Sulfide mining pollution would forever change Minnesota, including the Boundary Waters, Lake Superior and our economy. Know the truth about its impact and make your choice.

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1. What is sulfide mining?

“Sulfide mining” is a term used in the Upper Midwest to refer to mining metals that are found in sulfide-bearing rock. It also known by two other names: 1. “non-ferrous mining,” (which simply means “not iron mining”), a term used often by state agencies and the legislature; and 2. hardrock mining, a term used by much of the rest of the country which refers broadly to mining hard minerals such as gold, silver, iron, copper, zinc, nickel, and lead, in contrast to softer minerals such as coal or tar sands. Sulfide mining is simply a form of hardrock mining that does not include iron mining.

In sulfide mining, it is the metals found within the sulfide ores that are sought. In Minnesota, the sulfide mining proposals and exploration activities to date are focused primarily on extracting copper, nickel, platinum, palladium and gold, which make up only a very small fraction of the ore. These metals have many important functions in modern society. Copper is used in electrical systems, automotive components, and in new wind turbines. Nickel is used to make stainless steel and hybrid car batteries. Platinum, palladium and gold are used for making catalytic converters, fuel cells, medicine, and jewelry. Laptop computers and cell phones contain many of these metals as well.

Mining metals in sulfide ores can be done in two ways: in underground mines when the ore deposits are very deep, and in open-pit mines when the deposits are relatively shallow. Underground mines involve the excavation of deep shafts, while open-pit mines are created by scraping off the surface soils and rocks and digging crater-sized holes to reach the ore. Mining companies often favor open-pit mines as they are less expensive to design and operate, but they also disturb a much larger amount of the surface. In the United States, 97 percent of all metals are now mined in open pits. Once the metals of interest are chemically extracted from the mined rock, the mine operator must find a way to dispose of the remaining large volumes of waste rock.

2. Has it been done in Minnesota before?

Minnesota has more than a century of history of iron mining, but sulfide mining has never been done in the state. There are important differences between sulfide and iron mining. Iron is found mostly in oxide ores, while copper, nickel and other metals are embedded in sulfide ores. These different ores can result in very different kinds of pollution with different levels of persistence (see Question 3 for details of these differences).

Iron mining in Minnesota has been conducted in a stretch of northern Minnesota referred to as the “Iron Range.” While sulfide mining proposals for Minnesota are also focused in the northern part of the state, they are proposed for the very eastern edge of the Iron Range and farther east into the Arrowhead region where mining has never occurred before.

While sulfide mining has never been done in Minnesota before, it has been conducted in many other states and countries across the world. (See Question 4 below for an examination of sulfide mining experiences elsewhere).

While Minnesota has not conducted sulfide mining, it has experienced two pollution issues related to the excavation of sulfide ores. In the 1970s, a company called International Nickel (INCO) operated briefly, looking for nickel in an area southeast of Ely near Highway 1 and the Spruce Road. They drilled exploratory holes and at one site, dug up a “bulk sample,” essentially a “miniature open pit mine.” Almost immediately, the site began discharging pollution. The Minnesota Pollution Control Agency required the company to correct the problem immediately, resulting in some re-contouring and re-seeding of the site. The following year, contaminated seepage was still found to be discharging from the site. Records show that the state determined the need to continue monitoring the discharge, but there is no indication that this occurred. In 2010, the INCO bulk sampling site was found to still be leaching harmful runoff. Lab tests showed levels of copper, arsenic and other metals above state water quality standards.
Fifty years ago, near the south end of Birch Lake at a site called the Dunka Pit, the iron mining company LTV Steel Mining Company, excavated a significant quantity of sulfide ore to access taconite buried beneath it (the site is now owned by Cliffs Erie L.L.C.). The unwanted sulfide ore is leaching contaminants into Birch Lake’s Bob Bay still, in violation of water quality standards. (See Question 7 for more details).

3. Is it safe?

While any kind of mining creates a certain level of environmental impact, mining sulfide ores has been shown to result in unique pollution and health risks, some quite different from those associated with iron mining. Pollution from sulfide mines can occur at various points in the mine operation, leaching from the waste rock piles and mine pit walls at the mine site, from the transportation of ore from the mine site to the processing facility, and from processing wastes disposed in tailings basins.

“Waste rock” is the term given to the excavated rock that is not going to be sent to the processing plant because it contains too little of the desired metals to be profitable to process. In sulfide mining, the vast majority of excavated rock is waste rock, while only a small fraction is sent for processing. But this sulfide-laden waste rock is the source of some very dangerous pollution.

It can sometimes be surprising to learn that naturally occurring substances on Earth are not always benign or “safe” to humans or our environment. Sulfides are those kind of substances. When left deep within the Earth, unexposed to air, they present no problem. But when brought to the surface, as is done with mineral extraction, sulfide ores undergo a chemical reaction that can create long-lasting contamination to water and the plants and animals dependent on that water.

When sulfides interact with oxygen (in our air) and water (in rain or snowmelt, for example), they create sulfuric acid – the same caustic substance used in car batteries. If this acid makes its way into water systems [streams, rivers, lakes, groundwater] in sufficient quantity, it will kill all organisms that cannot tolerate highly acidic waters. In addition, the acids dissolve harmful metals that are toxic to fish and other aquatic life, as well as to humans, out of the surrounding rocks. A common term for this pollution is Acid Mine Drainage (AMD). Acid mine drainage can be discharged from a variety of places in the operation of the mine – any place where the ore comes in contact with air and water – such as the open pit walls, the waste rock piles, tailings, and underground tunnels.

Sometimes, if large quantities of iron are leached from the rocks, the water turns a yellow-orange color. Pictures of orange rivers and streams from sulfide mining operations around the country have become visible representations of this pollution. It is important to know, however, that not all acid mine drainage or toxic metal leaching is visible – and rivers, lakes and streams have been contaminated without showing the signature orange color.

Preventing the chemical reaction and the toxic metal leaching is no small task for sulfide mines. The proposed PolyMet project, for example, expects to excavate and pile waste rock on the land – the size of 500 football fields 20 stories tall. (See Question 7 for more details of this project.) To keep Minnesota’s surface and ground waters free from sulfide mining pollution, none of these mountains of sulfide ore can ever be allowed to come into contact with oxygen and water or, if they do, they must be completely contained for hundreds of years while these pollutants persist. Mining operators have yet to identify a sulfide mine that has ever managed to accomplish it (See Question 4 for details about the experiences of other sulfide mines).

AMD has devastated water bodies in many states where this kind of mining has occurred. “Water contaminated by AMD, often containing elevated concentrations of metals, can be toxic to aquatic organisms, leaving receiving streams devoid of most living creatures.” Research shows fish that experience direct contact through their gills to metals and hydrogen ions experience impaired respiration, both from acute and chronic exposures. Indirect exposure to fish can also occur when fish ingest contaminated sediments and food.
The orange colored precipitate, iron hydroxide, that often symbolizes the formation of AMD, may "physically coat the surface of stream sediments and streambeds destroying habitat, diminishing availability of clean gravels used for spawning, and reducing fish food items such as benthic macroinvertebrates."

The crater-sized pits created with open-pit mining, as PolyMet proposes to do, are usually deeper than the water table. This means that without active pumping, they will fill with water, becoming artificial lakes. The PolyMet mine proposal plans for this to happen at its West Pit when the mine is no longer in operation. These pit-lakes can be highly contaminated water bodies, with acid and metal leaching occurring along the pit walls. Unsuspecting migratory waterfowl and other wildlife may use the pit-lakes as resting places or water sources and become poisoned. Any contamination that leaches out of the pit into groundwater becomes a risk to the broader environment, and to human drinking water supplies and health. In northern Minnesota, where surface and groundwater mix so readily, this is a real concern for sulfide mine proposals.

The metal contaminants that result from sulfide mines can be extremely unsafe for human health at certain exposure levels. Arsenic, manganese and thallium, potential by-products of acid mine drainage, have been shown in high levels to increase the risk of cancer and other illnesses in humans. Common tailings basin pollutants include mercury, copper, lead, arsenic, cadmium, selenium, zinc and nickel. "Water-borne pollutions [e.g., heavy metals] resulting from acid mine drainage can pollute communities well downstream of the mine." This can occur from accidental spills or intentional releases. The draft Environmental Impact Statement (EIS) for the PolyMet mine project predicts that the West Pit will fill with water and overflow into the Partridge River about 45 years after the mine’s closure. The draft EIS noted that this discharge was predicted to exceed water quality standards for antimony for 550 to 2,000 years. Other contaminants that were cited as possibly exceeding water quality standards were nickel, sulfate, cobalt, copper and mercury [DEIS, pgs. 4.1-45, 4.1-64, 4.1-113, 4.1-123].

Some contamination comes from expected leaching that occurs from waste rock piles – whether lined or not – or from leaking tailings basins. The PolyMet draft Environmental Impact Statement (EIS) acknowledges that waste rock liners may fail to contain contaminated drainage and that liners may degrade over long periods of time and may experience tears or rips [DEIS pg. 4.1-75]. Groundwater seepage from the proposed PolyMet tailings basin is also expected to occur, but it will not be collected or treated. Modeling shows this seepage is expected to exceed standards for aluminum, antimony, arsenic, fluoride, iron, manganese, sulfate and possibly beryllium and thallium. Aluminum is expected to exceed water quality standards for as many as 500 years [DEIS pg. 4.1-120].

In addition to the concerns related to pits and waste rock piles, there are risks that the structures designed to contain mine wastes could fail or collapse, disbursing pollution beyond the mine facility. PolyMet’s draft EIS describes a proposal to dispose of mine tailings in a pre-existing tailings basin from an old iron mining operation. But the draft EIS acknowledges that there already exist concerns about the stability of the tailings basin’s embankments [DEIS pg S-10, 4.13-1]. Should the tailings basin dams fail, the polluted contents would be released to the area’s ground and surface waters. Tailings basin failures have occurred at other mines. [See Question 4 for examples].

Metals do not break down in the environment, but rather persist as contamination sources for long periods of time. In aquatic systems, they may fall into sediments where they remain available for ingestion by fish, which can subsequently be eaten by humans.

In addition to acid drainage and metal contamination, chemical compounds called “sulfates” are often discharged from sulfide mining operations when sulfides are oxidized. Sulfates have been shown to facilitate turning non-toxic forms of mercury into toxic forms – a process called “mercury methylation.” This toxic form of mercury bio-accumulates in fish and results in fish consumption advisories. Mercury contamination causes brain and kidney damage and behavioral disorders in humans.

In a health study of newborn babies in the Lake Superior Basin conducted from 2007 to 2011, the Minnesota Department of Health found eight percent of tested newborns had mercury levels above the safe dose limit for methylmercury as set by the U.S. Environmental Protection Agency [EPA]. After years of seeing declines in mercury levels
in fish, the EPA is once again finding mercury increases in fish tissues. And, according to the EPA, mining is the largest source of mercury contamination to the Lake Superior Basin.

New sulfide mines in the region are expected to add to this sulfate loading. The PolyMet mine proposal near Babbitt, Minnesota acknowledges this. In the draft Environmental Impact Statement for the project it notes: “Relatively high sulfate concentrations in seepage from the Tailings Basin would be released to wetlands north of the Tailings Basin and lakes downstream on the Embarrass River that represent ‘high risk situations’ for mercury methylation. There is some uncertainty as to whether the West Pit overflow would meet the Lake Superior mercury standard” (DEIS pg. S-9).

Sulfates are also known to affect the growth of wild rice, Minnesota’s state grain and a cultural and economic resource of tremendous importance to the Anishinabe people and others who harvest and market it. Wild rice also provides important food and habitat for waterfowl and other wildlife. Research has shown that elevated levels of sulfates are detrimental to the growth of wild rice. In 1973, Minnesota adopted a sulfate water quality standard to protect waters where wild rice grows. As interest in sulfide mining in Minnesota has increased, so too has industry criticism over the sulfate water quality standard. In 2010, the Minnesota Chamber of Commerce sued the state seeking the development of a new standard and to prevent the state from enforcing the current sulfate limit. On May 2012, a Ramsey County District Court upheld the state’s standard. As of May 2012, it is not yet known if the Chamber of Commerce will appeal the decision.

While iron mining certainly has impacts on the landscape and produces its own kind of pollution, oxide ores do not produce acid mine drainage. The starkest difference between the two kinds of mining, however, is in the duration of the pollution. Sulfide mining pollution can continue for hundreds or thousands of years, even indefinitely. The generation of acid drainage will continue as long as sulfides, water and air mix. No new technologies have emerged that can stop the chemical reaction once it begins. Some hardrock mines in western states need expensive water treatment into perpetuity. (See Question 4 below for examples of mines requiring perpetual water treatment).

