

Discussion Case: *Digging Gold*

Gold mining is one of the most environmentally destructive industries in the world. Most gold today is extracted using a technique called cyanide heap-leaching. Workers dig and blast the earth in open-pit mines so massive that astronauts can see them from space. Using huge earth-moving machines, they pile the gold-bearing ore into mounds the size of pyramids, then spray them with a solution of cyanide to leach out the gold. In a series of steps, gold is then removed from the drainage at the bottom of the heap and is further refined in smelters into pure bars of the precious metal.

Heap-leaching enables the economic extraction of gold from low-grade ores; some modern mines use as much as 30 tons of rock to produce a single ounce of precious metal. But this process can be highly damaging to the environment. Cyanide is one of the most potent poisons known; a pellet the size of a grain of rice can kill a person. Most spent cyanide solution is stored in reservoirs, where it gradually breaks down. But these reservoirs are prone to accidents. In 2000, at a gold mine in Romania operated by the Australian firm Esmeralda Exploration, 100,000 tons of wastewater laced with cyanide spilled into a tributary of the Danube River. The toxic plume washed all the way to the Black Sea, causing a massive kill of fish and birds and contaminating the drinking water of 2.5 million people.

After this incident, a Romanian citizen's group called Alburnus Maior organized to block construction of a new gold mine by the Canadian firm Gabriel Resources at Rosia Montana. "We have to decide whether we want [these] mountains to become a no-man's land," said Eugen David, a local farmer and activist.

Transportation of materials to and from mines, which are often located in remote areas, poses additional risks. A truck carrying containers of mercury (a by-product of gold extraction) from the Yanacocha Mine in Peru, owned by U.S.-based Newmont Mining, spilled its load on a rural road. Villagers from the area, not understanding the danger, collected the hazardous liquid metal. More than 1,000 people became ill, some permanently, a lawsuit later filed on their behalf charged.

In most developed nations, environmental laws prohibit the discharge of mining waste directly into waterways. But elsewhere in the world, laws are often weaker and regulations poorly enforced. In Indonesia, U.S.-based Freeport McMoran's Grasberg operation, the largest gold mine in the world, dumped its waste directly into local rivers, badly damaging downstream rain forests and wetlands. An official of the Environment Ministry said that the agency's regulatory tools were so weak that it was like "painting on clouds" to get the company even to follow the law.

Gold mining also pollutes the air. The entire process of metal extraction—from diesel-powered earth-moving equipment to oil- and coal-burning smelters—consumes large quantities of fuel, contributing to global warming. Smelters produce oxides of nitrogen and sulfur, components of acid rain, as well as traces of toxic metals such as lead, arsenic, and cadmium.

Another environmental hazard of gold extraction is acid mine drainage. Often, the rock that harbors gold also contains sulfide minerals. When this rock is crushed and exposed to air and water, these minerals form sulfuric acid. As this acid drains from mine debris, it picks up other metals, such as arsenic, mercury, and lead, creating a toxic brew that can drain into groundwater and waterways. This process can go on for decades, long after a mine has shut down.

In the United States, although mining companies have to follow environmental laws, no law specifically ensures that a mine will not create acid runoff. Sixty-three Superfund sites are abandoned mines; the EPA has estimated their cleanup cost at \$7.8 billion. In a study