Environmental Impacts Related to:

- Coal mining
  - Land subsidence
  - Underground fires
  - Mining injuries/fatalities
  - Mine reclamation
- Extracting and transporting oil
  - Habitat destruction
  - Oil spills
- Burning fossil fuels
  - Airborne ash
  - Carbon dioxide and sulfur dioxide
  - Acid rain
  - Smog

Coal Mine Land Subsidence

- If part of an underground coal mine collapses, rock above the mine may collapse too.
- This may create a pit on the surface.
- Few injuries occur as a result of pit subsidence, but the hazard can strike without warning.

Underground Coal Fires

Coal can spontaneously combust as low as 104º F. Once ignited, the underground fires are impossible to put out.

Centralia, Pennsylvania
Fire started May 1962
Fire under 500 surface acres of land.
Over 100 homes purchased -- town population dwindles to less than 44.

Underground Coal Fires

- Thousands of underground fires are burning worldwide within coal deposits.
  - A fire in Australia has been burning for 6,000 years.
  - In China 20-30 million tons of coal burn underground per year.
Mining Injuries/Fatalities

- Mines can collapse
- Miners contract black lung disease from coal dust or cancer from radon gas
- Explosion occur from pockets of natural gas

Figure 13.21

Coal Mine Reclamation

- This site outside of Black Diamond, WA operated as an open pit coal mine from 1982-1986.
- Approximately 35,655 tons of coal was removed.
- Mine reclamation restored the area to its original topography and replanted with groundcover and trees
- Not all sites are so exemplary.

Impacts of Oil Extraction and Transport

- Development in environmentally sensitive areas.
- Destruction of habitat.
- New technology is helping to reduce environmental impacts.
  - Drill pads
  - Roads
  - Pipelines

Oil Spills

- About 10,000 spills each year in U.S. waters
  - 15 to 25 million gallons of oil annually
- Sources of spills
  - Oil tankers
  - Drilling accidents
  - Careless disposal of used oil
  - Intentional destruction of pipelines
  - A few natural seeps do occur
- Damage Control techniques:
  - Floating barriers and skimmers
  - Mop up with absorbent material (wood chips, peat moss, chicken feathers, ...)
  - Burn it off
Burning Fossil Fuels

- Why burn coal?
- Why burn petroleum?
- What else is in fossil fuels besides hydrocarbons?
- What happens when we burn these fossil fuels?

Burning Coal

- Sulfur content:
  - Low 0-1%
  - Medium 1.1 - 3%
  - High > 3%
  - What was the sulfur content of the Appalachian anthracite and Wyoming sub-bituminous coal?
- Liberates sulfur as sulfur dioxide into atmosphere upon burning
  - Acid Rain: sulfur dioxide is toxic and combines with atmospheric water to produce sulfuric acid
- Low sulfur coal causes the least air pollution (emission of SO₂).
- Ash is liberated from coal upon burning
  - Ash is as much as 20% of the volume of coal
  - Often contains toxic metal such as selenium and mercury
- Produces abundant carbon dioxide when burned
  - Carbon dioxide is a greenhouse gas

Burning Petroleum

- It’s the “combustion” in an internal combustion engine.
- Releases CO₂, SO₂ into the atmosphere.

1.2 tons of CO₂ is released every year for each person on Earth!

Acid Rain

- SO₂, Sulfur dioxide
- NOₓ, Nitrogen oxides
- Oxidation and complex reactions
- H₂SO₄, Sulfuric acid
- Nitric acid
- Cloud processes
- Materials
- Acidic precipitation
- Dry deposition
- Soil buffering
- Wet deposition
- Runoff
- Industry—Transportation
- Terrestrial ecosystem
- Aquatic ecosystem
- Distance
- Up to several hundred kilometers
Portions of U.S. with high sensitivity to acid rain

Tropospheric Ozone and Smog
Incomplete combustion of fossil fuels releases NO\textsubscript{x}, SO\textsubscript{2}, VOC that react chemically with sunlight to create near-ground ozone --- smog!

Near-ground ozone inflames lung tissue and causes respiratory infections.

Its corrosiveness can damage plants and trees and destroy agricultural crops and forest vegetation.

Summary
• The impacts of fossil fuel extraction and use are great!