

Mining and Community Health

Introduction

Mining operations are large scale industrial operations with significant environmental impacts. Mining is destructive to the immediate landscape and create significant amounts of waste. Even regulated and controlled mining sites release toxins into the surrounding environment.¹ There are numerous ways in which mines impact the health of nearby environments and local communities. Mining involves some generally standard processes and practices.

Removing overburden

First the mine removes material that is covering the ore (or in the case of an underground mine shafts or other openings and accesses are blasted/cut into the ground to access the ore). Waste rock is the material that is removed to access the ore – but has no value of its own, and may cause environmental impact, such as through the formation of acid mine drainage. It is usually deposited in “waste rock piles” that remain forever.²

Mining Ore

Ore is removed from the ground or underground workings – resulting in a pit or final underground configuration of the mine. These openings may pose physical hazards, such as subsidence(caving and sinkholes) or steep hazards. They may also pose chemical hazards, because their now-exposed rock surfaces can react with air, water, or other mine chemicals to result in acid mine drainage or other leaching/leached drainage.

Mining uses large amounts of energy requiring the transport and the combustion of high volumes of fossil fuels. Mining operations consume 7-10 percent of the world's energy production annually.³ Burning fossil fuels releases toxic substances such as mercury and polycyclic aromatic hydrocarbons (PAHs) into the atmosphere.⁴ Because of the remote nature of mining sites in Alaska, the burning of fossil fuels typically takes place on site. In addition to significant energy needs, most mining requires massive amounts of water. The Betze-Post Gold mine in Nevada (run by Barrick Gold) for example, pumps 100 million gallons of ground water a day.⁵

Mining operations are also noisy and noise produced by human activities reduces the populations of animals nearby. Animals ranging from birds to deer are known to avoid areas with significant amounts of noise produced by people.⁶ The noise associated with mining operations could potentially have an adverse impact on subsistence hunting, making it more difficult for communities that rely on a subsistence diet to ensure livelihood. The EPA determined that noisy activity at the Red Dog mine and transport road contributed to a decrease in caribou harvest, a similar decrease in Beluga harvest was associated with Red Dog port site.⁷

Milling

Milling is the step where ore is processed to remove as much of the valuable minerals as possible on-site. Some mines use chemical processes to remove metals from crushed ore including chemicals such as cyanide and sulfuric acid. The waste from the milling or other processing is usually called "tailings", which is most frequently a liquid or slurry material. These tailings are often known to be contaminated with toxic metals and cyanide, and may continually produce sulfuric acid as they degrade. Cyanide bearing mine tailings are extremely toxic to wildlife that come in contact with them and it has been found that most mining operations greatly under-estimate the number of animal deaths caused by mine tailings.⁸ Mine tailing must be stored in an engineered tailings dam to prevent their release into the environment, but tailings dams are known to leak and occasionally to break.⁹ In some cases waste rock or tailings material can be deposited in the pit or underground workings as a means of permanent deposit. Regardless of the means of storage, mine tailing must be stored and monitored forever.

Environmental Contamination and Human Health

Mines are notorious polluters; the mining industry is continually one of the top producers of toxic substances in the United States. Every year since 2004, Alaska's Red Dog mine has released more toxic substances than any other site in the United States. In 2007, it released 533,421,606 pounds of toxic substances. In Alaska, Red Dog, Greens Creek, Fort Knox and Pogo mines hold the top four places in the Toxics Release Inventory.¹⁰ Together they release more toxic substances than the next 30 Alaskan sites combined.¹¹ These toxic substances include dioxin, cyanide, mercury, arsenic, lead, cadmium, polycyclic aromatic hydrocarbons, and numerous others. The toxic nature of mining operations puts human health at risk. Not only are mine workers directly affected by their work environment, but toxic substances may be transported from the mine site to affect local communities and the environment.

Release of Toxic Metals

Mining activities may also release toxic substances from the earth. Ore deposits are often associated with arsenic, lead, mercury and other toxic metals. The majority of the mercury released into the environment in the United States is released by mining. Almost all of this mercury is released as a result of mines' waste rock disposal. Waste rock in Alaska is known to contain arsenic, mercury, cadmium and

other toxic metals. These toxic metals often find their way into the air, water and food chains once they are released from underground rock formations during mining.¹²

Teck Cominco, the company that runs Red Dog mine, was responsible for serious mercury contamination of Pinchi Lake in British Columbia. The Tl'azt'en First Nation communities who previously relied on these fish populations are now unable to harvest fish from the lake due to contamination. Some fish tested had mercury concentrations above more than 20 times higher than the Canadian FDA limit of 0.05 ppm.¹³