“The mining industry has spent large amounts of money to prevent, mitigate, control and otherwise stop the release of AMD using the best available technologies, yet AMD remains as one the greatest environmental liabilities associated with mining, especially in pristine environments with economically and ecologically valuable natural resources. Problematic to the long-term operation of large scale metal mines is recognition that no hard rock surface mines exist today that can demonstrate that AMD can be stopped once it occurs on a large scale. Evidence from literature and field observations suggests that permitting large scale surface mining in sulfide-hosted rock with the expectation that no degradation of surface water will result due to acid generation imparts a substantial and unquantifiable risk to water quality and fisheries.”

Acid Mine Drainage and Effects on Fish Health and Ecology: A Review

4. What is the experience of other states and countries with sulfide mining?

To understand what Minnesota might experience from sulfide mining, we can examine what other states and countries have encountered. Two clear issues emerge – one regarding pollution and the other about financial irresponsibility.

The U.S. Environmental Protection Agency (EPA) has identified hardrock mining as the nation’s top toxic producing industry. The EPA produces an annual “Toxic Release Inventory” (TRI) that provides the public with information about toxic releases in and around their communities. The 2011 TRI data show that, as with every year since 1997 when the metal mining industry was required to report, this industry releases the largest amount of toxic materials,
accounting for 41 percent of all toxics reported in 2010, or 1.6 billion pounds. These figures do not include some of the most toxic substances found in waste rock because in 2002, the metal mining industry successfully sued to exclude these from the TRI calculations. **These substances are still released by mining operations, but go unreported.**

The EPA estimates that the headwaters of 40 percent of the watersheds in the western United States are contaminated by pollution from hardrock mining. And the U.S. Forest Service estimates that between 20,000 to 50,000 mines are currently generating acid on its lands, impacting between 8,000 to 16,000 km of streams.

To date, mining companies are unable to point to a sulfide mine that has ever been developed, operated and closed without producing polluted drainage from its operations. Yet studies show that the companies and state agencies reviewing mine plans consistently predict no pollution will occur during the planning and permitting process. Analysis of environmental impact statements for hardrock mines showed that 100 percent of mines predicted compliance with water quality standards before operations began. When researchers examined the track record of these mines after operations began, they found that 76 percent of them were actually discharging pollutants in excess of water quality standards. In addition, “mitigation measures,” or those efforts taken to remedy the discovered pollution problems, failed to do the job 64 percent of the time.

Pollution problems from sulfide mines are not just an issue of old mines using old technologies. Acid mine drainage and toxic metal contamination are problems from modern mines using the latest technology as well. Here are some examples:

- **Summitville Gold Mine, Colorado.** Operated by Galactic Resources Ltd, a subsidiary of Summitville Consolidated Mining Company, Inc. Pollution spilled from a containment pond, impacting all aquatic life for 18 miles in the Alamosa River, as well as adjacent farms and ranches that relied on the river for irrigation and livestock watering.

- **Zortman Landusky Mine, Montana.** Operated by Pegasus Gold Inc. This mine is generating acid mine drainage that is predicted to continue for thousands of years. "Nearly every drainage in the Little Rocky Mountains has been contaminated with contaminated runoff from the mine."

- **Red Dog Mine, Alaska.** Operated by Teck Cominco. Studies have found heavy metals such as cadmium, lead and zinc along a 24-mile stretch of the mine’s 52-mile haul road. The Alaskan Department of Environmental Conservation found lead levels outside the mill to be 30 percent higher than safe for human health. The company has routinely been found in violation of state air quality standards. The native village of Kivalina, downstream from the mine, is concerned about toxic levels of metals in a nearby creek that flows into the Wulik River, the village’s source of fish and drinking water.

- **Pinto Valley Mine, Arizona.** Operated by BHP Copper Co. In 1997, a tailings dam failed, and 3.4 million gallons of heavy-metal tainted water were released into Pinto Creek, a water body that flows into Roosevelt Lake, one of the area’s largest sources of drinking water.

- **Chino Mine, New Mexico.** Operated by Phelps Dodge Corporation. Between 1991 and 1996, almost 250,000 gallons of tailings were released into Whitewater Creek when the mine experienced a series of pipeline ruptures. During a three-month period of time in 2000, at the Chino Mine and two other Phelps Dodge mines in the vicinity, hundreds of bird carcasses were discovered. The birds, some protected by the Migratory Bird Treaty Act, had landed in water in tailings impoundments and in stormwater retention basins. Concentrations of hazardous substances in other birds, small mammals and reptiles showed evidence that wildlife had been exposed to toxic substances at the mine site.

- **Gilt Edge Mine, South Dakota.** Operated by the Brohm Mining Company, a subsidiary of Dakota Mining. The mine began generating acid mine drainage in 1992, contaminating nearby water bodies with acid showing pH levels as low as 2.1, destroying viable fish populations in area streams.
• **Grouse Creek Mine, Idaho.** Operated by Hecla Mining Company. When the mine opened in 1994, it was heralded as a “state-of-the-art” mine. Three years later, the mine closed, leaving no profits and leaking tailings impoundments. In 2003, the EPA and the Forest Service declared the mine site to be an “imminent and substantial endangerment.”

• **Flambeau Mine, Wisconsin.** Operated by the Flambeau Mining Company. The mine began production in 1993 and ceased operations in 1997. It is sometimes cited by industry representatives as an example of a sulfide mine that has not polluted its adjacent waters. Recent studies show this claim to be false. Two areas of contamination have been discovered, one discharge that exceeds water quality standards into a stream that flows into the Flambeau River, and another in a groundwater monitoring well between the mine pit and the River. The Flambeau Mine is currently the subject of a lawsuit under the Clean Water Act.

Pollution disasters are not limited to the United States. Sulfide mining has a track record of pollution around the globe. In 1995, a tailings dam failed at the Omai gold mine in Guyana, South America, operated by the Canadian mining corporation, Cambior. Fifty-one kilometers of river area, home to 23,000 people, were declared an “Environmental Disaster Zone.” In Papua New Guinea, when the Ok Tedi mine, operated by Australian mining company BHP Ltd, experienced a tailings dam failure due to a landslide, the company started dumping its mine wastes directly into the Ok Tedi River. Daily, this mine dumps 120,000 tons of waste rock into the river, contaminating it with toxic metals and poisoning fish.

This pollution not only takes a toll on the environment and human health, but also brings long-lasting financial burdens to communities and states. The history of metal mining is filled with companies going bankrupt or lacking the financial resources to respond to pollution from their mines. The result has either been ongoing environmental contamination, with community-wide environmental and economic impacts, or a shift of financial burden from the companies to the public to clean up mining pollution. The U.S. Environmental Protection Agency estimates that the cost of mine cleanup for sites listed as national priorities is $20 billion. The most significant cost associated with this cleanup is long-term water treatment and management. The mining pollution examples listed previously are also examples of the financial failure of mining companies and the associated taxpayer liability:

• **Summitville Gold Mine, Colorado.** The company filed for bankruptcy in 1992, leaving cleanup costs to the public. Costs are expected to be about $235 million and cleanup efforts to take at least 100 years.

• **Zortman Landusky Mine, Montana.** In 1998, the company abandoned the site and filed for bankruptcy. After several lawsuits against the mining company and its creditors following the company’s bankruptcy, Montana’s taxpayers are still liable for anywhere from $8 million to $90 million.

• **Gilt Edge Mine, South Dakota.** The parent company, Dakota Mining, went bankrupt and abandoned the mine in 1999 with only a $6 million bond in place, an amount insufficient to cover water treatment for a single year. In 2000, South Dakota requested the mine be designated a Superfund site for long-term cleanup, leaving the burden of reclamation costs on taxpayers.

Other reported financial liabilities from sulfide mining include:

<table>
<thead>
<tr>
<th>State</th>
<th>Potential Unfunded Liability</th>
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<tbody>
<tr>
<td>Alaska</td>
<td>$7 – $57 Million</td>
</tr>
<tr>
<td>Arizona</td>
<td>$73 – $292 Million</td>
</tr>
<tr>
<td>California</td>
<td>$17 – $68 Million</td>
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<tr>
<td>Colorado</td>
<td>$20 – $50 Million</td>
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<tr>
<td>Idaho</td>
<td>$20 – $160 Million</td>
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<tr>
<td>Montana</td>
<td>$20 – $50 Million</td>
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<tr>
<td>Nevada</td>
<td>$96 – $480 Million</td>
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<tr>
<td>South Dakota</td>
<td>$6 – $15 Million</td>
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<tr>
<td>Utah</td>
<td>$10 – $50 Million</td>
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<tr>
<td>Washington</td>
<td>$5 – $10 Million</td>
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"The total, potentially unfunded reclamation bonding liability of all the western states presently exceeds one billion dollars. ... At the same time, the financial failure of numerous mining companies has exposed shortcomings in both bond methods and bond amounts. ... American taxpayers are faced with paying for this significant liability from mines left unreclaimed, shifting the economic burden from the companies that profited from the mines and leaving environmental disasters behind for the public to clean up."

Several possible factors are involved in the failure of mining companies to pay for their own cleanup costs, including that predictions for the amount of disturbance and contamination, especially long-term water pollution, were significantly underestimated. In some cases, mining companies may not have provided adequate levels of "financial assurance." Financial assurance is similar to a damage deposit one must pay to rent an apartment. It is money provided up front to cover any damages that may occur, and it is money that is returned when the apartment is left in good condition. In the case of mining, financial assurance is intended to cover the cost of pollution issues and the reclamation of the site at the mine’s closure. But history has shown companies and state agencies consistently unable to accurately predict what those costs will be, resulting in inadequate levels of financial assurance. Many reasons account for this failure. Researchers have found that predictive modeling results are not adjusted to account for past real-life failures at other mines. Prediction models may also use incorrect characterizations of the hydrology and geochemistry of the site, or be built on insufficient data to come to accurate predictions. In addition, the science of water flow and pollutant interactions is complex and not always easy to predict.

In some cases, mining companies have been allowed to use forms of financial assurance that are not secure – such as self-guarantees. If the company goes bankrupt, the money for pollution cleanup and reclamation also disappears.

Minnesota requires sulfide mining companies to provide financial assurances for their operations. These provisions were established roughly 20 years ago, but in the absence of any sulfide mines, they have not been tested. In recent years, concerned experts and advocacy groups have studied financial assurance provisions and experiences in other states, and believe Minnesota would greatly benefit from strengthening its financial assurance requirements. Two decades of study of what works well and what does not could help Minnesota avoid the costly mistakes of other states. To date, efforts to reform Minnesota’s financial assurance provisions have not passed at the state legislature. (See Questions 14 and 15 for details about improving financial assurance provisions).

5. Where is it being proposed in Minnesota?

Sulfide mining projects and exploration are focused in northern Minnesota on the eastern edge of the Iron Range and farther east into the Arrowhead region. Most of the drilling and proposed development is on public land, either on the Superior National Forest or on state or county lands. Some mineral exploration is also occurring on private lands where the mineral rights are owned separately from the surface rights.

Some people are surprised to learn that national forest lands, such as the Superior National Forest, are not protected like national parks and can be mined. Even so, as lands owned by the citizens of the United States, projects proposed on National Forests must be presented to the public for scrutiny and input.

Private mineral exploration and development may also come as a surprise to some. Sometimes when people purchase property, the mineral rights are owned separately. The mineral rights are considered "severed," with one entity owning the surface and another the minerals. In the United States, someone seeking to explore or develop their mineral rights cannot be denied access even though it may involve disturbing the surface rights of another. Recently in Minnesota, some private property owners were surprised and upset to discover that the state of Minnesota had leased mineral exploration rights to companies who would be drilling on their land. For leases of state owned minerals, surface owners must be compensated for any damages to the surface that come from the mining activities, and denying access to these companies is not allowed under the law.
Two major mine projects in Minnesota are proposed as of May 2012. With several other companies conducting exploratory drilling across northern Minnesota, additional mine projects are likely to be proposed in the coming years. Some are heralding this as the beginning of a new sulfide mining district in the state, which will exceed the iron ore industry in size. If their predictions are true, it will mean a radically changed northern Minnesota landscape from what we know today.

