TOPIC: WATER QUALITY AND MINING

SUB-TOPIC:
PART A: AN OVERVIEW OF CHEMICAL MINING HAZARDS

Supporting Transcript

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This transcript accompanies associated presentation slides and video content developed for the TIDE project in 2021, with acknowledgements and disclaimer as noted in associated files.

SLIDE 1

Welcome to this lesson where we'll be talking about water quality and mining. I'm George Wilson and in this mini-lecture I'll be presenting an overview of mining in Myanmar and mining chemical hazards.

SLIDE 2

I'll be taking you through a brief summary of mining activity in Myanmar before looking at some of the dangers of using chemicals in mining, particularly those posed by cyanide and mercury from the mining of gold.

SLIDE 3

When we talk about mining hazards we can mean hazards which refer to miners, local communities as well as dangers to the environment, and I'll be touching on all of these here. Some of the hazards I'll be talking through often have little awareness surrounding how people may be exposed to them.

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So for this mini-lecture it is hoped that by the end of it you will become aware of the predominant types of mining in Myanmar, recognize that mining can severely affect water quality in Myanmar, particularly through cyanidation and amalgamation, and also recognize chemical mining hazards in other parts of the world.

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Myanmar has a unique geology. Located on an area of converging tectonic plates and just south of the Himalayas, it resembles a sort of ancient tectonic jigsaw puzzle. It has large reserves of tungsten, copper, gold, silver, nickel and precious stone. Mining currently

contributes one trillion Myanmar kyat per year and this is mainly through large industrial mines.

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Key mining areas include the antimony belt in the states of Shan, Kayah and Mon; the lead-zinc belt of Shan State; the porphyry copper-gold belt in Monwya and the precious stone belts in the Kachin region. This map only shows us the large industrial mines in the country. Here we can look at industrial mining activity at a higher resolution. The classification of the mines is not considered here, but at least it shows us the general distribution of mines, based on inspection from satellite imagery.

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Here we can see just how many mines are located in the Mandalay area, and distinct belts of minerals being exploited in northern Myanmar.

SLIDE 9

But still this fails to quantify the full extent to which minerals are exploited, as we have not taken into account artisanal mining. This we are defining as someone who mines, but not for a particular company and on a subsistence scale. There are an estimated half a million artisanal and small-scale miners in Myanmar. Whereas industrial mining activity generally has specific health and safety measures and laws to abide by, artisanal is unregulated and can be extremely hazardous for anyone taking part, especially if dangerous chemicals are being used.

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There are two ways of extracting gold and this depends on the form that it exists in. for hard rock deposits, the gold can be processed using cyanide, which is particularly good at dissolving the gold. This gold can then easily be extracted be from this solution. For gold found in the soft banks of rivers, known as alluvial deposits, artisanal miners may simply use a shovel to load up trucks for processing. The panning process then takes place, where the sediment is broken down and inspected for gold. As the gold particles can be extremely tiny and cannot be seen by the eye, mercury can be used to combine with the gold to form what is known as an amalgam. The mercury is then burnt off the gold to leave behind valuable material. Its important to remember this is a worldwide issue and it is estimated 20 million people across the globe extract gold using mercury.

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So what is the issue with using these chemicals to mine?

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Well mercury is a highly toxic (heavy) metal on its own, but perhaps even more harmful is methylmercury, which is produced by microorganisms from elemental mercury.

Methylmercury has a much higher absorption into the gut than mercury itself which makes it far more toxic. Mercury and the compounds it forms are toxic to the nervous system and any inhalation of these sorts of vapours will have similar effect. Mercury is very toxic in the environment and will concentrate in the cells of organisms. We'll talk about the magnification of heavy metals in trophic systems in another mini-lecture.

SLIDE 13

Now cyanide is an extremely reactive compound when allowed into the environment and it can rapidly be absorbed through the skin or through the airways. Depending on dosage, it can be similarly damaging to the nervous system as mercury exposure. Cyanide itself is not necessarily a particular direct concern in the environment due to its rapid decay time, but its toxic breakdown products may persist in the environment for some years, and these are the cyanates and thiocyanates.

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So why do miners continue to use both mercury and cyanide? Well ultimately, it improves the yield of extraction, which improves revenue for miners. Both have recently been banned in commercial mining. Lack of sufficient environmental monitoring and regulatory enforcement risks the waste from this process contaminating water and soil in the area. Locals report that they have seen masses of dead fish in nearby waterways.

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Now let's talk about mining hazards more generally.

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This table lists five types of mining activity and the dominant chemical hazard they pose. The hazard will be dependent on what is being mined, what process is being undertaken to achieve this, and what mitigation strategies are in in place. For hard rock mining, crystalline silica or coal dusts within the rock will be present in the rock and can lead to pulmonary disease upon inhalation. The diesel fumes from powering machinery in mining is a source of carcinogens to the lungs, especially in not very well-ventilated areas.

Due to its ability to dissolve most oxides and silicates, hydrofluoric acid is used in the analysis of core samples taken during exploration drilling. This can be extremely dangerous when touched and may lead to cardiac arrest. The smelting of ores poses a number of hazards too – chemicals like arsenic , sulfur and coal pitch volatiles can all be used and I've put the main hazards posed by each here.

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In summary, we have seen that Myanmar hosts extensive mineral resources due to its unique and complex geology. And there are risks to extracting some of these minerals like gold, particularly by subsistence mining methods, and it is important that they are known to those

that carry this out, in Myanmar and worldwide. Other chemical hazards can arise from rock dust, hydrofluoric acid and the products of ore smelting.

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And now for the learning exercise.

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I'd like you to firstly describe three chemical hazards that could be associated with mining gold, and secondly I want you to research a possible alternative for using mercury to retrieve gold from its ore. To give you a hint, think about some of the ways we could separate gold particles from the rock based on gold's properties.

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Here you can find the references used in these slides. Those that are marked 'OA' are freely available for anyone to view.

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Along with some further resources, both are freely available. The first resource will be very useful for the learning exercise.

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Please note the disclaimer and conditions of use. Next time we'll be having a look a look at a specific mining problem and that is acid mine drainage. Thanks for listening.