Health Effects of Toxic Metals

Mercury is toxic to the central and peripheral nervous systems. Health problems associated with mercury include personality changes, deafness, changes in vision, loss of muscle coordination or tremors, loss of sensation, and difficulties with memory. Mercury can be passed from pregnant mothers to unborn children and also to babies through breast feeding. Because they are still developing, fetuses and children are especially sensitive to the harmful effects of mercury.¹⁴

Bacteria within the environment transform inorganic mercury into methylmercury, a more toxic form of mercury that is best known as being the form that accumulates in fish. Indigenous populations that rely on subsistence fishing are especially susceptible to the effects of methylmercury, because they are disproportionately exposed through their traditional diet.¹⁵ One study found that prenatal methylmercury exposure due to consumption of marine mammals and fish by the mother resulted in attention, language, and memory deficits in children.¹⁶ Not only does presence of methylmercury present a danger to health, it also presents a danger to the livelihood of anyone who relies on healthy stocks of fish.

Arsenic is known to cause cancer of the skin, liver, bladder and lungs. Mines can release arsenic into the air and breathing arsenic from the air near mines is known to cause lung cancer. Arsenic exposure may cause disorders of the nervous system and of the circulatory system. Arsenic exposure may interfere with fetal development. Arsenic can cross the placenta into fetuses and can be transported from mother to her child in breast milk. Unlike mercury, the naturally occurring forms of arsenic are the most toxic.¹⁷ Chronic arsenic exposure has been associated with birth defects and still births.¹⁸

Lead is neurotoxic, which means it destroys brain and nerve cells. Children exposed to lead can suffer from abnormal and reduced physical and mental growth, and may also have lower intelligence. Lead can be passed from mother to child during pregnancy and breast feeding. Developing children are much more sensitive to lead exposure than adults.¹⁹ There is evidence that lead can cause health problems at much lower levels than previously thought, and that no level of exposure to lead is

safe for developing fetuses or children.²⁰ Lead exposure has also been associated with attention deficit hyperactivity disorder and antisocial behavior.²¹ Lead has been determined to be a probable human carcinogen by the Environmental Protection Agency.²² There is also evidence that lead is an endocrine disrupting chemical, with the potential to alter hormone function.^{23,24}

Antimony has a number of adverse health effects. Antimony is a possible human carcinogen associated with the development of lung cancer. Breathing air contaminated with antimony can cause lung diseases, heart problems, and numerous gastrointestinal disorders.²⁵ The Occupational Safety and Health administration (OSHA) lists cumulative heart and lung damage as major health effects of antimony.²⁶ According to the EPA, these health effects can include antimony pneumoconiosis (lung damage), alterations in pulmonary function, chronic bronchitis, chronic emphysema, pleural adhesions, increased blood pressure, altered EKG readings and heart muscle damage.²⁷ Antimony accumulates in organs, especially in the liver and kidneys and also in the blood.²⁸

Cadmium is a known carcinogen; some studies of workers exposed to cadmium found higher levels of lung cancer. Cadmium also causes kidney, lung, and intestinal damage.²⁹ Cadmium can pass from mothers to children through breast feeding. In animals, cadmium exposure during pregnancy has caused negative effects on behavior and learning, as well as abnormal fetal metabolism, low fetal weight and skeletal deformations. There is some evidence that cadmium causes reproductive problems in humans including low birth weight and reduced sperm count.³⁰

Mining Dust

Dust is a major problem for many mining operations, and has historically been one of the greatest threats to human health.³¹ The Alaska Department of Environmental Conservation analyzed the air outside the mill at Red Dog mine and found lead concentrations 30% higher than considered safe for human health.³² The dust emissions along the access road for Red Dog mine have significantly contaminated the environment with toxic metals including lead and cadmium.³³ Even moss 1,000 to 1,600 meters from the road was contaminated at levels above those found in many of the most polluted countries in Europe.³⁴ Dust from mining operations can potentially contaminate the surrounding environment with any of the toxic substances found at the site. Mining activities may expose local residents to hazards as well. Dust from mining operations may be transported to local communities.³⁵ Toxic metals such as arsenic, lead, or mercury, cadmium and antimony are frequently present in the rock of Alaska mining sites.³⁶

Health Effects of Mining Dust

In a review of information on the health effects of gold mining, researchers found that miners' exposure to silica dust, a component of crushed rock, increased the risk that miners would develop silicosis, a disease of the lungs.³⁷ Cancer is more

common among mine workers exposed to dust from a variety of mines including gold, copper and zinc.³⁷

Toxic Chemicals Used In Mining Operations(Cyanide)

