

Caution - Fossil Fuels Below!

The potential evils of strip mines have received wide publicity. Less well-known, but often equally serious, are the possible consequences of underground extraction of fossil fuels.

Withdrawal of oil, like that of water, can cause surface subsidence, resulting in building failure and, in low-lying coastal areas, flooding. Subsidence of up to several meters has been observed in more than thirty oil fields in California and Texas, and the flooding of low-lying coastal properties at Long Beach, California, has been widely publicized. The pumping of water associated with secondary oil recovery often serves the additional purpose of "propping up" the land surface as the petroleum is withdrawn.

Surface subsidence over old, shallow underground coal mines also is not uncommon (recall figure 12.20B). In fact, it is much more common over coal mines than other types of mines, partly because the sedimentary rocks with which coal beds are interlayered may be weaker than the igneous or metamorphic rocks that may host ore deposits, partly as a consequence of coal-mining methods that maximize coal extracted, often leaving only "pillars" of coal to support the overlying rock layers. Indeed, sometimes even the pillars are mined out as the last stage of mining, and the overlying rock slowly sinks under its own weight. This subsidence typically takes the form of pits or trenches, which may be deeper than the thickness of coal mined. Surface failure may lag years or decades behind mining, developing as supporting structures decay and subsurface waters weaken rocks through weathering. Areas so affected are particularly common in the northwestern and north-central United States.



Figure 1 - Fire out of control in abandoned underground coal mine in Sheridan County, Wyoming.

Photography by C.R. Dunrud, USGS Photo Library, Denver, CO

As water and oxygen seep into abandoned coal mines, spontaneous combustion may ignite the remaining coal (figure 1). In the mid-1980s, the U.S. Bureau of Mines estimated that more than 250 uncontrolled mine fires were presently burning in seventeen states. The burning can lead to more settling, more subsidence pits, and increased air supply to the fire. Carbon monoxide and noxious sulfur gases rise to the surface. Such fires are not easily extinguished. Pouring in water from the surface has been known to increase some mine fires' intensity. The flames can, in principle, be suffocated by blocking all pits, shafts, and other openings through which air is reaching the flames, but the geometry of the mine workings and cracks above may be so complex that locating and sealing every airway is impossible. As a result, such fires can and do burn for years. An underground coal-mine fire that may initially have been ignited by a trash fire at a dump has been burning beneath Centralia, Pennsylvania, for a quarter of a century. The fire has traveled several kilometers underground in that time, and, periodically, people and property have dropped into new collapse pits at the surface. In 1983, conceding the futility of repeated fire-control efforts, the federal government approved a \$42 million plan to buy out owners of threatened properties-not all of whom wanted to leave their homes.