The Bowdens Lue mine and the problems of Acid Mine Drainage (AMD)

Sunny Corner

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My history re acid mine drainage

- I worked for 7and a half years on acid mine drainage and heavy metal pollution from metal sulphide mines in the CSIRO Physical Technology Unit.
- We worked on the abandoned Sunny Corner (near Portland), Woodlawn near Tarago (active at the time), Captains Flat near Canberra (abandoned) and operating coal mines near Lithgow.
- I read many dozens of scientific papers on the problem of acid mine drainage around the world.

The problem of AMD in a nutshell

- Over geological time all sulphide deposits at the surface have been oxidised to ‘gossan’ and don’t produce AMD or heavy metal pollution.
- When we dig into the sulphide underneath, we allow the bacteria *Acidithiobacillus* to gain access to the sulphide ore (along with water and oxygen). *Acidithiobacillus* gets its energy from breaking down sulphide to sulphuric acid, creating acid mine drainage rich in toxic heavy metals.
- This can continue for hundreds of years.

What does AMD do?

- Zinc and copper are highly toxic (at low levels) to all aquatic life with gills. Copper is also toxic to algae. Precipitated iron can block gills.
- Lead and cadmium are toxic heavy metals, and cadmium can travel far down the stream as it precipitates out at a higher pH (around 8).
- Heavy metals never 'go away', most accumulate in body organs.

Fish killed by heavy metal pollution, Nigeria

Scope of the problem of AMD

- Engineers Australia (EA 2019) summarises the problems of acid mine drainage:

'Acid mine drainage (AMD) occurs when mining operations result in sulfide bearing ores, … being exposed to oxygen and water. Over time, sulfides react with oxygen and oxidise to form sulfates. Often, this leads to large quantities of water with very low pH having high concentrations in heavy metals. Unfortunately, AMD is expensive and difficult to treat, and as a consequence, large quantities of acid mine drainage is stored at both operational and disused mine sites globally'.

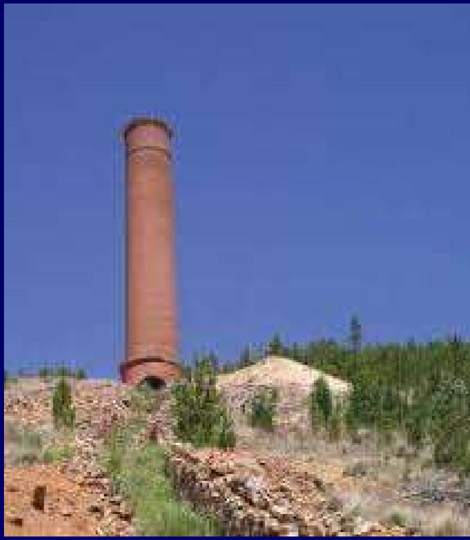
- Earth Science Australia (ESA n.d.) states:

One of the most under-publicized problems facing environmental health in Australia is that of toxic waste emissions or acid mine drainage (AMD) from abandoned mining sites. It threatens the quality of the surface and ground water supply with contamination of toxic heavy metals and high levels of acidity.

Examples of AMD

The Rio Tinto (painted river) in Spain (gave name to Rio Tinto mining) has produced AMD ***since Roman times,*** and continues to do so today. Its pH is highly acidic at 2, and it contains high levels of heavy metals.

Sunny Corner (near Portland)



Mined for silver and copper from 1875 to 1922. The stream from the main adit has a pH of 2.8 and levels of Cu of 12.7 ppm and Zn of 130.8 ppm and cadmium levels of 0.23 ppm (Chapman et al 1983). No money was spent to rehabilitate the site, which continues to pollute today. Daylight Ck below the mine does not attain normal aquatic diversity until **22 km** below the mine (Washington unpublished). The mine stopped operating 98 years ago yet there is no sign of the acid mine drainage and heavy metal pollution ceasing.

Woodlawn (near Tarago)

- Was the largest heavy metal mine in NSW, now closed (1998).
- EIS said the water coming out would be ‘cleaner then the water going in’.
- In fact, the creek below the waste rock dump that flowed to Lake George was bright blue from precipitated copper carbonate.
- High levels of toxic cadmium of 0.23 ppm (mg/L) or 230 ug/L (compared to WHO safety guideline of 3 ug/L, WHO 2011) found close to the mine property boundary. Cadmium causes the disease Itai Itai where it replaces calcium in the bones, causing them to weaken and break.

Captains Flat (near Canberra)

- The mine operated from 1892 until 1962, producing lead, zinc, copper, pyrite, silver and gold. Because the mine drains to Lake Burley Griffin in Canberra, extensive rehabilitation work has been conducted by government since closure to control erosion, improve safety and to control tailings pollution leaving the site ($2.5M). Current and ongoing issues include acid mine drainage seepage and heavy metal contaminants leaving the site, with zinc the main concern.

Rum Jungle (NT)

Rum Jungle extensively polluted the Finniss River after closure in 1971. Despite a major rehabilitation project by the Commonwealth in the 1970 and ‘80s, the damage to the local environment is ongoing. Environnmental engineer Gavin Mudd (RMIT) says:

‘Rum Jungle serves as a warning: rehabilitation shouldn’t be an afterthought, but carefully planned, invested in and monitored for many, many years. Otherwise, as we’ve seen, it’ll be left up to future taxpayers to fix … I’ve seen few mines completely rehabilitated — let alone successfully. ’.

So what is the risk at Lue?

- Key risk is that Bowdens has ***totally ignored*** the problem of AMD and heavy metal pollution. The EIS *fails even to mention it*.
- Despite repeated submissions by me, they *still* fail to discuss it.
- 30 million tonnes of sulphide ore is planned to be mined. The EIS notes on p. 8-16 that pyrite (iron sulphide) is the most wide-spread sulphide material found. Fig 10 of the leachate columns shows that the pH of the leachate of one sample was consistently **pH 3 or less** (i.e. quite acidic).
- The assessment by Bowden Silver thus fails to show that acid mine drainage will not occur. It has occurred with every other sulphide mine. ***It will here also.***

If mining is to proceed, how can we improve things?

- We need to be shown the design of the waste rock dump to see exactly **how air and water will be sealed off** from entering in the long term.
- We need to know the long term security of the tailings dam, with multiple redundancies to ensure it will not collapse (as has happened at Clarence Colliery).
- There needs to be a higher bond on the company for long term measurement of AMD and heavy metals ***and*** a serious fund to treat this, possibly for *decades*.
- Bowdens has failed to discuss *any* of these. These will have substantial cost. **The community should not have to pay.**

Partially successful restoration at Captains Flat cost $2.5 million

Time to stop denial of AMD

- For many decades, the mining industry in Australia has ***denied*** the problem of ongoing acid mine drainage. **Bowdens continues this trend.**
- Due to this, if any action is taken, the community most likely will have to pay.
- It is time for both government, industry and the community to ***wake up*** to the serious problem of AMD.
- The health of our river systems demands we *prevent or limit AMD* in all new mines.

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Washington, H. (unpublished) I prepared a draft paper on the distance it took for aquatic fauna in Daylight Ck below Sunny Corner to return to normal diversity levels. The figure of 22 km comes from this. I left CSIRO before the paper could be finalized.

Washington, H. (pers.comm) I worked at Woodlawn with our team and we walked down the creek bed below the dam below the waste rock dump, being amazed at the bright blue sediments on the creek bed.

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