PolyMet Mining Corporation has proposed a sulfide mine called the “NorthMet Project” between Babbitt and Hoyt Lakes, Minnesota. This project proposes to develop an open-pit mine to extract copper, nickel and other metals. The potential mine site is on public land in the Superior National Forest on a location that has never been mined. PolyMet plans to transport the ore to a former taconite processing facility that is on private corporate lands about eight miles west. The former iron ore facility would be re-configured for processing sulfide ore. Mine tailings are proposed to be disposed of in basins already in place from the former operation and that are adjacent to the processing buildings.

The PolyMet project lies within the Lake Superior watershed. Surface waters in the mine area flow to the adjacent Partridge and Embarrass Rivers. Both of these flow into the St. Louis River which flows into Lake Superior. It has not yet been established, however, in which directions groundwater at the site may flow. The mine site is located near the division of a second watershed, the Rainy River watershed. Some technical experts in hydrology have wondered if groundwater might flow north toward the Boundary Waters Canoe Area Wilderness as well as south toward Lake Superior. The flow of both surface and groundwater is critical to understand, for it indicates where potential pollution may be distributed.

PolyMet Mining Corporation is a Canadian company. It has never initiated or operated a mine before.

A second sulfide mine has been proposed for northern Minnesota by Twin Metals Minnesota LLC. Twin Metals is the joint venture of Duluth Metals Limited, a Canadian company, and Antofagasta PLC, a Chilean-based mining company. This endeavor is seeking to mine copper, nickel and other metals in an underground mine located near Birch Lake, southeast of Ely, Minnesota. The ore deposit is two to three miles from the Boundary Waters Canoe Area Wilderness (BWCAW). The project is actually comprised of four mineral deposits, which the company refers to as “Nokomis,” “Maturi,” “Spruce Road,” and “Birch Lake.” The area of interest includes beneath Birch Lake (the company may propose to mine under the lake) and the area between the lake and the BWCAW, along the South Kawishiwi River. The area is public land on the Superior National Forest.

Twin Metals is currently developing its “prefeasibility study” which will describe more of the project details, such as engineering design and facility locations. While the project details are pending, Twin Metals spokespeople describe it as the largest underground mine in Minnesota’s history and “a lot like an underground city.”

This project lies within the Rainy River watershed, an area where surface waters flow north through the Boundary Waters Canoe Area Wilderness and other parts of the Superior National Forest, as well as through Voyageurs National Park. The route surface waters take (and potential pollution) are through the South Kawishiwi River, into Birch Lake, into the White Iron Chain of Lakes, and then into the BWCAW.

Mineral exploration by other companies is occurring throughout the same area as Twin Metals mine proposal, as well as south of Birch Lake and east to the Isabella, Minnesota area. This area is part of the “Duluth Complex,” a mineral area of interest that stretches across the Arrowhead region. The Superior National Forest expects mineral exploration and development to increase over the next 20 years in this region. The Forest Service is in the process of granting additional permits to explore and developing guidelines for future mineral activities across the Superior National Forest. Never before has this forest been the focus of so much mining activity. If these activities continue, this national forest will undergo a dramatic change in how it appears and is used.
6. Who are the mining companies proposing sulfide mines in Minnesota?

**PolyMet Mining Corporation** is a Canadian mine development company. Its largest investor is the giant Swiss commodities trader, Glencore International PLC, which owns over 24 percent of the PolyMet project and has agreements with PolyMet that may bring that ownership to 35 percent. It has also arranged to purchase and market 100 percent of the products from the PolyMet mine. Because the NorthMet project is the first mine PolyMet has ever sought to develop, and because PolyMet as a mine development company is not experienced in operating a mine, it is possible a different company will eventually acquire and operate the project. Some have wondered if Glencore will eventually gain majority control and become that entity. For these reasons, Glencore’s relationship to PolyMet is starting to receive increased attention in the media.

Glencore was founded in 1974 by Marc Rich, a billionaire commodities trader, who was charged with tax evasion and illegal business dealings with Iran in the U.S., but given a pardon in 2001 by President Clinton in the last moments of his presidency. While the company has grown to control large segments of the global market, including 50 percent of the world’s copper and nine percent of the world’s grain markets, it has also been the subject of allegations of fraud, unsafe working conditions, and gross environmental and human rights violations. Some examples include:

- accusations of illegal operations with “rogue states” such as apartheid South Africa and Iraq under Saddam Hussein
- named by the CIA to have paid over $3 million in illegal kickbacks to obtain oil in the UN oil for food program for Iraq
- allegations of corruption and human rights violations in its operations of a Colombian mine, where forced evacuations of villages were reported
- severe environmental violations at a coal operation in Colombia
- payments to Colombian paramilitary killers
- allowing acid mine wastes to flow into a river for three years in the Democratic Republic of the Congo
- fined for high levels of environmental and human safety violations in its global operations
- allegations of allowing child labor in its mining operations in the Democratic Republic of the Congo

**Twin Metals Minnesota LLC** is the joint venture of Duluth Metals Limited, a Canadian company, and Antofagasta PLC, a Chilean-based mining company. Twin Metals Minnesota is 60 percent owned by Duluth Metals Limited and 40 percent by Antofagasta PLC. Antofagasta holds the option to acquire an additional 25 percent of the Twin Metals Project from Duluth Metals. Duluth Metals Limited does not describe on its website any previous projects it has developed. Antofagasta owns and operates three copper mines in Chile, with a fourth mine being commissioned. Antofagasta has exploration and evaluation programs in North America, Latin America, Africa, Asia and Australia.

In Chile, Antofagasta’s mining operations have come under international attention for their environmental contamination as well as disregard for water rights of local farmers and communities. **Antofagasta’s Los Pelambres mine was fined in 2007 by the Chilean government for toxic spills into the Cuncumén River.** Another devastating spill occurred in 2009 when 13,000 liters of copper concentrate spilled directly into the Choapa River. Antofagasta’s plans to build a massive tailings dam created controversy from local farmers concerned that existing scarce water supplies would be depleted and the tailings could poison remaining water sources. The farmers won a court appeal over water rights, but a water commission allowed the company to continue with construction while they appealed the ruling. In 2008, the Chilean Supreme Court ruled in favor of the farmers’ water rights, but by that point the tailings dam had already been built and water supplies impacted.

Twin Metals has hired several consulting companies to assist in the development of its mine proposal. Because the work of these companies could result in a sulfide mine near the nation’s most popular wilderness area and in a region Minnesotans value for its natural qualities, it is important to examine the track records of these companies.

The San Francisco-based engineering company Bechtel Mining & Metals was hired by Twin Metals to develop the mine proposal’s Pre-Feasibility Study. This study will determine all the critical details of the mine project, preparing
for the project’s environmental and regulatory review. Bechtel has designed numerous mines and other projects that have caused serious and long-lasting pollution.

- In Papua New Guinea, two mines designed by Bechtel dump hundreds of thousands of tons of waste into streams and rivers each day. An accident at one of the mine dumps killed four local people in 2000.
- The Grasberg and Ok Tedi mines are having an “irreversible impact” on the water and forests of the area.
- In 1998, the state of New Hampshire fined Bechtel $90,000 for numerous violations of environmental laws and permit conditions associated with a gas pipeline the company constructed. The violations included the discharge of sediments into wetlands and streams.

Twin Metals has also hired URS, an environmental, engineering, construction and project management firm, as its lead environmental consultant. In this role, URS will advance the project’s environmental review and permitting. The State of Minnesota sued URS for $52 million over the 2007 collapse of the I-35W bridge in Minneapolis, which killed 13 people. The state’s lawsuit claimed that URS, which had been hired to inspect the bridge, failed to adequately do the job. The company was accused of taking shortcuts in its inspection by not inspecting all the gusset plates, which eventually failed and caused the collapse.

An internal URS memo from 2006 referenced in the lawsuit stated, “We will not calculate actual capacities of all the connections since that is too much work, although that provides the most accurate results.”

Failed predictions of pollution, and an over-reliance on computer models, are key flaws of many copper-nickel mines across the country that have generated long-lasting pollution. URS has been accused of making these same mistakes regarding the inspection of the I-35W bridge.

Minnesota Governor Mark Dayton has expressed his concerns about the state doing business with URS for development of the Southwest light rail project. Likewise, the lawyer who represented many of the victims of the 35W bridge collapse has stated grave concerns about hiring URS for work within the state. “You kind of have to think twice as to why the state would hire them yet again given their track record in our state,” said attorney Chris Messerly. Messerly noted regarding the bridge collapse, “We uncovered a lot of issues that were extremely troubling to us...This wasn’t, in our view, just a negligent actor. It was someone who deliberately disregarded the public safety.”

Many other companies are exploring for metals in Minnesota and other mining proposals are likely to occur. Teck (formerly Teck Cominco) is a Canadian mining company that holds mineral leases from the state of Minnesota and private entities for a deposit near the proposed PolyMet mine. In 2011, Teck representatives visited the state and met with stakeholders, including non-profit conservation organizations, as part of their discernment process about mining their minerals. Twin Metals and Duluth Metals are also conducting exploration activities in addition to their proposed project. Other exploration companies in Minnesota include Lehmann Exploration Management Inc., Encampment Resources LLC, Prime Meridian Resources Inc., Franconia Minerals, Kennecott Exploration, and Vermillion Gold.

7. What are the mining proposals for Minnesota?

In October 2009, PolyMet’s Draft Environmental Impact Statement (draft EIS) for its proposed mine near Babbitt, Minnesota was released for public review and comment. The draft EIS was released by the two agencies responsible for the project: the Minnesota Department of Natural Resources (MN DNR) and the U.S. Army Corps of Engineers (Army Corps). The plan includes these features:

- a mine life-span of about 20 years
- excavation of three crater-sized open-pits
  - acres in size: 278, 54.5, 118
  - depth in feet below ground: 840 ft, 550 ft, 760 ft
- excavation of about 91,000 tons of ore a day
- generation over the life of the mine of almost 400 million tons of waste rock
• all the waste rock will be considered “reactive” – capable of producing acid mine drainage and heavy metal contaminants; some waste rock is expected to be extremely reactive, others less so
• leaving reactive waste rock “piles” the size of 500 football fields 20 stories tall on the land forever
• allowing the West Pit to fill with water (potentially contaminated) and overflow into the Partridge River when the mine is closed
• allowing surface seepage from the tailings basin to flow into the Partridge River when mine is closed
• no collection of groundwater seepage from the tailings basin even though it is expected to occur and to exceed water quality standards
• impacting and/or destroying about 1600 acres of wetlands, which would be the largest permitted destruction of wetlands in Minnesota history
• depositing mine tailings wastes in a basin already leaking pollution from previous use, and that has embankments with a low margin of safety
• exceeding water quality standards at the mine site for numerous contaminants for hundreds or several thousands of years
• exceeding water quality standards at the tailings basin for certain contaminants for hundreds of years
• potentially increasing methylmercury availability to fish
• loss of critical habitat for the federally-listed Canada lynx
• loss of access to public lands for tribal use

DEIS

In February 2010, the U.S. Environmental Protection Agency (EPA) took the unusual step of commenting on the proposed plan. It criticized the mine plan for the magnitude of its adverse environmental impacts – especially water quality impacts, for its failure to present adequate information to analyze the project, and for failing to identify appropriate mitigation measures to address pollution issues. It gave the project a ranking of “EU-3, Environmentally Unsatisfactory-Inadequate,” a rating the EPA has given out less than one percent of the time for similar projects. As a result, the agencies and the mine company initiated additional work on the proposal. This “Supplemental” draft EIS (SDEIS) is scheduled to be released in Fall 2012.

While PolyMet holds the rights to the minerals at the mine site, they do not own the surface lands at the site. These lands are publicly owned and located in the Superior National Forest. While the Forest Service does permit mining, “it is the position of the United States that the mineral rights leased by PolyMet do not include the right to open pit mine the National Forest System land” (DEIS pg S-1). An underground mine could be consistent with their management plan, but PolyMet has so far been unwilling to consider this option, citing unacceptable financial costs (DEIS pg. 3-68).

Despite years of planning for this mine, and despite the considerable resources put into the preparation of the draft EIS, the mine company still does not hold title to the property. In order for PolyMet to proceed with an open-pit mine on this location, they must obtain the surface rights as well. PolyMet has therefore proposed a land exchange with the National Forest Service. PolyMet would purchase other lands that might be desirable to the Superior National Forest, and then exchange these for the mine site land. At one point, this exchange proposal was proceeding separately from the project’s draft EIS analysis. One of the criticisms the EPA leveled at the project in 2010, was that this exchange, which is integral to the project, was not being analyzed as a part of the overall project EIS. In response, the land exchange proposal is now being integrated into the Supplemental draft EIS. Five separate parcels scattered across northern Minnesota will be proposed for exchange with the mine site.