Modern mining practices frequently use toxic chemicals to extract metals from rock. For example, cyanide is often used to extract gold and silver from metal ores. Although certain cyanide compounds degrade quickly in the open environment, their byproducts are also frequently toxic and more persistent. Some cyanide compounds persist in ground water, and there is evidence that some cyanide compounds such as thiocyanate, accumulate in fish.³⁸ Cyanide is toxic to fish and aquatic organisms – and people. Cyanide spills around the world have caused extensive environmental damage. For example, in 1990, an overflow pond at Brewer Gold mine in South Carolina failed; a cyanide, copper and mercury laden solution was released, causing a fish kill along 49 miles of the Lynches river.³⁹ Mine tailings are known to contribute toxic gases such as HCN (hydrocyanide) to the atmosphere.⁴⁰

Health Effects of Cyanide

Cyanide is an extremely toxic substance, both to humans and animals. Exposure to high levels of cyanide damage to the heart and brain and can lead to coma and death. Low level exposure over long periods can cause “breathing difficulties, chest pain, vomiting, blood changes, headaches, and enlargement of the thyroid gland.”⁴¹ There is evidence that children born to mothers exposed to cyanide over long periods are more likely to have thyroid disease.⁴¹

Contaminated Water Resources

Mining operations may affect drinking water, especially in rural areas dependent on ground water wells or potable surface waters. Mining activities all over the U.S. and world have been associated with water contamination. In 1993, the US Forest Service estimated that 20,000 to 50,000 mines were currently producing acid mine drainage in the western U.S. alone, contaminating up to 16,000 kilometers of streams.⁴² Uranium mining on the lands of the Navajo Nation has caused significant contamination of drinking water. Between 1990 and 1997, the EPA documented 95 major toxic substances releases. In 2008, 21 drinking water wells within the Navajo Nation were found to be contaminated with unsafe levels of radioactive contamination due to uranium mining.⁴³

Impact on society and traditional culture

The creation of a large scale industrial mining operation will undoubtedly have effects on local communities and Native cultures. Mining is a dangerous occupation, and consistently has some of the highest fatality rates among all industries.⁴⁴ It is stressful, difficult and hazardous work. This often leads to a high turnover rate for employees.

Prolonged separation of mine workers from their families and communities can cause conflicts at home. The two-week-on two-weeks-off work schedule common in the mining industry can make it more difficult to maintaining healthy relationships. This is especially true for couples with children where one partner is left as a single parent.⁴⁵ Even when preference is given to Indigenous Peoples in hiring, numerous outsiders are hired, usually for management positions. This influx of outsiders into Indigenous communities can lead to conflicts about local values, language and social structure.⁴⁶

Traditional food gathering practices can also be adversely affected. Because mining typically takes place in remote areas, mine workers may be less able to participate in traditional hunting and fishing activities.⁴⁶ The presence of non-traditional foods, as well as lack of time to harvest subsistence foods can result in a shift away from the traditional diet.⁴⁷ Mining itself or its offsite pollution may also contaminate traditional food sources. Dust from ore transportation at the Red Dog mine has contaminated local plants with heavy metals.³³ Contamination of traditional foods is a serious matter because there is often no other source to ensure all community members have access to food. Traditional foods that are contaminated with toxic substances present a serious health risk, while imported foods may be less nutritious. The fear of toxins in traditional foods can have a large impact on traditional food gathering practices central to the way of life for many northern Indigenous Peoples.⁴⁸

Long Term considerations

What happens when mines no longer produce ore – whether because the ore is exhausted or market prices make the mine uneconomic? When mines stop producing, their pits and underground workings are typically allowed to naturally fill with water over time to create artificial lakes and flooded underground caverns, or are back-filled with waste rock. In either case, old mine sites can be potential sources of acid mine drainage, a highly acidic toxic solution frequently contaminated with toxic metals such as arsenic, mercury and lead.⁴⁹ Acid mine drainage has been associated with destruction of aquatic habitats and altering of food webs.⁵⁰ Acid mine drainage is highly toxic to salmon fry, and also affects the ecosystem in ways that diminish the food supply for juvenile salmon.⁵¹ The effects of acid mine drainage on humans has not been well studied, but high toxic metal concentrations associated with acid mine drainage are known to be harmful to human health.⁵²

After mines close, mine tailings will remain “in perpetuity” or throughout the foreseeable future, and in many cases must be continually monitored for weaknesses and leaks by either the mining company or government agencies. Tailings dam failures and leaks are not uncommon. There have been numerous catastrophic tailings dam failures both in the United States and around the world. The options for cleaning up major mining contamination are few and often prohibitively expensive. Bonding, trust funds for continued monitoring, and other

financial “assurances” are often insufficient to protect and restore the environmental impacts left behind after a mine closes.

Mine closures significantly impact the communities near the mine. Large mining projects usually provide the majority of jobs when they are located in rural communities. When the mine closes, the lack of employment for large numbers of community members can strain community resources. Unforeseen closures make this process even more difficult, because reclamation plans and insurance bonds may be inadequate.⁵³

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