. Most people in Nigeria have not benefited from the money earned by selling oil. Why is this?

Experts point to a pattern of events that can lead to the resource curse. People in the government spend the money on themselves instead of on education, healthcare, or any other improvements. Fighting starts among groups who want a larger share of the money. The government develops and sells only the main natural resource. They do not encourage other industries, such as tourism. To control the unhappy population, the government often uses harsh actions. The military has controlled Nigeria since oil was discovered, often ignoring human rights.

1. **GEOGRAPHIC PERSPECTIVE** Identify at least three different views on the topic of fossil fuels. Give an example of someone who might hold each view. Identify some of their concerns or interests. Create a visual organizer to record your ideas.

2. **SPATIAL SIGNIFICANCE** Why does the process used to extract fossil fuels depend on where they are located?

3. **EVALUATE AND DRAW CONCLUSIONS** Most of China’s electricity is generated by burning coal. Do you think this approach is sustainable? Explain why or why not.

4. **INTERRELATIONSHIPS** With a partner, discuss what impacts oil spills have on the environment. Create a poster or presentation showing how oil spills affect the environment nearby and farther away.