Concerns about this proposed exchange have been raised from many sectors. The proposed mine site includes land identified repeatedly as some of the highest quality remaining habitat left in that landscape (DEIS, pg. 4.3-2; Anderson 1997; Vora 1997). The mine site contains high-value, thousands-of-year-old peatlands that help with flood control and are critical in storing carbon that otherwise contribute to global warming. While the Superior National Forest may acquire other wetlands in the exchange, it is not clear if their habitat quality matches what will be lost. In any case, northern Minnesota will experience a net loss of valuable peatland habitat from the proposed exchange and mine development. In addition, the exchange would result in a loss of lands inside the 1854 Ceded
Territory, lands available to Ojibwa bands for access for hunting, fishing, gathering and other uses. The exchange lands proposed are also scattered across northern Minnesota and of varying size, some as small as 32 acres. If an exchange occurred, the public would be divesting itself of a known, high-quality, intact and unfragmented piece of land, in exchange for five separate, disbursed pieces. The principles of conservation biology indicate unfragmented lands provide greater ecological value.

Twin Metals’ proposed mine project has fewer details developed as of May 2012 than does PolyMet. However, early indications from the company point to a mine greater in size and production. As Twin Metals has noted, “it will be a lot like an underground city.”

Initial information from the company includes the following features:

• a mine life span of between 22 and 50 years
• excavation of an underground mine, possibly under Birch Lake, and in an area between Birch Lake and the BWCAW along the South Kawishiwi River
• excavation of possibly 80,000 tons of ore per day, putting it on par with some of the largest mines in the world
• considering use of the old Dunka Mine pit for tailings disposal – or using other Duluth Metals land nearby for additional or alternative tailings holding sites

(The Underground mine near Ely would be largest in Minnesota
Technical Report On the Preliminary Assessment on the Nokomis Project, Minnesota, U.S.A.)

The Dunka pit considered by Twin Metals for a tailings disposal area sits at the south end of Birch Lake. It is a site of a former iron mining operation that excavated through sulfide ore and generated Minnesota’s first experience with acid mine drainage. For more than three decades, the site has discharged a toxic mix of heavy metals and acidic waters into an unnamed creek that flows into Birch Lake. With the exception of constructing artificial wetlands to act as passive water treatment, little action has been taken by the responsible mining company or the state of Minnesota to halt the drainage. Monitoring has shown the wetland treatment approach to be unsuccessful at treating the problem.

8. Are there new technologies that will help these mines be safer?

Supporters of bringing sulfide mining operations to Minnesota cite new technologies and modern mining methods as assurances that environmental and human health impacts will be minimal. “The mining industry has availed itself of the high-tech tools necessary to compete in today’s global economy. It is also a better steward of the environment, using modern mining practices and technology to do everything reasonably possible to minimize disturbance and reclaim the land following operations.” Both PolyMet and Twin Metals pledge to protect the environment using modern methods and new science. “PolyMet will protect air and water resources while promoting efficient use of natural resources through an open and transparent process.” “PolyMet and other proponents of the mining resurgence say new technologies... would protect the region and its $700 million tourism industry.” “Twin Metals Minnesota is committed to using modern mining practices... Twin Metals Minnesota is building state of the art mining and environmental protection technologies into every aspect of mine development and operation.”

No mine company sets out with a goal to pollute. Certainly, there are aspects of these projects that represent advancements from the way mining was done a century ago. Nevertheless, an examination of the PolyMet project details, as well as a review of the technologies used by modern mines and their resulting track records, indicates industry assurances may be overly optimistic, and the portrayals of technological advancements are misrepresented.

The plan for the PolyMet mine does include using some new technologies that will help contain, but not eliminate, air pollution. Rather than using a smelting process for extracting the metals from the ore, smelting contributes
to air emissions problems such as acid rain and the release of toxic contaminants that can pollute area soil and vegetation and create human health problems], PolyMet proposes to use a high-pressure, high-temperature autoclave process [DEIS pg. 3-24]. After the ore is crushed and initially processed, the metal “concentrate” will be put into the autoclave where high pressure and added oxygen will create a chemical reaction that creates high temperatures. These high temperatures help separate the metals to be recovered. The process also produces a solution that is highly acidic. PolyMet plans to add limestone to the remaining acidic solution, which they expect to help neutralize the material into gypsum; DEIS pg 3-25 and 26). PolyMet plans to use a special autoclave process called the “Platsol process,” a technique devised specifically for this mine project, but has never been tested or operated at this commercial scale)

Processing the ore without smelting is an advanced approach deserving of acknowledgment. Nevertheless, this new technology does not eliminate significant issues for air or water pollution. Mines using autoclaves have experienced releases of high levels of mercury. Autoclaves should contain mercury-capturing equipment and be regularly monitored to ensure they are properly functioning. PolyMet has not yet indicated if these will be features of their project.

The PolyMet draft Environmental Impact Statement (draft EIS) also outlines air emissions problems that are expected to occur despite the use of an autoclave. The project is projected to contribute haze-producing levels of sulfur dioxide, nitrogen oxides, and particulate matter that will lead to visibility impairments for the region [DEIS pg. 4.6-37 and 53 and 54]. The federal Regional Haze Rule of 1999, requires Minnesota to reduce haze in “Class I areas,” which include the Boundary Waters Canoe Area Wilderness (BWCAW) and Voyageurs National Park in Minnesota. The PolyMet project is predicted to move Minnesota farther away from complying with this requirement. By itself, this mine is expected to result in a five percent visibility impact for 23 days a year in the BWCAW, and as much as a 10 percent impact for one day a year [DEIS pg. 4.6-37]. This is not an insignificant impairment from a single project. Air quality impacts in the draft EIS do also not account for cumulative impacts when the PolyMet project’s emissions are combined with existing or other foreseeable projects (US EPA 2009; DEIS pg. 4.6-44).

Proposed use of special liners and covers to contain contaminated waste material are techniques that are improvements in mining operations. But liners and covers are known to fail (See Question 4 for examples of modern mines that have experienced this). Indeed, the PolyMet draft EIS predicts the failure of many of its liners. For example, the leftover materials from the autoclave process are still sufficiently contaminated to warrant their disposal in a separate and lined section of the tailings basin called the “hydrometallurgical residue facility.” These and other waste materials disposed of together are expected to be especially high in sulfates [DEIS pg. 4.1-64] (See Question 3 for why sulfates are unsafe). Despite a series of liners underneath the wastes designed to “minimize release of water that has contacted the residue,” the basin is predicted to experience leakage to the surrounding area [DEIS pg. 3.33; 4.1-64]. The rest of the tailings basin, which will receive other processing wastes, is not designed to be lined at all, but is predicted to leak pollution to the Embarrass and Partridge Rivers [DEIS pg. 4.1-63]. Engineered liners that are planned to be used around waste rock stock piles – designed to prevent the leakage of acid mine drainage and associated heavy metals – are also predicted to fail. “Concerns remain regarding...the potential for the geomembrane to degrade over long periods of time, and the adequacy of the proposed overliner buffer thickness...to protect the liner from accidental tears or rips...” [DEIS pg. 4.1-75]. It is this leakage that the draft EIS predicts will contaminate groundwater and the Partridge River for as many as 2,000 years [DEIS pg. 4.1-80].

No new technologies will be used by PolyMet in the mining of the ore itself. “PolyMet will mine via traditional open pit methods currently used on the Iron Range.”

PolyMet proposes some special techniques to address waste rock disposal. At the end of the mine’s operations, PolyMet plans to place some (not all) of the reactive waste rock back into the East and Central pits, and allow them to be covered by water, a process called “subaqueous disposal.” The idea is that under water, the waste rock will be more protected from contact with oxygen, thus limiting the chemical reaction that generates acid mine drainage. Under certain conditions, however, this method does not always inhibit the development of acid or metal leaching. It is not clear how well this method will work to halt acid generation for the PolyMet project.
Another special technique proposed in PolyMet’s plan is that the waste rock and water in the East and Central pits would eventually be covered with earthen material and transformed into an artificial wetland. The goal for this created wetland is for it to function as a passive water treatment system for expected ongoing contamination from the pit walls and waste rock (DEIS pg. 3-12). Neither PolyMet nor any other mine operation has demonstrated that this method can successfully perform this function. There are no supporting data to show artificial wetlands will work, and even the draft EIS concludes that the “results have been variable,” where this method has been used elsewhere (DEIS pg. 4.1-112). Minnesota’s experiment in using an artificial wetland for water treatment at the Dunka Pit (see Question 7) showed this to be an unsuccessful technique. As the draft EIS notes, “Constructed wetlands performance, however, is not sufficiently reliable to function as the primary treatment measure for assuring consistent year-round compliance with water quality standards (DEIS pg. 4.1-113). Neither are artificial wetlands reliable at removing mercury. There is very limited data regarding the effectiveness of constructed wetlands in removing mercury” (DEIS pg. 4.1-123). In fact, the draft EIS notes, this kind of wetland treatment system may actually promote mercury methylation (DEIS pg. 4.1-167). PolyMet continues to rely on the wetland idea, building in assumptions that “wetland removal efficiencies in the East Pit passive wetland system would range from 50 to 80-90 percent for six parameters” (DEIS pg. 4.1-63).

Computer modeling of potential impacts from mining operations is a modern technique now used by mines and the agencies charged with permitting new operations. PolyMet highlights its use of precision modeling to help it with its analysis of its project. “The information is then used in state-of-the-art models to predict the potential environmental impacts. PolyMet has worked in conjunction with the agencies and third party contractor to establish modeling protocol.” The United States Environmental Protection Agency (EPA) has found many of the assumptions and features of the models used by PolyMet to be flawed. “The model assumptions and the amount of data used for groundwater modeling at the mine site are inadequate and may not be protective of water quality.” The EPA is critical of PolyMet’s reliance on the outcomes of a particular model, even when it was acknowledged that the model was not developed to accurately predict those events (such as aquifer drawdown and the related impacts to adjacent wetlands and surface waters). PolyMet draws conclusions from modeling results about certain hydrological responses that the EPA finds inconsistent with what is known about the mine site. The EPA notes many modeling assumptions are incorrect and insufficient data were used in the model. In a note to state and federal officials overseeing the PolyMet project, the EPA states, “Any modeling...using this inadequate number of samples would have results that are not scientifically defensible.” Researchers who have studied why hardrock mines often fail to accurately predict pollution, note the need to use better and sufficient site-specific information before operations begin and to carefully use this information within appropriate models. As the EPA’s chief reviewer of the project notes, the model and the data are crucial to the accuracy of the environmental analysis. “It predicts how the (mine) will perform...And that is the essence of environmental impact.”

In describing the techniques to be used in the proposed PolyMet project, industry representatives sometime talk about “recovering” the sulfides. They state that this is a technique they will employ to help minimize acid mine drainage. Mining Minnesota, an industry trade association, notes, “Water that makes its way through an unprotected stockpile of sulfide minerals that has been left exposed to the atmosphere can contain dissolved metals and low pH values. The sulfide, however, contains the desired metals and is sent to the plant for processing.” It is accurate that ore identified as high in the desired metals is sent to the processing plant. However, this will represent only a small amount of the ore that is extracted. The remaining majority of ore is not processed. The sulfides are not removed, having been determined to be of no economic value, and are left on the land. It is these sulfide-bearing materials that are at risk of generating acid and metal contamination. In PolyMet’s situation, more than 64 percent of the materials extracted, 394 million tons, will never be sent to the processing plant (DEIS pg. S-5; 3-2).

Liners, lack of smelters, and under-water disposal of mine wastes are important mine features. Nevertheless, experience shows they do not prevent significant environmental impacts. PolyMet’s assertion that “state-of-the-art technology...offers significant environmental benefits” is not borne out by the experiences of other mines, the impacts predicted in the draft EIS, or by a review of current methods and technology. PolyMet and Twin Metals do make promises that, if implemented, would be useful practices, such as installing air emissions controls even though not required by environmental regulations and re-circulating water in mine operations to minimize water use.
9. Will these mines provide needed jobs and an economic boost for the region and the state?

If sulfide mines are permitted in Minnesota, some job creation will occur. It is unclear how many jobs this would be, for how long, for whom, and at what cost.

The country’s recession has greatly affected northeastern Minnesota’s economy and employment. Nevertheless, even before the 2008 financial collapse, persistent unemployment has been a problem for the region. Since 1979, when the region’s mining jobs peaked at 14,000, the area has experienced a continual decline in mining employment, reaching a low point of fewer than 3,000 jobs in 2009.

