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Cyanide: gold mining's devastating killer

Cyanide is highly toxic

Cyanide is one of the most toxic chemical substances on Earth. Cyanide is toxic to most aquatic life and humans, even at low concentrations. Its use in gold mining is controversial. The extreme toxicity of cyanide arises from its readiness to react with other elements and hence interfere with normal biological processes. Cyanide gas is a biological weapon and was used in European Nazi extermination camps in World War II. Cyanide compounds do occur naturally in low doses in some foods, for example, in bitter almonds. Excesses or extracts of these have long been known to be toxic. (Moran, 2004)

Unlike toxic metals, cyanide is not an element but a compound composed of only carbon and nitrogen. The in-depth chemistry of cyanide and its chemical behaviour in streams and sediments is complex and its toxicity is influenced by several factors, including acidity or alkalinity (Moran 2004). Free cyanide does not bioaccumulate up the food chain, or persist like toxic metals. Its toxicity is instant or acute and, once reacted, leaves little residual trace. Therefore, it's hard to analyse after mining spill to know how much, and what type of cyanide has been spilt.

There is much that is still unknown about the toxicity of cyanide and its degradation products. Free cyanide, as used in gold mining, is the most toxic form. The meta-cyanide complexes and break down products (e.g. such as cyanates and thiocyanates), although less toxic than the free cyanide, can persist in the environment. These break-down products could cause long term effects in addition to the immediate effects from free cyanide (Moran, 2004).

Devastating ecological effects from cyanide spills

In mining, cyanide is typically used to dissolve gold from crushed ore. The gold is then adsorbed onto charcoal and the excess cyanide stored for recycling in ponds. Problems occur when there are breaks in the ponds and a pulse of cyanide enters watercourses. Often, tailings and cyanide are released in these accidents causing multiple environmental effects.

Mine accidents involving cyanide spills result in devastating ecological effects. Typically, the cyanide kills all life in the streams it enters for a considerable distance. In early 2000, two accidents at Baia mine in Romania, Europe resulted in cyanide spills. Heavy snow followed by heavy rain caused a tailings dam to break and large volumes of mine-waste slurry and cyanide entered the rivers. The contamination continued into the Danube, a major river in Eastern Europe flowing through many countries to the Black Sea. Extensive fish kills from the cyanide were reported, not only from Romania but also from other countries downstream of the spill. Although an emergency response team worked constantly to repair the dam, enough cyanide was released during the first spill to cause a major ecological catastrophe along the Danube. The spill killed 1,200 tonnes of fish and hence endangered birds feeding on fish within a national park (UNEP/OCHA 2000a, b). In Hungary, the spill was reported to have caused a five kilometre carpet of dead fish and left a quarter of the population without drinking water (Cunningham, 2005). There were adverse impacts on local communities, economies and also tourism, all because of the lack of a fishing industry (UNEP/OCHA 2000a, b). The scale of the disaster resulted in calls for gold mining using cyanide to stop (Korte et al. 2000)

Cyanide is often not the only pollutant from tailings dam breakages. Along with water containing cyanide, often the spills involve the solid waste products. These are usually muds containing very high amounts of heavy metals such as lead, copper, cadmium and zinc. For example, at the Baia mine in Romania, mine-waste tailings were released along with the cyanide. The second spill at the mine resulted in a slick of black mine-waste slurry 40 km long moving downstream (UNEP/OCHA 2000b). These can cause long-term, effects on ecosystems as they persist for many years (Macklin et al. 2003).

Cyanide spill kills fish at Rapu Rapu

At Rapu Rapu, there have already been cyanide and tailings spills. Two cyanide and tailings spills occurred in October 2005, which resulted in the suspension of mining. On both occasions the cyanide caused death to marine organisms and fish, shrimp and crustaceans, resulting in several kilos of dead fish (Rapu Rapu Fact Finding Commission, 2006). People were scared to eat local fish after the incident and stopped fishing in the area. Incredibly, yet another spill occurred during a 30-day test run in mid 2006. Hence, there is no doubt that, if the mine at Rapu Rapu becomes fully operational, more spills would be expected.

Mine-tailings spills at Rapu Rapu

The dead fish and other organisms are only the immediate and visible signs of the spill, caused by cyanide. Along with the cyanide spills, there are usually mine-tailings spills, when the solid waste material leaks out of the dam and travels downstream along with the liquid cyanide. This has happened on at least one of the occasions of the cyanide spills. These mine-tailings contain toxic heavy metals and other elements that will persist for many years, as the Romanian spill showed. These can give rise to long-term adverse effects on aquatic ecosystems but these effects are not yet known.

Long-term effects on marine ecosystems

The marine ecosystems surrounding Rapu Rapu, sea grass and coral reefs are delicate. The cyanide spills have already caused the death of marine life. But, as it recovers from the cyanide spill, the ecosystems face another threat: the threat of heavy metal toxicity.

The community of small animals that graze on the seagrass is sensitive to heavy metal pollution (Marín-Guirao et al., 2005) and this could have impacts up the food chain, resulting in adverse ecosystem effects. Similarly, coral reefs are known to be sensitive to sedimentation (Rogers, 1990). Increased sedimentation from the tailings spill would have adverse effects on the coral reef ecosystem, with possible adverse impacts high up the food chain. In addition, there could be direct, long-term effects on the health of fish and other marine organisms. Therefore, any tailings spill from Rapu Rapu will affect the surrounding ecosystem both physically and chemically.

The Rapu Rapu Fact Finding Commission (2006) recognises the fragility of Rapu Rapu's ecosystem as one of their recommendations is to "Issue a moratorium on mining in Rapu-Rapu...in the island pending scientific and experts' favorable resolution of the issue of ecological conservation and the acid mine drainage problem in a fragile small island ecosystem."

Conclusion

Rapu Rapu is a wholly unsuitable place for mining, especially one that involves the use of cyanide. In the mine's short history there have already been cyanide and tailings spills. Cyanide has devastating immediate ecological effects, whilst the tailings may have longer term adverse effects on ecology. Both these aspects of mining pollution could be extremely damaging to the fragile marine ecosystem at Rapu Rapu, should the mining become full scale.

Greenpeace demands that there should be no mining in Rapu Rapu because of the risk of severe adverse effects on the corals, sea grass and marine life. In particular, the proximity for Rapu Rapu to a marine sanctuary makes it wholly unsuitable for a mining.

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