Mine Drainage Issues at Keno Hills Mine, Yukon
Keno Hill Mines (formerly UKHM)
45 km NE of Mayo
452 km N of Whitehorse
Mine site covers 15,000 hectares (150 sq.km) 
678 mining leases, 121 claims, and 2 crown grants,
Geology

- Phyllite and schist over and under 700m Quartzite
- Cut by greenstone sills
- A granitic intrusion below caused faulting and hydrothermal activity
- Argentiferous galena, freibergite, pyrargyrite (ruby silver), sphalerite, pyrite. Siderite is the main gangue mineral
Early Mining History

1895-placer gold found in area
1903-Silver King staked
1913-Silver King highgraded
1919-Beauvette on Keno Hill
1921-Wernecke/Treadwell
1924-1933 136 tonne concentrator
1935-mill moved to Elsa
1941-47 no activity
1947-91 various companies
From 1921-88 there were 4.872M Tonnes of ore milled yielding

- 6.769M kg silver
- 273.62M kg lead
- 153.2 M kg zinc
Recent History

- 1990-2000 UKHM managed site with limited exploration but no production.
- 2001 site declared abandoned DIAND contracted the Care and Maintenance
- 2002-03 AMT operated C&M but dropped project in 2003
- 2003 Nevada Pacific Gold for a few months, then quit.
- 2003 site again declared abandoned
- 2005 Alexco chosen as preferred purchaser and took over C&M in June 2006.
Some of the sites mined
UKHM – Tailings Ponds

Approximately 75 years of tailings deposition below Elsa, 4.6M Tons.
A 1996 study on reprocessing the tailings by G. Hawthorn P.Eng.

This project was undertaken to evaluate the potential to economically recover additional metal values from the 4.6 million tons of Keno Hill flotation tailing which grades 3 – 4 oz/t Ag, 0.8 % lead, and 0.9 % Zn.

The study determined that the higher grade portion of the tailing, containing some 1.0 million tons at 5.35 oz/t Ag, responds well to cyanide heap leaching with a silver recovery of 50 – 60 %. The testing data suggests that heap leaching is economically feasible at the current silver price of $ US 5.50 / ounce and a currency exchange rate of 1.35 in favour of the US dollar.

The response to gravity and flotation concentration was poor.
Tailings Desert (dry portion)
Sometimes even the problems can look beautiful.
Remnants of the Wernecke Camp. Sadie Ladue, Lucky Queen, and Wernecke all are in the Ladue Creek Watershed, in the MacKenzie River system.
Tailings from the Wernecke mill were discharged down the slope to the small lake in the top of the photo. 250K-400K tonnes
The tailings from 102,000 Tonnes of ore processed at the Mackeno mill were discharged into and beside Cristal Lake.
Water Treatment Sites
Bellekeno lime treatment settling ponds
Mine Adit Discharge Treatment

Silver King, Bellekeno, Galkeno 900, lime treated

Flows – 3-10 L/sec

Raw discharge – max. 10ppm zinc

Treated discharge – generally less than 0.5ppm
Hector-Calumet-Galkeno plan
Hector Mine section
Galkeno 300 Drainage

- No significant drainage before 1999
- By 2002 flows from 3 – 20 L/sec, ave. 10 L/sec
- 80 – 140 ppm zinc
- Discharge stream flows intermittantly (goes to ground) for ~1 km to road, then to Christal Creek
- Aufeis (glaciation) development at road
- Increased zinc loading downstream
Galkeno 300 drainage paths
Settling pond at Galkeno 300
New mixing tank with sludge recirculation

Galkeno 300 Treatment Modifications to date
Items in gray denote changes and additions to the treatment system

1. Sludge pump on floats approximately 12" above the bottom of pond, can be moved around to effectively recycle sludge
2. Tank buried to reduce elevation and allow adit water to directly flow into tank
3. Valves installed to bypass the mix tank if necessary
4. Piping sized to handle 300 gpm (8" line)
5. Solution enters the mix tank at the bottom and exits out the side
6. All existing systems left intact and operational and can be activated immediately if necessary
7. Sludge pump recirculated to allow desludging directly into tanker on a routine basis

Figure 1: Schematic of Galkeno 300 water treatment improvements.
Site Challenges

• Remoteness and harsh climate
• Extensive development prior to environmental regulation
• Lack of appropriate data
• Unexpected changes in discharges
• Lack of stable ownership
Sunset at Elsa – 3 PM