In May 2012, overall unemployment rates for two of Minnesota’s primary mining counties, St. Louis and Lake, were respectively 7.7 and 6.6 percent. New business development bringing new employment opportunities would offer some relief to this region of the state.

Some look to the development of sulfide mines as a source of unemployment relief and economic assistance to communities. In analyzing what sulfide mining could offer, it is important to closely examine job predictions and outcomes, community economic responses to mining operations, and potential impacts to other economic sectors.

A study of hardrock mines around the country shows that mine proposals often start out with extremely high job predictions, only to have these whittled down as the design is developed. But these early projections can significantly influence initial public and policy-maker decisions about whether the operations are a good deal for the state.

PolyMet is a good example of an operation that has scaled back its job predictions. In October 1999, PolyMet estimated it would employ between 425 and 450 people, and that indirect employment would create up to 3,600 jobs in the Iron Range. The mine’s life span was predicted to last for possibly 40 years.

A year later, PolyMet’s predictions were more optimistic, citing 450 jobs at the mine and processing plant, and a mine life of up to 45 years. PolyMet used a multiplier to calculate indirect employment of five to seven indirect jobs per direct job, a projection far beyond others in the region (another study on mining employment by the Bureau of Business and Economic Research at the University of Minnesota Duluth, projects fewer than two indirect and induced jobs per direct job) (Bloomquist, L. 1999).

By November 2006, PolyMet had revised the job number to 400 permanent workers, with construction jobs at no more than 1,000 (Bloomquist, L. 2000). In February 2011, employment numbers for the PolyMet project changed once again when the company made a significant design change in the project. PolyMet announced it would no longer produce cathode copper on site, but instead use a single autoclave to create copper and nickel concentrates to be shipped elsewhere to be processed. This change reduced permanent jobs to 360 when the mine is at full capacity, and construction jobs to 500. The decision to not produce cathode copper eliminated prospects for associated industries producing wire, tube and other products from the copper.

In addition, PolyMet predicts that 55 percent of the jobs would be “non-local” and filled by individuals relocating to the area, 20 percent would be commuters from “centers such as Duluth,” and only the remaining 25 percent would be local hires (DEIS pg. 4.10-15). Even if Polymet’s prediction of 360 direct jobs is fulfilled, only 90 of these jobs would come from the local community. It remains to be seen whether the jobs filled by local individuals will be the higher skill, higher paid jobs or the lower skill, lower paid jobs.

While Twin Metals is still developing its mine design, it has made early predictions for direct and indirect employment, projections. In August 2010, Antofagasta Chairman Jean-Paul Luksic “estimated from 2,000 to 2,500 individuals would be hired as permanent operations staff” at the mine (TendersInfo.com. 4 Aug 2010). By December 2010, Twin Metals modified the prediction, stating the mine could employ 1,500 workers over a mine life of at least 30 to
By May 2012, Twin Metals on its website predicted it will provide “hundreds, potentially thousands, of long-term, well-paying jobs for generations of Minnesotans.” At the same time, company information provided to media predicted “more than 1,000” people employed, and a mine that could last “a half-century or more.” Further development and clarification of their project design will confirm if Twin Metal’s job projections continue to be scaled back.

In 2008, the mining industry and the Minnesota state agency Iron Range Resources, commissioned a study by the Bureau of Business and Economic Research (BBER) at the University of Minnesota Duluth. The goal of the study was to project the number of jobs created by existing and future iron and sulfide mining operations. Its findings were that more than 12,000 construction jobs and 5,000 long-term mining jobs would be created in Minnesota by 2013 if all non-ferrous mining projects currently under study moved forward and became operational.

These findings require closer examination as the study did not reveal how many or which non-ferrous mining operations it modeled as becoming fully operational. This is important because Minnesotans and our decision-makers may have different levels of acceptance for different projects, for projects in certain locations, and for a threshold number of sulfide mining projects. A great many jobs could be created by permitting hundreds of sulfide mines, but if this is an unrealistic expectation from our public and its government, those numbers are meaningless. The study also did not break out job predictions by individual projects. Information for this study and its modeling was provided by the mining companies themselves, Duluth Metals, Encampment Minerals, Franconia, Kennecott, PolyMet, and Teck-Cominco. The study also acknowledges that this report was not a cost-benefit analysis of mining operations.

What is the likelihood that if permitted, Twin Metals and PolyMet will meet their job predictions? For help answering this, we can study metal mines opened or expanded in North America during the last decade and their job projections. An examination of five of these mines [Safford, Morenci, Carlotta mines in Arizona; Lisbon Valley mine in Utah; Montcalm mine in Ontario] shows that job predictions can sometimes be met if metal prices remain high and if there are no technical challenges. But these are conditions that rarely last, and the data show us meeting employment targets can be short-lived.

The Safford and Morenci mines in Arizona are good examples. Both are owned by the same company, are adjacent to each other, and are located in an area with shared characteristics with northeastern Minnesota. Similar to the Iron Range, they are located in a mining district that has experienced booms and busts. The area encompasses two rural counties far from urban centers and with a high percentage of land owned by the U.S. federal government. And, like the Iron Range, the area has a long mining history. The Safford Mine began construction in 2006. The Morenci Mine has been in operation for more than 100 years, but as an open pit mine since 1937. At the height of the copper market in mid-2008, Safford and Morenci mines were at full employment. By the end of that year, the mines laid off 402 workers at Morenci, and 59 at Safford. As metal prices continued to fall, the mine made more layoffs. Over 600 layoffs were made before the year was over. In 2009, over 2,000 miners were laid off between the two mines [Wise, H and Conn, S. 2008; Rudolf, J.C. 2008]. As copper prices began to increase again in late 2009 and 2010, the mine began hiring again (Freeport-McMoran Copper and Gold. May 2011).

This is the story of many other mines. The Carlotta Mine in Arizona, the Lisbon Valley Mine in Utah, and the Montcalm Mine in Ontario, Canada have all experienced fluctuating employment as mines respond to market changes, technical problems, safety issues, and temporary closures.

The Safford and Morenci mines also provide information about what kind of economic prosperity metal mining communities experience. Even when these mines had full employment, the surrounding area continued to have high unemployment, higher than the average for the rest of the state. And, despite the opening of the Safford Mine, the population of the county went down. While the new mine created jobs, especially in the construction phase, the economic benefits were not sustained or uniformly shared.

This phenomenon of mining communities failing to prosper, even when the mines are operating at their peak and despite high mining wages, has been noticed by researchers. “Across the United States, mining communities, instead, are noted for high levels of unemployment, slow rates of growth of income and employment, high poverty rates,
and stagnant or declining populations.” One analysis compared mining-dependent counties (those where mining represented 20 percent or more of the labor earnings) with those that are non-dependent. Between 1980 and 2000, “aggregate earnings in mining-dependent counties grew at only half the rate of other American counties...and per capita income grew about 25 percent slower.” During this same time period, population growth in these counties was only one-fourth to one-eighth of the average of other counties in the country.

Another analysis conducted a literature review of relevant studies to examine whether extractive industries bring expected economic benefits to rural regions. “Contrary to the long-established assumptions...roughly half of all published findings indicate negative economic outcomes in mining communities, with the remaining findings being split roughly evenly between favorable and neutral/indeterminate ones.” This study concludes, “Until or unless future studies produce dramatically different findings, there appears to be no scientific basis for accepting the widespread, ‘obvious’ assumption that mining will lead to economic improvement.”

A 2003 study by the Sonoran Institute looked at the relationship of how public lands are managed in the Western United States and the economic health of neighboring communities. The study discovered an “inverse relationship between resource dependence and economic growth; the more dependent a state’s economy is on personal income earned from people who work in the resource extractive industries, the slower the growth rate of the economy as a whole.”

Poverty is higher in mining areas as well. Counties classified as dominated by mining by the U.S. Census Bureau, show the highest rates of poverty of any industrial group. These poverty rates increased between 1989 and 1996.

As one researcher notes, “The important point to be drawn from all of these statistical results from an economic development perspective is that whatever might be said about the impact of mining on national economic development, in the U.S. these mining activities, in general, have not triggered sustained growth and development in the local regions were the mining took place.”

Many reasons account for the lack of long-term economic prosperity for mining communities: fluctuating market prices and employment, technological advancements that replace human labor, depletion of the ore body, a non-renewable resource. Mining is an industry with a history of booms and busts. In Minnesota, where iron mining once provided 43 percent of income to Lake County, it now measures about 13 percent. So too for St. Louis County, where it once was a source of about 13 percent of the county’s income, today iron mining accounts for about five percent.

In addition, mining creates a significant, lasting impact on the local environment. It is land-intensive, has a wide footprint, and brings a level of environmental degradation that can make the area a less attractive location to live and work. This inhibits economic diversification critical for the economic prosperity of the wider community.

When iron mining in northern Minnesota slumped after the late 1970s, the non-mining sectors for the region “showed considerable vitality, allowing ongoing expansion despite the...
loss of the mining jobs and payroll.” Since mining had been the foundation of those economies, why didn’t they collapse? An examination of what transpired for those counties may help Minnesota make decisions about what role sulfide mining should play in the area’s future economy.

In St. Louis County, as real earnings declined from iron mining and processing, earnings in the rest of the economy – in services, trade, finance, government, expanded steadily.”

The services’ sector increased 104 percent and health services expanded, adding $334 million in real income. Income from sources other than employment, such as dividends, rent, interest and federal payments, increased by $380 million. Also of note – the changes in employment did not involve a shift from high-paid jobs in natural resources to low-paid work. “Among the industries with the largest gains in employment and real income were medical services, construction, government, and finance. In addition, investment and retirement income expanded significantly, injecting income into the local economy….”

This county maintained its vitality “through the diversification of the economy away from traditional natural resource activities…. The source of almost all new jobs and income lay outside of those industries that are usually assumed to make up the local economic base.”

This is does not mean resource extractive industries don’t play an important role for local economies. It does, however, provide insight into creating long-term, sustainable growth and development for communities.

The proposed mines are planned for the heart of Minnesota’s lake country. Whether the mines will negatively impact other economic sectors and employment has not yet been analyzed. This is a region where resorts, hotels, bed and breakfasts, outfitters, sporting good stores, guide services, cabin and second home real estate agencies, gas stations, restaurants, campgrounds, and gift stores depend on tourism and recreation dollars. Tourism and recreation is a $1.6 billion industry for northeastern Minnesota. The Forest Service estimates that the Superior National Forest brings in $500 million dollars to the region, $100 million of that from people coming to the Boundary Waters Canoe Area Wilderness (Supervisor J. Sanders, Superior National Forest, Heart of the Continent Presentation, October 2011).

A study by economist Spencer Phillips shows that communities near wilderness areas experience an array of economic benefits, including the attraction and retention of businesses and increased property values. Another study of western states by the Sonoran Institute found the more public lands a county had or the closer it was to protected lands, the faster the economic growth was for that county. The study also concluded for the states it studied, “the more diverse an economy, the faster it will grow. The more specialized, the slower it will grow, especially if the specialization is in mining, oil and gas development, logging, wood products manufacturing, or other resource extractive sectors.”

A growing number of businesses and individuals are concerned about the potential negative economic impacts from sulfide mining, as reflected in public comments on the PolyMet draft Environmental Impact Statement, in opinion pieces and letters to the editor in local and statewide media, in statements at public forums, and at the October
meeting of the Governor’s Executive Council. The case studies in Question 4 reveal significant taxpayer liabilities for sulfide mines that have polluted. What if this happens in Minnesota? Questions about possible negative economic impacts from sulfide mining have not been fully explored. A full cost-benefit analysis of sulfide mining’s potential impacts for Minnesota has not been conducted. Sulfide mining proposals are being forwarded and analyzed in the absence of answers to these and other important questions. Good economic decisions are informed by examining relevant information. Right now, Minnesotans don’t have access to that information.

10. Who may benefit and who may be at risk with these mines?

Who may benefit?

- **International corporations with financial interest in the mines.** Both PolyMet and Twin Metals are international corporations with international major investors [like Glencore] who stand to benefit from the proceeds of the sale of minerals from the mines.

