



Donlin Gold Project DEIS Hazardous Chemicals

The proposed Donlin Gold project would use hazardous chemicals (such as cyanide) in the milling process, and would produce hazardous byproducts (such as mercury). Before operations begin Donlin Gold's plans for managing and transporting hazardous chemicals would require permits and approvals from State and Federal regulatory agencies. The region's residents are concerned about the safe transport and storage of these hazardous chemicals, as well as impacts to the environment. The Draft EIS provides in-depth analysis of the steps taken for containment, and addresses questions brought forward by local residents. Some key questions and findings are summarized here.

► How would cyanide be used in the milling process?

Sodium cyanide would be utilized to process ore in a step called cyanidation (also called cyanide leaching). This is a chemical reaction that uses dilute cyanide-containing solutions and oxygen to selectively dissolve gold or other precious metals from the host rock, making these metals available for separation. When the process is complete, residual cyanide in the tailings would be destroyed using sulfur dioxide prior to discharge to the tailing storage facility. Cyanide leaching and cyanidation are commonly used at gold mining operations in the U.S. and world-wide.

► What are the effects of cyanide in the environment?

If solid sodium cyanide is spilled on dry ground, it does not present a danger to people or the environment as long as the sodium cyanide remains dry and is swept up and contained for proper disposal. In the event of an accident with release of sodium cyanide into surface waters, all aquatic life in the immediate area would be killed. In flowing streams, the effects would continue downstream until dilution and/or volatilization reduced the cyanide content to nontoxic levels. Although cyanide is highly toxic, the duration of impacts from a release of cyanide would likely be short term. Cyanide is relatively reactive and does not persist in the aquatic environment nor does it bio-accumulate in the food chain.

Vessel transportation and transfer operations between vessels, the Bethel cargo terminal and Angyaruaq (Jungjuk) Port barge terminal would be a potential spill source, however unlikely. Cyanide is regularly safely transported to existing mining operations in Alaska. An ocean barge would transport solid sodium cyanide in ISO-approved type 2 watertight sparge tank-tainers from Seattle or Vancouver to Bethel. The sodium cyanide tank-tainer would then be transferred from the ocean barges to the Bethel cargo terminal for storage or onto river barges for towing up the Kuskokwim River to Angyaruaq (Jungjuk) Port. In the unlikely event that a tank-tainer is dropped into the water during vessel transport or these transfer operations, the potential for spills is very low because the tank-tainer would be watertight and the solid sodium cyanide would be protected from potential contact with water. Transfer operations would only occur during the shipping season.



Example of a cyanide ISO container

► How much mercury is naturally occurring in the bedrock, and how much is found in sediment and water in the Kuskokwim River basin?

The project area contains mercury from existing natural sources and also from human activities like coal combustion (in Asia), waste incineration, and historic mining activities (such as the historic Red Devil Mine). The ore from the Kuskokwim gold belt contains naturally occurring mercury at an estimated concentration of 1.62 parts per million (ppm). Total mercury concentrations in water samples from the main stem of the Kuskokwim River currently range from 0.0019 to 0.0097 ppm. (This is a very low concentration equal to 1 to 5 drops of mercury in 135 Olympic-sized swimming pools.) Within the region, mercury is concentrated in hotspots near naturally mineralized sources, and; these concentrations decrease over short distances due to dilution (mixing with water and sediment) in the main stem of the Kuskokwim River.

Mercury concentrations can also be tracked through human health monitoring of hair samples. In 2010, the Alaska Department of Health and Social Services obtained samples in the Southwest Region service area and Bethel Census Area, which showed a median methylmercury level of 0.78 ppm with a maximum of 7.82 ppm; both levels were below the Agency for Toxic Substances and Disease Registry screening level of 15.3 ppm.

► How could mercury affect the subsistence resources and human health in the region?

There is a potential risk to fish and aquatic organisms from mercury resulting from mine operations. Methylmercury, which is formed when mercury combines with carbon, is readily absorbed by living organisms, is persistent in the environment, and has high toxicity and bioaccumulation characteristics. If released into water, mercury can bioaccumulate in fish and animal tissue and thereby enter into the food chain. High levels of exposure to humans and other animals can result in brain damage and possible death. Chronic or long-term low-level exposure can also cause serious health problems. It is very unlikely that even combined exposures to mercury from multiple pathways related to the proposed project (e.g., air inhalation, consumption of fish and game), would result in mercury concentrations in people that would exceed the health guidelines.



Most mercury from ore processing would be captured and contained and shipped off site. Concentrations of mercury found in fish in the Crooked Creek watershed could increase, but the changes would be small (up to 3 percent above current levels) and within the range of regional background fish tissue concentrations of mercury. The potential for risk to birds and mammals from mercury leaching into the surrounding soil was also evaluated in the Draft EIS. The study found that there is no difference in ecological risk to birds and mammals between current baseline and estimates of concentrations at the end of the mine life.

The concentration of mercury in the air emissions would be well below the standards for human health protection.

► What are the worker safety risks of using mercury and how would it be controlled during the milling process?

When ore containing mercury is processed within the enclosed milling facility, mercury will be released and must be captured for proper disposal. Since they are enclosed containers, workers are not exposed to gaseous mercury. Worker safety is regulated by the U.S. Department of Labor, Mine Safety and Health Administration, with two inspections annually. During the ore processing, there are several points at which mercury would be separated and recovered. These processes are done in closed vessels and the vents from these vessels have controls to prevent the release of mercury to the air. Mercury captured in these control systems would be collected and disposed

of in two forms: liquid elemental mercury and mercury impregnated carbon. Both forms would be shipped off-site by barges to a permanent, federally-approved, mercury storage facility. Donlin Gold estimates the mine would remove approximately 34,600 pounds of mercury per year from the gaseous waste streams, while 0.2 percent of mercury passing through the mill would be released through the air under an air quality permit. The concentration of mercury in the air emissions would be well below the standards for human health protection.

► How would mercury byproducts be safely transported from the mine to the appropriate recycling/disposal facilities?

Spent carbon containing mercury would be transported in plastic-lined 55 gallon UN and USDOT approved drums. Elemental liquid mercury would be transported in 1 metric tonne containers ("pigs") or 76 pound flasks. The containers would then be secured on a 4-Drum Spill Containment Pallet, and then containerized inside of a "Conex" intermodal shipping container for transport via truck and barge. Given those protections, it is very unlikely that mercury would be released during transport. However, the Draft EIS looks at effects to the environment if mercury were released from a container rupture, transfer operations, or losing cargo overboard from an ocean or river barge. Additional information can also be found in referencing the Spill Risk, and Barge Traffic posters.



Mercury pig

Note: This topic poster is designed to give a general overview. More information on Contaminants and Hazardous Chemicals can be found in the Draft EIS, Sections 3.7 - Water Quality, 3.8 - Air Quality, 3.12 - Wildlife, Section 3.13 - Fish and Aquatic Resources, Section 3.22 - Human Health, and Section 3.24 - Spill Risk. Other chemicals brought in for processing ore are listed in Chapter 2

