Lafayette causes pollution during 30-day trial run

In April 2005, Lafayette started mining gold, silver, copper and zinc on Rapu Rapu island. The poor environmental safeguards resulted in spills of cyanide and other contaminants from the mine spilled into the sea and around the island, resulting in massive fish kills after heavy rains in October 2005. The mine stopped processing but in July this year (2006) a 30-day trial run commenced to see if the mine could operate without causing contamination.

On July 18, a fishkill occurred in Mirikpitik Creek, one of the creeks leading out of the mine premises. Greenpeace sampled the creek at the beginning of August and found it to be clearly affected in its lower stretch by acid mine drainage. The creek waters were acidic in this section, and the presence of the characteristic yellow solid precipitate (ochre, composed of iron oxides and hydroxides) indicated that this creek is significantly impacted due to acid mine drainage.

This acid mine drainage has resulted in very high levels of heavy metals in this creek, particularly cadmium, copper and zinc (see Appendix). These metals were present in dissolved forms at many hundreds of times general background levels for these metals in river water. Cadmium and copper are both highly toxic to plants, animals and humans and many aquatic species are very sensitive to cadmium and copper. Ongoing exposure to zinc at sub lethal concentrations can also impact aquatic organisms.

The acid mine drainage and associated metal contamination indicate that the stream has been affected by the recent mining activities. It’s possible that the fish kill has been caused by this acid mine drainage and associated metal contamination. It might have been caused by a spill from tailings dam, causing a pulse of acidic mine drainage to spill down the creek. The fish kill might also have been caused by a cyanide spill. Cyanide toxicity is instant or acute and, once reacted, leaves little residual trace so it’s hard to analyse after an accident to know how much, and what type of cyanide has been spilt. So, the fish kill may have been caused by cyanide.

From these analyses, the cause of the fish kill cannot be established. It could be the acid mine drainage caused by a leak, a cyanide spill, or possibly both. However, it is clear that even from this 30 – day trial, Lafayette is causing contamination of the waters on Rapu Rapu. If full-scale mining is allowed on Rapu Rapu, it will be an ecological disaster for the local ecology. Because the mine is so close to the sea, the contamination would be likely to also affect the marine environment, including impacting corals and causing harm to the coral reef ecosystem. Such impacts on the reef would be a disaster for marine biodiversity, including the whale shark, and also local fisheries.

Greenpeace joins local communities and other sectors in demanding for the permanent closure of Lafayette’s mining operations in Rapu Rapu Island, and for the immediate clean up and rehabilitation of the mine site and all affected areas.

APPENDIX

Analysis of samples of water collected from creeks in the vicinity of the Lafayette mine site

Sampling and analysis

Two samples of waters were collected from Mirikpitik Creek (MI06093, MI06094) in the vicinity of the Lafayette mine site on the 2nd August 2006. Local residents had reported fish kills in the stream. Close to the outflow to the sea, this creek splits into two separate parallel channels: one sample was collected from each of the two channels.

All samples were collected and stored in acid-rinsed glass. All samples were kept cool and returned to the Greenpeace Research Laboratories in the UK for analysis. Prior to analysis, a portion of each water sample was filtered to remove all suspended material. Samples were analysed for a range of metals both as a filtered sample (to obtain dissolved concentrations) and as a whole sample (to obtain total dissolved and particle bound concentrations).

Results and discussion

The two samples from Mirikpitik creek (MI06093, MI06094) collected from separate, parallel, channels of the creek were similar in composition and metal concentrations. Both samples were acidic at the time of collection (pH 5.5), and also contained high levels of suspended solids. These suspended solids consisted of fine orange particles, most likely precipitate of iron oxides and hydroxides, known as ochre. The metal concentrations are presented in Table 1.

Table 1 Heavy metals concentrations (µg/l) in samples of water collected from Mirikpitik creeks, Rapu Rapu, 2nd August 2006 and those of normal river water. Data are separately presented for whole sample and the dissolved concentrations in the filtered samples.

	MI06093		MI06094		Normal dissolved river
Metal	Whole	Dissolved	Whole	Dissolved	concentrations[1]
Cadmium	875	846	813	811	< 1
Cobalt	287	208	253	197	
Copper	35 900	5 300	28 900	7 050	<20
Iron	116 000	295	91 500	528	
Manganese	6 110	6 100	5 960	6 020	
Zinc	30 400	23 500	27 800	22 900	<50

[1] ATSDR (2000), WHO (1992)

The samples contained similarly very high concentrations of a number of metals, both in dissolved forms as well as within the suspended material. Analysis of the filtered water samples showed very high dissolved concentrations of cadmium, cobalt, copper, manganese and zinc. Of particular concern are the dissolved concentrations of cadmium (811-846 ìg/l), copper (5 300-7 050 ìg/l), and zinc (22 900-23 500 ìg/l), being very high compared to typical background river water concentrations. Furthermore, cadmium concentrations in river waters are generally reported to be below 1 ìg/l, while those of copper and zinc are below 20 ìg/l and 50 ìg/l respectively (ATSDR 2000, WHO 1992). Both samples contained these metals at many hundreds of times higher than these typical background concentrations.

For both channels, the concentrations of cadmium and zinc were only slightly higher in the unfiltered samples compared to the filtered samples, indicating that the high levels of cadmium and zinc in the creek waters are present almost exclusively in dissolved forms. In such forms these metals are highly mobile and bioavailable.

Very high levels of iron were also found in both unfiltered samples from this creek, while the dissolved iron levels were not high in either sample. The very high levels of particulate iron are consistent with the orange coloured suspended material in the water being ochre (iron oxides and hydroxides).

Waters impacted by acid mine drainage can be extremely toxic to most aquatic organisms as a result of their high acidity and the high amounts of dissolved heavy metals they generally contain (Pentreath 1994). Of the metals found at high concentrations in the Mirikpitik creek, the presence of cadmium and copper at these levels are of most concern.

Cadmium is highly toxic to plants, animals and humans, having no known biochemical or nutritional function. Many aquatic species are very sensitive to cadmium, with harmful effects at levels as low as 5 mg/l (Bryan & Langston 1992). When present in bioavailable forms, bioaccumulation has been observed in both aquatic and terrestrial organisms (ATSDR 2000, WHO 1992). In humans, the kidney is the main target organ of cadmium toxicity following extended exposure, and recent studies have demonstrated impacts at lower levels of exposure than previously anticipated (Åkesson *et al.* 2005, Elinder & Jarup 1996).

Copper is particularly toxic to many aquatic organisms, and a considerable number of species, including many invertebrates, are highly sensitive to dissolved copper at very low concentrations (Bryan & Langston 1992). Whilst copper is an essential trace elements for other plant and animal life (including humans), toxic effects can occur at higher doses.

Zinc is generally less toxic to aquatic organisms, though ongoing exposure to sub lethal concentrations can also impact aquatic organisms (Bryan & Langston 1992).

Conclusions

At the time when the samples were collected (2nd August 2006), the waters of Mirikpitik creek is clearly impacted in its lower stretch where the samples were collected. The acidity of the creek waters in this section, and the presence of ochre (iron oxides and hydroxides) indicate that this creek is significantly impacted due to acid mine drainage. This impact has also resulted in very high levels of heavy metals in this creek, particularly cadmium, copper and zinc. These metals were present in dissolved forms at many hundreds of times general background levels for these metals in river water.

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