- **Local communities.** The mine projects will foster a certain number of direct and indirect jobs. [See Question 9 for more details about mining job predictions.] How many jobs will be created is not yet known. For both proposed mines in Minnesota, job predictions have already been revised downward. PolyMet itself predicts that 55 percent of the jobs would be “non-local” and filled by individuals relocating to the area [DEIS pg. 4.10-15]. It remains to be seen whether the jobs filled by local individuals will be the higher-skill, higher-paid jobs or the lower-skill, lower-paid jobs. As noted in Question 9, these jobs are usually unstable, fluctuating with the volatile nature of international mineral markets. There is no guarantee that PolyMet’s job predictions will not continue to shrink as the project design is modified.

- **Society:** We rely on metals in the products we use every day: computers, cell phones, green technology, medicines.

Who may be at risk?

- **Taxpayers.** Sulfide mines in the United States, almost without exception, have left a legacy of toxic pollution behind. Commonly, the mining company (or, more accurately, the subsidiary or corporate entity created specifically to manage that mine) has very few resources by the time the mining project is winding down to address cleanup and long-term monitoring of the site.

Section 108(b) of the Comprehensive Environmental Response, Compensation and Liability Act [CERCLA; commonly called “Superfund”] gives the U.S. Environmental Protection Agency (EPA) the authority to require mines to retain financial responsibility for the damage caused by production, transportation, treatment, storage or disposal of hazardous substances at the mine site, including the pollutants that are the byproduct of sulfide mining. When contamination at a site requires EPA intervention, these sites become known as Superfund sites. CERCLA established a tax on certain industries to be held in a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. When a Superfund site is identified, the EPA attempts to hold liable the persons responsible for the cleanup. The trust fund is used where no responsible party can be identified. However, locating and holding liable responsible parties has proven to be a lengthy, complex and difficult process.

The EPA has identified the hard rock mining industry as a priority for developing financial responsibility requirements. It will propose rules for financial responsibility in the industry for its Superfund liabilities in 2013. In the meantime, a great many hardrock mines are already Superfund sites. The EPA estimated in 2004 that there are 156 hard rock mining Superfund sites with potential cleanup costs ranging from $20 and $54 billion, well in excess of the existing cleanup funds.

- **Local communities, economies and property values—** While local communities benefit from some new employment, a community that is dependent upon a mining operation for employment and economic viability is also vulnerable to volatile international mineral markets. Mining jobs often rise and fall during the life of the mine, and naturally end all together when the mine closes. [See Question 9 for more details on this and the economic impacts to mining communities.]
While the life-span of a mine is finite (the PolyMet mine is expected to last 20 years), negative impacts to communities may be experienced for a much longer time. Local property values may fall in nearby areas. If the area has been valued for aesthetic reasons, there may be long-lasting impacts to tourism, outdoor recreation, and hospitality-related businesses. As described in Question 9, communities near wilderness areas and other public lands experience certain economic benefits. These benefits may be compromised by surface disturbance from mining, water pollution, and visitor perceptions that the area has transitioned to an industrial district.

**The state budget** - No analysis has been conducted to assess what impacts sulfide mining could have on our state budget. Just such an assessment was performed on the impact of coal mining on the West Virginia state budget. West Virginia analyzed both the tax revenues and the expenditures associated with this industry for fiscal year 2009. They discovered that the total impact to the West Virginia state budget was a net cost of $97.5 million. The study not only looked at revenues from various mining payments of taxes and fees, but also examined coal-related expenditures in the form of units of government involved with mining; costs for repair of mining haul roads; forgone revenues from industry tax exemptions, credits and preferential tax rates; and certain state expenditures connected to supporting mining employment. Minnesota has not performed the same analysis to determine if sulfide mining could similarly result in a net cost to our state budget.

**Minnesota’s tribes** – Minnesota’s tribal communities are directly affected by mining operations in Minnesota. Wild rice is an important economic and cultural resource for Minnesota’s tribal communities. Both taconite and sulfide mines discharge sulfate, a pollutant that is harmful to wild rice production. The Minnesota Pollution Control Agency (MPCA) already grants tax permits to taconite mines, allowing them to discharge sulfate in excess of the limit for wild rice waters (10 mg/L). PolyMet has stated it intends to meet the standard with its project. However, the PolyMet draft Environmental Impact Statement predicted sulfate discharges that could exceed water quality standards. As of May 2012, the company has not yet articulated how it intends to meet the standard.

**Society:** Much of our demand for these metals could be met through conservation and recycling. “Metals are eminently and repeatedly recyclable without degradation of their properties.” Recycling copper instead of extracting new results in an 85 percent energy savings. Metals recycling reduces the cost of landfilling, and “creates many more jobs than does landfilling and waste disposal.”

11. How are these mines approved or rejected?

Proposed mining projects must first go through an environmental review process, and then apply and receive a variety of permits. For the proposals in Minnesota, state, federal, and tribal agencies are involved in this process.

**STEP 1 - ENVIRONMENTAL REVIEW**

Any mine is required to prepare an Environmental Impact Statement (EIS) before permitting under the Minnesota Environmental Policy Act. Since PolyMet’s proposal also requires involvement of federal agencies, it is required to do an environmental review under federal law, the National Environmental Policy Act (NEPA). However, PolyMet does not have to undergo two environmental reviews. It is consolidated into a single process.

In the environmental review process, a lead agency is picked to oversee the review. The review takes place at the expense of the project proposer. The Minnesota Department of Natural Resources (DNR) is the lead for any state-level EIS. In PolyMet’s case, the U.S. Army Corps of Engineers is a co-lead agency due to the mine’s plan to fill in and destroy wetlands, over which they have jurisdiction. The U.S. Forest Service is another co-lead agency due to the plan to exchange the publicly-owned mine site for lands acquired by PolyMet. The U.S. Environmental Protection Agency is a cooperating agency because of its oversight in enforcing the Clean Water Act and the Clean Air Act. The Boise Forte Band of Chippewa and the Fond du Lac Band of Lake Superior Chippewa are also involved.
as cooperating agencies. Their involvement is because the mine and plant sites are located within the 1854 Ceded Territories, under which the Bands retain hunting, fishing and gathering rights. And the U.S. Fish and Wildlife Service is involved due to the project’s potential impacts to endangered species such as the Canada lynx.

The process starts with an Environmental Assessment Worksheet (EAW), a brief description of the environmental impacts of the project. Publication of the EAW begins a 30-day comment period on the “scoping” of the EIS, or the identification of potentially significant issues, the level of detail required, content, alternatives evaluated, time table for the EIS process, and the permits for which information will be developed concurrent with the EIS.

According to Minnesota rules, the EIS must contain, among other things, a description of the project, a list of government permits and approvals required, reasonable alternatives to the proposed project such as alternative sites, technologies, modified scale or magnitude, and alternatives incorporating mitigation measures. The EIS must also evaluate environmental, economic, employment and sociological impacts of the project, as well as mitigation measures that could reasonably eliminate or minimize any adverse impacts identified.

Environmental Impact Statements are strictly evaluative. That is, the National Environmental Policy Act (NEPA) requires the lead agency to take a “hard look” at environmental impacts of government actions and to do so in an analytical and thorough fashion. The goal is to force agencies to look at the environmental impacts of a project and analyze potential alternatives, including the alternative that no project proceeds. It does not require that the project proposer choose any particular alternative, only that the alternatives are thoroughly analyzed. It is an information-gathering tool. Nevertheless, the process of evaluating the project and obtaining public input may improve a project as concerns are identified. “NEPA emphasizes the importance of coherent and comprehensive up-front environmental analysis to ensure informed decision making to the end that ‘the agency will not act on incomplete information, only to regret its decision after it is too late to correct.’” Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1216 [9th Cir. 1998] [citing Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 371, 109 S.Ct. 1851, 1858 (1989)]. The purpose of a draft Environmental Impact Statement (“DEIS”) is to prepare a “detailed statement” that discusses the environmental impacts of, and reasonable alternatives to, all “major Federal actions significantly affecting the quality of the human environment.” 42 U.S.C. § 4332(2)(C). The DEIS must “provide full and fair discussion of significant environmental impacts and shall inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment.” 40 C.F.R. § 1502.1.

NEPA and the Minnesota Environmental Policy Act (MEPA) both require that the project proposer develop a draft of the EIS and receive public comments on the draft before issuing a final EIS. Polymet’s draft EIS underwent a public comment period in 2010. It was criticized for, among other things, failing to account for impacts on water quality, failing to provide an estimate of costs of closure and long-term monitoring of the site for pollution for financial assurance purposes, and failing to evaluate the associated land-swap with the Forest Service. The next version, the “Supplemental Draft Environmental Impact Statement” (SDEIS) is expected to be released for public review in Fall 2012. At that time, there will be a public review and comment period for at least 45 days, but possibly longer if the state and federal agencies extend that time period. Agency staff will review the input to the SDEIS, incorporate any changes determined necessary, release a Final Environmental Impact State (FEIS), and then prepare a Record of Decision (ROD) that will outline what the decision is.

**STEP 2 - OBTAINING A PERMIT TO MINE AND OTHER NECESSARY PERMITS**

Upon completion of the environmental review process, the agencies will consider whether to grant a variety of different mine permits. For PolyMet, the permits under consideration include a “Permit to Mine, an integrated State Disposal System (SDS)/National Pollution Discharge Elimination System (NPDES) Permit, an Air Emission Permit and a Section 404 Permit for Wetland Impacts. These permits must be issued before PolyMet can begin construction.” Multiple agencies are responsible for granting the permits. If granted, development of the mine can proceed. Permits may be granted quickly following completion of the EIS.
Agencies Granting Permits:

**Minnesota Department of Natural Resources** – The Department of Natural Resources issues the Permit to Mine, as well as a host of ancillary permits that may be required for operation, such as water appropriation permits, endangered species taking permits, and dam safety. [DEIS pg. 1-5].

**Minnesota Pollution Control Agency** – The MPCA issues permits for discharge of pollutants to surface water under the Clean Water Act, or NPDES Permits; solid waste management; air emissions under the Clean Air Act; and also must either certify that the project will comply with state water standards under Section 401 of the Clean Water Act (though it may choose to waive that certification).

**Minnesota Department of Health** – The Minnesota Department of Health regulates the quality of groundwater. It may need to issue permits to the project related to its water supply and protection of well water.

**U.S. Army Corps of Engineers (USACE)** – USACE must issue a permit for dredging or filling navigable waters under Section 404 of the Clean Water Act. PolyMet is currently proposing to destroy 1,600 acres of wetlands, the largest single loss of wetlands in Minnesota history. As a result, USACE is a co-lead agency on the environmental review process.

**U.S. Fish and Wildlife Service** – The U.S. Fish and Wildlife Service must be consulted to determine whether there are significant effects on an endangered species.

**U.S. Forest Service** – The USFS currently manages the land on which the proposed PolyMet mine will be placed. The USFS does not allow open pit mining of the type that PolyMet is proposing. Thus, a portion of the PolyMet EIS will analyze the environmental impacts of a land-swap between USFS and PolyMet. The USFS’s role is to determine whether this land-swap is in the public interest and ensure that PolyMet will trade for lands that are approximately equal in value.

**U.S. Environmental Protection Agency** – The EPA would be a consulting agency for most mining EISs. However, their opinion of the EIS is very important because they enforce so many of the environmental laws regulating mines. The EPA rated PolyMet’s first draft of its EIS “inadequate,” the worst possible rating. While the EIS does not require EPA approval, PolyMet will need to take EPA’s critiques seriously in the next draft and seek EPA approval to avoid a legal challenge of the adequacy its final EIS.

**The Minnesota Department of Natural Resources (DNR)**

The DNR plays two conflicting roles with regard to mining. As the agency charged with granting mine permits, it must ensure no mine proposal moves forward unless it is environmentally sound. But the agency is also given the charge to promote mining as an industry. This sets up a conflict of interest within the agency.

The DNR houses the Division of Lands & Minerals, which is tasked with managing the state’s mineral resources “for the benefit of all Minnesotans” and managing mineral exploration and development on state-owned and tax-forfeited lands to generate income for Minnesota’s schools, communities and the general fund. Thus, it may be unlikely that the DNR would deny a permit to mine because it is also tasked with managing the mineral resources to benefit all Minnesotans.

The U.S. Department of the Interior had a similar conflict at the national level. The Department of Interior once housed the Minerals Management Service (MMS), which regulated, among other things, oil drilling in the Gulf of Mexico. The MMS exempted BP’s Gulf of Mexico drilling from doing a detailed environmental impact statement. The Center for Biological Diversity observed that the agency had relinquished all control over BP’s operations and “devolved to little more than rubber-stamping” of BP’s proposed drilling operations. In the days leading up to the BP oil spill, the MMS ignored warning signs that the Deepwater Horizon had significant problems. On April 20, 2010, an explosion at the drilling platform killed 11 workers, injured 17 more, and resulted in the largest oil spill in the history of the petroleum industry.
In the wake of the disaster, the Obama Administration dismantled the MMS and established two separate, independent bureaus to carry out management of offshore drilling and safety and environmental oversight. The DOI press release announcing the change stated that:

The Deepwater Horizon blowout and resulting oil spill shed light on weaknesses in the federal offshore energy regulatory system, including the overly broad mandate and inherently conflicted missions of MMS which was charged with resource management, safety and environmental protection, and revenue collection.

Only time will tell whether DNR can manage its conflict of interest better than MMS did.

12. How soon might decisions happen for these mines?

Since 2010, the PolyMet project has been undergoing additional study, analysis and design modifications. The next version, the “Supplemental Draft Environmental Impact Statement” (SDEIS) will be released for public review in Fall 2012 [See Question 11 for details of the decision process.] The PolyMet proposal has encountered numerous delays. It is not possible to know at this time if additional delays will occur that change the decision timing for this mine proposal.

With the release of the SDEIS, there will be a public review and comment period for at least 45 days, but possibly longer if the state and federal agencies extend that time period. Agency staff will review the input to the SDEIS, incorporate any changes determined necessary, and then release a Final Environmental Impact State (FEIS). The FEIS will be circulated for public comments for 30 days. Following this, the agencies will prepare a Record of Decision (ROD) that will outline what the decision is.

Officially, the Environmental Impact Statement (EIS) does not approve or disapprove a project, but rather outlines what the environmental impacts of an action will be and describes alternatives and plans for how to mitigate impacts. Nevertheless, the completion of an EIS with a Finding Of No Significant Impact (FONSI) usually leads to the development of the project.

The Twin Metals project is not yet in the environmental review process. As of May 2012, it is still completing its “pre-feasibility study,” which will provide more details of their project. Twin Metals anticipates completion of the study in 2013. Following this, the environmental review process may begin which would likely be a multi-year process.

13. If these mines are approved, what will the changes be for northern Minnesota?

Without a cost-benefit analysis for these projects [See Question 9], knowing the full extent of changes in store is not possible. But certain outcomes are known or can be expected.

The PolyMet mine site will be excavated, creating three crater-sized pits. One of these pits will remain after the mine closes, filled with water that will likely contain contaminants. The other two pits will be filled with waste rock and water and turned into artificial wetlands. While the proposed mine site is currently public lands, the project would result in this land being exchanged and turned over to the mine company. The entire mine area and some of the surrounding area will be fenced off and restricted from public access during the mine operations and remain so after the mine closes. Water treatment facilities would need to remain in operation after the mine closes, although PolyMet has not defined the type of facilities it believes will be necessary, nor how it plans to finance its long-term operation. As long as the drainage from the closed mine continues to be contaminated, water treatment will be needed. The draft Environmental Impact Statement indicates that this could be for thousands of years. [DEIS, pgs. 4.1-45, 4.1-64, 4.1-113, 4.1-123].
The Twin Metals mine project would be about two or three miles from the Boundary Waters Canoe Area Wilderness (BWCAW). The ore body to be mined is adjacent to the South Kawishiwi River, along both sides of scenic Highway 1, and under Birch Lake. This is expected to be an underground mine, and exactly where features like the mine building facilities, the entrance, and ventilation shafts will be is not yet public. It is likely, however, given the ore location and predicted size of this operation, that people would experience mine trucks along scenic Highway 1 and on other area roads. Blasting noises and vibrations may be experienced in the area, including in the BWCAW. The ore body is under a great deal of public lands, and it is possible areas now accessed by the public will be restricted and fenced off. It is probable that a mining presence in the area between Birch Lake and the BWCAW would be noticeable. Like PolyMet, it is likely long-term or perpetual water treatment facilities would be needed after the mine has been closed. Who would run and pay for these facilities has not been defined.

Not yet fully understood are the possible impacts to tourism and recreation in the area. This area is currently used for fishing, canoeing, camping, and accessing the Boundary Waters Canoe Area Wilderness (South Kawishiwi River and Little Gabro Lake entry points). Private cabins, an historic research facility, a resort and an Outward Bound camp are also in the area. People in this area are already experiencing impacts from mineral exploration, such as drilling sounds, clearcut drill pads, and increased traffic from drilling trucks and equipment. These impacts would likely increase should a large-scale mine be developed. Some real estate professionals are noticing investments in property and land sales to have fallen off with news of mineral development. Property values within a certain area around the mine may be impacted.

If water pollution from either mine occurs (this is predicted by the PolyMet draft Environmental Impact Statement; analysis of Twin Metals’ mine has not yet occurred), fish could become too contaminated for safe human consumption. Fish consumption advisories for area waters would then be issued. For some people, drinking clean water directly from lakes in the BWCAW is an important wilderness value, and this would be unwise to continue should water contamination occur.

Should mineral exploration across the Superior National Forest continue to increase, as predicted by the U.S. Forest Service, the public will notice the creation of additional mining roads and clear-cut drill pads, as well as increased noise and traffic from mining trucks and equipment. Each drill site consumes large quantities of water, which are drawn from local water sources, such as lakes, streams, wetlands and ponds. Drawdowns may be experienced in some cases. Between mineral exploration and additional mine projects that may be proposed, the public is going to see a changed Superior National Forest, where mineral development activity is noticeable and is a major activity on these public lands.

14. What have other states done to protect themselves from sulfide mining pollution?

Some states have determined a need to improve financial assurance provisions to adequately ensure funds are available for pollution problems and to do mine reclamation. Financial assurance is money the mining company must provide to address pollution problems later, much like a renter of an apartment puts forward a damage deposit in advance. Some western states have not required this from mine companies. Other states are deciding that the amount of assurance has either been inadequate or the form of financial assurance has not been secure from corporate bankruptcy. Without adequate, secure funds, pollution can continue unaddressed or taxpayers are left to pay for expensive cleanup costs.

Some states are pursuing higher levels of financial assurance to adequately address water pollution problems and long-term water treatment. New Mexico, after experiencing significant pollution problems from two of its sulfide mines, increased financial assurance for the two mines to roughly $400 million each. Montana is another state that, after significant mining pollution experiences and financial liabilities, increased financial assurance amounts that ranged from 50 to more than 10,000 percent.
While these are large sums of money, they sometimes still do not cover the full amount of the calculated liability. In other words, pollution issues could be to such a degree that even these sums of money cannot adequately clean them up. For example, while the New Mexico mines mentioned above have a combined financial assurance of about $820 million, estimates of the collective liability for these mines suggest an amount greater than $1.5 billion.

States may also try to protect themselves by requiring more secure forms of financial assurance. Some states are recognizing that forms like corporate self-guarantees, which are basically pledges made by the company, do not prevent the funds from evaporating should the company go bankrupt. "Cash or its equivalent is the preferred form of financial assurance, as it is the most secure and readily available in the event of a mining company’s default." Forms of cash or equivalents can include letters of credit, which are bank guarantees, certificates of deposit, government bonds and trust funds. "Cash financial assurance, together with an accurate assessment of reclamation requirements, is the best protection for taxpayers against paying for cleanup. Where closure costs are long-term (in many water treatment situations, costs are ‘in perpetuity’), forms of cash such as trust funds are the only practical way to provide a financial guarantee.”

Closure costs for a mine fall into two separate categories. The first is the cost of reclamation of the site. This involves filling in holes, planting vegetation, and attempting to restore the land to its pre-mining state as much as possible. The second is the cost of long-term water monitoring and treatment at the site. This second cost is likely to be much larger and more difficult to calculate. Some researchers who study mines across the country warn state regulatory agencies against permitting projects that will require long-term or perpetual water treatment. "...The financial risk to the public involved with permitting a mine that calls for treatment of water in perpetuity is poor public policy." Establishing accurate calculations for how much financial assurance is needed for water treatment that lasts forever can be challenging and inaccurate. If the bond is too little, taxpayers will eventually pay the costs. If the bond is too high, mine companies may lose the profitability of the operation. Agencies are put in the tough spot of trying to anticipate average inflation over long periods of time. Errors in calculation, even by single percentage points, can result in huge changes in the bond amount. Moreover, the form of the financial assurance may not stand the test of time, when the time-frame is effectively forever. "Financial institutions, and even government institutions, have a finite life." Water pollution from sulfide mining is likely to outlast these institutions, but still needs to be addressed.

Minnesota’s financial assurance regulations for sulfide mining were written 20 years ago and have never been tested. In the intervening years, much has been learned from the experiences of other states, and advocacy groups have lobbied for strengthening the provisions to avoid costly mistakes. In 2010, a bill introduced in the Minnesota Legislature proposed improvements that included:

- ensuring all financial assurance calculations include the costs of long-term water treatment, which is the most expensive reclamation part of a sulfide mine, but in some states has been left out of cost calculations.
- calculating financial assurance numbers during the environmental review process as the U.S. Environmental Protection Agency has urged. Knowing if adequate funds will be available is integral to understanding the full environmental impacts of a mine.
- stipulating the acceptable, secure forms of financial assurance that will be allowed.

Mining industry representatives and some legislators argued forcibly against these improvements, and the bill did not pass.

Beyond financial assurance measures, states are using other means to protect themselves from long-lasting sulfide mining pollution. In Arizona, large numbers of hardrock mining proposals at the very edge of the Grand Canyon National Park threatened the Park, the Colorado River, the region’s watershed, and the $3.5 billion tourism and outdoor recreation industry. A state coalition of politicians, tribal leaders, businesses, civic leaders, city and county officials, hunting, fishing, ranching and conservation interests pushed for an initiative that would prohibit new hardrock mines in the area around the Park. After years of study, the U.S. Department of the Interior formally signed a 20-year moratorium for new mines on one million acres of federal land around the Grand Canyon. Interior Secretary Salazar noted that the jobs in tourism and recreation outweighed the potential loss of employment from restricting mining.
Wisconsin offers other examples of responses to sulfide mine proposals. When the Crandon Mine was proposed in northeastern Wisconsin near the Mole Lake Ojibwe Reservation, there was concern the mine would pollute a downstream Class I trout stream and wild rice beds. A coalition of American Indian tribes, fishing groups and environmentalists waged a multi-decade effort to defeat the mine. In 2002, the U.S. Supreme Court ruled in favor of the right for Indian nations to enforce their own, potentially more restrictive than the state’s, water standards. Given this potential and that the state’s environmental review predicted greater groundwater contamination than the company had projected, the mining company found the project to no longer be economically feasible. It sold the mine site to area Indian tribal governments, which have no plans to develop the area as a mine.

The public awareness raised over the Crandon Mine in the late 1990s helped bring about the passage of a law in Wisconsin that some have dubbed the “Prove It First Law.” In 1998, Wisconsin passed a moratorium for opening new sulfide mines until a similar mine could be demonstrated elsewhere that had been operating for ten years and closed for ten years without having created acid mine drainage. Before the Crandon mine was defeated, the mine company sought to meet this burden of proof, providing three example mines. The Wisconsin Department of Natural Resources found two of the mines did not meet the requirement for having been open and closed for ten years. The third mine was rejected for failing to show it had not operated without creating pollution. Since that time, no new sulfide mines have been proposed.

15. What can the federal government do to address problems with this kind of mining?

The Environmental Protection Agency (EPA) is engaged in several activities to improve hard rock mining operations in the United States. As an agency that consults on Environmental Impact Statements (EISs) for mining operations, the EPA has attempted to hold mining companies to a high standard of environmental review. The EPA rated PolyMet’s first draft of its EIS “inadequate,” the worst possible rating, in part because of a failure to address long-term water quality impacts and a failure to address financial assurance.

In addition, the EPA objected to PolyMet’s failure to include an assessment of the environmental effects of its proposed land-swap with the Forest Service that will make the mine possible.

The EPA is also drafting rules to address financial assurance for hardrock mining operations. In 2009, the EPA identified portions of the hardrock mining industry as a priority for developing financial assurance rules. These rules will help define the type of financial resources that a mining operator must make available up front in order to cover the costs of closure, reclamation and long-term monitoring of the mining site. When identifying the hardrock mining industry as a priority for its financial responsibility rules, the EPA cited the Toxic Release Inventory (TRI), which revealed that the metal mining industry releases “enormous quantities” of toxic chemicals, approximately 28 percent of the total releases by U.S. industry quantified by the TRI. Hardrock mining facilities manage a very large volume of waste, which creates a risk of ground and water pollution, as well as air quality issues. The EPA, under CERCLA (often referred to as “Superfund”), is the agency charged with finding the parties responsible for contaminating sites and coordinating cleanup, so it is very familiar with the legacy of hard rock mining. The EPA concluded that “The severity of consequences posed by hardrock mining facilities is evident in the enormous costs associated with past and projected future actions necessary to protect public health and the environment, after releases from hardrock mining facilities occur.” The EPA has estimated that the cost of cleaning up all hardrock mining facilities is between $20 and $54 billion. This is many times EPA’s total Superfund budget of approximately $1.25 billion. Thus, EPA is developing new rules to attempt to hold hard rock mining companies financially accountable for the pollution at their sites. The EPA is still in the drafting phase of these rules.

The EPA can improve regulation of mines by closing two “loopholes” in the Clean Water Act that exempt mining companies from certain regulations. Under the first loophole, mining operators are permitted to designate natural lakes, rivers, streams and wetlands as “waste treatment systems,” exempt from Clean Water Act regulation.
Although federal regulations explicitly state that “waste treatment systems” may include only “manmade” bodies of water, the EPA has permitted mining companies to designate natural bodies of water as “waste treatment systems,” allowing companies to discharge into pits and tailings basins on their property, even when those pits and tailings basins were formerly wetlands, lakes, rivers or other waters that should be protected under the Clean Water Act. The second loophole was created when the EPA expanded the definition of “fill material” under Section 404 of the Clean Water Act to include waste material from mines. This allows mine operators to dispose of this waste material – which often includes heavy metals, sulfides, sulfates and other pollutants – in the same way as more innocuous materials such as rock, soil, clay and sand.

Minnesota law also contains these “loopholes,” and state regulators have the opportunity to close them and take a more stringent approach. The state of Minnesota is delegated by the EPA to enforce the Clean Water Act, and has adopted regulations accordingly. Under Minnesota Administrative Rule 7001.1030, Subpart 2, a person does not need a permit for “discharging dredge or fill material regulated by the federal government under section 404 of the Clean Water Act.” This is the state-level equivalent of the “fill material” loophole. Subpart 2 also provides that a person does not need a permit for “discharging pollutants into privately owned treatment works.” “Treatment works” are defined by statute to include dams, lagoons, and other works installed for the purpose of treating, stabilizing, or disposing of sewage, industrial waste, and other waste, and, although this has not been tested, may include tailings basins and pits at mine sites.

16. What can I do?

Responsible decisions about using our natural resources and about our state’s future are made when members of the public are informed and engaged. For wise decisions on this issue, people and state leaders need to fully understand the facts.

Here are the most critical ways Minnesotans can get involved and make a difference on this issue:

- Learn the facts about this issue. This report offers a good beginning. The Mining Truth website (www.miningtruth.org) is another place to find information. The discussion about sulfide mining should be based on accurate information.
- Contact elected officials – your state representatives, the Governor, your members of Congress, and your local officials too. Share your questions, thoughts and concerns with them. Urge them to learn more about the issue themselves. Share your opinions and recommendations with them. This is an extremely important way to take action. Our political leaders respond when they hear from constituents on issues of concern. Respond to citizen comment periods for specific mine projects. Input from people does help shape how these projects are designed.
- Share what you learn with others. Talk with neighbors, colleagues and friends and family. Help connect more people with information about the issue.
- Write a letter to the editor of your local newspaper or an opinion piece. This is another way to increase awareness with all Minnesotans, including key decision-makers, about this issue.
- Engage others in a dialogue and share information on social media – Facebook, Twitter, Pinterest.
- Host a gathering to watch the documentary “Precious Waters: Minnesota’s Sulfide Mining Controversy,” or share the link to the film with others.
17. Where can I get more information?

More information can be found at the Mining Truth website (www.miningtruth.org), or by contacting the coalition leaders at:

Friends of the Boundary Waters Wilderness (612) 332-9630
Conservation Minnesota – (612) 767-2444
The Minnesota Center for Environmental Advocacy – (651) 223-5969

Mining Truth is an initiative to educate Minnesotans about the issue of sulfide mining. Our goal is to help Minnesotans learn the facts about sulfide mining, understand this controversial and emotionally charged issue, and make their voices heard when it is time to make important decisions about sulfide mining in our State. We are committed to a truthful, open dialogue on this issue.
References Cited


Capitol Chatter Webpage
Myers, J. October 6, 2011. State Delays Mining Leases Second Time This Year. Duluth News Tribune.
http://capitolchat.areavoices.com/tag/mining/


CIDSE Webpage

CorpWatch Website
Chatterjee, P. March 1, 2003. Bechtel: Oil, Gas and Mining
http://www.corpwatch.org/article.php?id=6671


Daily Finance Webpage
http://www.dailyfinance.com/rtn/pr/polymet-simplifies-metallurgical-process-at-northmet-project/rfid410893200/

DEIS – Draft Environmental Impact Statement  
See “Minnesota Department of Natural Resources Webpage” citation

Dreisinger, D., Murray, W., and Hunter, D. The Application of the PlatsolTM Process to Copper-Nickel-Cobalt-PGE/PGM Concentrates from PolyMet Mining’s NorthMet Deposit.  

Duluth Metals Webpage  
http://www.duluthmetals.com/s/Home.asp

Duluth News Webpage  

Earthworks Webpage  
http://www.earthworksaction.org/media/detail/epa_metal_mining_industry_nations_top_toxic_polluter


Earthworks. Fact Sheet. Mining Industry Exploits Clean Water Act Loopholes  


http://www.epa.gov/ttncaaa1/t1/fr_notices/rhfedreg.pdf

Federal Reserve Bank of St. Louis Webpage  
Unemployment Rate in St. Louis County, MN [MNSTLO7URN]  
http://research.stlouisfed.org/fred2/series/MNSTLO7URN

Unemployment Rate in Lake County, MN [MNLAKE5URN]  
http://research.stlouisfed.org/fred2/series/MNLAKE5URN?cid=28705


http://www.tcgasmap.org/media/Mining%20Economic%20Implications%20for%20Rural%20Areas.pdf

Friends of the Boundary Waters Webpage  

http://www.epa.gov/raf/publications/pdfs/HUMANHEALTHEFFECTS81904.PDF

Grand Canyon Trust Webpage  
http://www.grandcanyontrust.org/grand-canyon/uranium_issues.php

http://www.guardian.co.uk/environment/2011/sep/07/glencore-fatalities-environmental-fines-record

InfoMine Webpage  
http://technology.infomine.com/articles/1/1595/tailings.chile.pelambres/los.pelambres.and.aspx

International Development Research Centre (IDRC) Webpage  
Gedicks, A. and Grossman, Z. Defending a Common Home: Native/non-Native Alliances against Mining Corporations in Wisconsin  

http://reclamationresearch.net/publications/Final_Lit_Review_AMD.pdf


http://seacc.org/mining/a-i/PredictionsReportFinal.pdf


Metals Place Website
   Church, L.J. December 5, 2007. Lisbon Valley copper mine to be shut down. Salt Lake Tribune.  


Mining Minnesota Webpage
   http://www.miningminnesota.com/who_companies.php
   http://www.miningminnesota.com/nonferrous.php

http://www.miningwatch.ca/sites/www.miningwatch.ca/files/Mining_Myths_0.pdf

Minnesota Department of Employment and Economic Development Webpage

Minnesota Department of Health Webpage
http://www.health.state.mn.us/divs/eh/hazardous/topics/studies/newbornhglsp.html

http://files.dnr.state.mn.us/lands_minerals/mineralownership.pdf

Minnesota Department of Natural Resources Webpage
http://www.dnr.state.mn.us/input/environmentalreview/polymet/eis_toc.html
Minnesota Office of the Revisor of Statutes Webpage
Minnesota Administrative Rules. 7050.0224 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 4 WATERS OF THE STATE; AGRICULTURE AND WILDLIFE.
https://www.revisor.mn.gov/rules/?id=7050.0224

Minnesota Administrative Rules. 4410.4400 MANDATORY EIS CATEGORIES.
https://www.revisor.mn.gov/rules/?id=4410.4400

Minnesota Administrative Rules. 4410.1200 EAW CONTENT.
https://www.revisor.mn.gov/rules/?id=4410.1200

Minnesota Administrative Rules. 4410.2100 EIS SCOPING PROCESS.
https://www.revisor.mn.gov/rules/?id=4410.2100

Minnesota Administrative Rules. 4410.2300 CONTENT OF EIS.
https://www.revisor.mn.gov/rules/?id=4410.2300

Minnesota Pollution Control Agency Webpage

Minnesota Public Radio Webpage
Hemphill, S. December 17, 2010. Business Group Sues Over Mining Pollution Rules
http://minnesota.publicradio.org/display/web/2010/12/17/wild-rice-pollution/

Hemphill, S. October 26, 2011. Permits Allow Mining Expansion, Require Reduced Pollution.

Kelleher, B. March 2011. Should Regulators Judge PolyMet on Glencore’s Record?


Minnesota State Legislature Webpage
HF2560 Status in House for Legislative Session 86


National Archives and Records Administration Webpage
Title 40: Protection of Environment. § 122.2 Definitions.
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=dIV8&node=40:q1=122.2&sid=ec283085c3500d45dca93745b3a945ff;view=text;node=40%3A22.0.1.12.1.6.2
http://www.nero.noaa.gov/whaletrp/NEPA%20Overview.pdf

New Hampshire Department of Justice Webpage 

New York Times Webpage  

http://www.nytimes.com/2010/08/03/us/03spill.html?_r=1&fta=y

Urbina, I. May 29, 2010. Documents Show Early Worries About Safety of Rig  

Patagonia Under Siege Webpage  
December 11, 2007. Farmers Quiz Government Officials Over Toxic Spills from the Los Pelambres Mine owned by the Luksic Group  


Pollution Issues Webpage  
Smelting  
http://www.pollutionissues.com/Re-Sy/Smelting.html

PolyMet Mining Webpage  
http://www.polymetmining.com/  


http://www.miningtruth.org/wp-content/uploads/2012/05/Economic+Role+of+Metal+Mining+in+Minnesota_smaller.pdf


http://www.sonoraninstitute.org/library/reports.html

Regulations.gov Website  
Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements, Environmental Protection Agency (EPA)  
http://www.regulations.gov/#/documentDetail;D=EPA-HQ-SFUND-2009-0265-0001


http://www.nicholas.duke.edu/people/faculty/boudreau/9thPtSymposium/Severson_Absract.pdf

Shaffer, D. December 21, 2010. Range Copper Firms Atop 'Mega-Deposit' to Merge.  
http://www.startribune.com/business/112190034.html?page=all&prepapg=1&c=y#continue


SiliconInvestor Webpage  


Star Tribune Webpage  
Kaszuba, M. April 25, 2012. Minnesota Lawmaker: No More State Contracts for Bridge Consultant URS.  

http://www.startribune.com/local/139067154.html

Marcotty, J. May 12, 2012. District Court Upholds Pollution Rule to Protect Wild Rice.  
http://www.startribune.com/local/151212935.html
The Guardian Webpage
http://www.guardian.co.uk/environment/2011/sep/07/glencore-fatalities-environmental-fines-record


The Telegraph Webpage


Twin Metals Webpage
http://www.twin-metals.com/who-we-are/
http://www.twin-metals.com/inside-the-project/protect-environment/
http://www.twin-metals.com/inside-the-project/
http://www.twin-metals.com/inside-the-project/protect-environment/
http://www.twin-metals.com/inside-the-project/jobs/

U.S. Environmental Protection Agency Webpage
Clean Water Act, Section 404
http://water.epa.gov/lawsregs/guidance/wetlands/sec404.cfm

http://water.epa.gov/polwaste/nps/upload/amd.pdf

U.S. Environmental Protection Agency Region 5.  August 2009.  Letter from Kenneth Weslake to Tamara Cameron, Chief Regulatory Branch, St. Paul District.

U.S. Environmental Protection Agency Region 5.  February 18 2010.  Letter from Bharat Mathur to Colonel Jon Christensen, District Engineer, U.S. Army Corps of Engineers.

U.S. Department of Interior Webpage
October 1, 2011.  Interior Department Completes Reorganization of the Former MMS


U.S. Geological Survey Webpage
Arizona State Minerals Information 1998
Vimeo Webpage
http://vimeo.com/39491123


Western Mining Action Network Webpage
False Promises: Water Quality Predictions Gone Wrong: Large Mines and Water Pollution.

Wikipedia Webpage
Glencore
http://en.wikipedia.org/wiki/Glencore
