

**PAH NEWS PIX**

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**C A L E N D A R**

- **2004 SME Annual Meeting & Exhibit**  
February 23–25, 2004  
Colorado Convention Center  
Denver, Colorado  
email: [sme@smenet.org](mailto:sme@smenet.org)
- **PDAC 04**  
International Convention, Trade Show & Investors Exchange  
March 7–10, 2004  
Metro Toronto Convention Centre, North Building  
Toronto, Canada  
email: [pdac@pinngroup.com](mailto:pdac@pinngroup.com)
- **EXPOMIN Chile 2004**  
April 20–24, 2004  
Fisa Maipu Fairground  
Santiago, Chile  
email: [info@fisa.cl](mailto:info@fisa.cl)
- **CIM Mining Industry Conference & Exhibition**  
May 9–12, 2004  
Shaw Convention Centre  
Edmonton, Alberta, Canada  
email: [jgaydos@cim.org](mailto:jgaydos@cim.org)

## Rain, Snow, Ice, and Wind

Meteorological assessment of mining projects, particularly in relation to ore characteristics, is usually given short shrift, yet its influence can be as important as the ore reserve base. The difficulty of quantifying ore characteristics and their relationship to climatic conditions and to mining and ore processing is probably the major factor in this frequent lack of appreciation; there's a tendency for us engineers to ignore that which we cannot quantify: if it can't be measured or calculated it can't be that important! Au contraire!

Here at Pincock, Allen & Holt, we have had the privilege of checking out numerous projects and following them from inception to completion and, in some cases, incompleteness. We are often required to look gift horses in the mouth; yet no matter how flashy the appearance, how spirited the gait, how good the lineage, the teeth may indicate that they are better suited for the abattoir, usually to the severe consternation of the owners and trainers. Though mining projects do stumble on erroneous reserve estimates, faulty mining plans, and inappropriate ore-processing methods, as often the problems are related to the four Apocalyptic Horsemen of Ore Characteristics:

### Muddy, Sticky, Slippery, and Dusty

And their four steeds:

#### Rain, Snow, Ice, and Wind

With them come sickness, hunger, pestilence and death for mining projects.

The horses alone can be a troublesome four-in-hand; major difficulties that result when they are given free rein are presented in Table 1 (shown on page 4). When the riders mount these steeds, watch out, there is serious trouble brewing, as shown in Table 2 (shown on page 4). These two tables also show the usual manner of mitigating the problems, as far as this is possible.

One steed conspicuously omitted, largely a result of his invisibility, is Fog. His presence is certainly problematical but it's limited to visibility, a concern that can usually be countered by good lighting. If persistent, then productivity needs to be adjusted downward.

Permafrost and other soil conditions, such as swampy ground or expansive clays, have not been included in this assessment. While they are certainly very important and have been the ruination of many a mining project, it is a separate subject, one that will be included in a future Perspectives article.

**GLOBAL COPPER MARKET FORECASTS DEFICITS IN 2004**

Soaring demands are expected to cause a deficit in the global copper market in 2004. According to analysts, a 500,000 ton shortfall can be anticipated for 2004 and 200,000-300,000 tons for 2005. In terms of prices, Macquarie Bank believes copper will average US\$1.20/lb in 2004 and will peak possibly in the second quarter at over US\$1.40/lb. The current copper market is being described as "phenomenally bullish."

**NMA WANTS POLICY TO ATTRACT INVESTORS**

National Mining Association CEO Jack Gerard asked Congress and federal agencies to create a domestic minerals policy that will provide the regulatory certainty needed to attract investments in the U.S. mining industry. Speaking at the National Western Mining Conference in Denver, Gerard said the domestic mining industry requires greater regulatory certainty to strengthen manufacturing and stimulate high-wage employment. According to Gerard, the U.S. mining industry is being hindered by government policy that discourages new mining investments and forces U.S. manufacturers to rely on foreign supplies of vital minerals. In its annual Mineral Commodity Summary released in January, the U.S. Geological Survey stated that the U.S. share of money invested in global mineral exploration in 2002 was just 7 percent, a 66 percent decline from 1997. Gerard feels that mining companies must be prosperous businesses in order to provide the jobs, tax revenue, and energy and minerals essential to economic growth. In order to do this, he suggested a consistent federal agency permitting policy, providing certainty to applicants that permits will be expedited.

**U.S. COAL DEMAND EXPECTED TO INCREASE**

A record demand for coal is expected this year, up as much as 26 million tons over last year. Reasons behind the demand include new hydrogen technologies that could generate emission-free energy from coal; the economy's growing appetite for electricity, which is expected to grow by 50 percent over the next three decades; and competing fuels reaching plateaus of utilization because of their inherent limitations.

Both intensity and longevity need to be considered in relation to the weather. In this regard, long winters or extended periods of intense rainfall can be very trying and few engineers are cognizant of these phenomena unless they have lived in



the area of the mine, which is seldom the case. Even if they have, their advice is rarely considered. In some cases, the problem may be minimized by seasonal operation, at least of the mining component.

Weather records are normally regional and specific information about local weather in new mining areas is seldom on record. Still, the indigenous population is usually very well aware of local weather patterns, their point-to-point travels have necessitated the accumulation of such knowledge and the heeding of their warnings can help avoid winding the project.

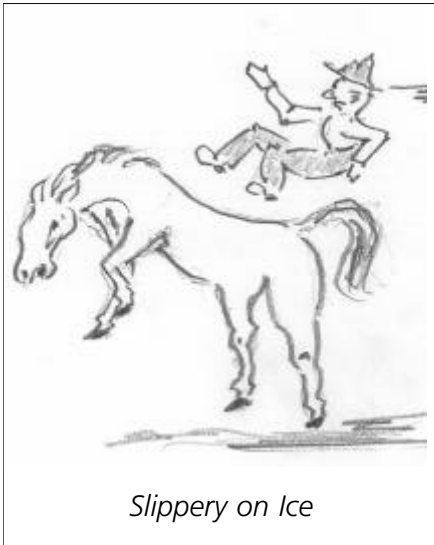
Euphoria for the race can often impair good judgment. The trainers have worked hard to prepare the horses and riders but the conditions

of the turf are uncertain. But race they must. They are off and running. The first jump of the steeplechase looks easy, but there are many more to go, most more difficult than the first. As the race proceeds chaos and bedlam ensue. Horses and riders fall; hazards mount, injuries escalate. And when it is over "The tumult and the shouting dies, the captains and the kings depart." another dead mining project to bury, or perhaps resurrect in some future year.

The lack of appreciation of the difficulties presented by the horses and riders is not always hubris, often it is just naïveté. The contrast between the depth of investigation and documentation of the climatic conditions and physical characteristics of the ore and their influence compared with other aspects of the project is sometimes astonishing. The geological reports of deposits, for instance, are usually exceptionally thorough and beautifully written and the rest of a project is also usually well thought out but the hedges, fences, and ditches that must be jumped by Muddy, Sticky, Slippery, and Dusty are often glossed over.



When these horses and riders are galloping at high elevation, as in the Andes, the problems are further compounded. They are more prone to lose breath and easily stumble and fall. Getting them moving again is not easy. In Chile and Argentina they talk of “*perdiendo los estribos*” (loosing the stirrups), a circumstance that’s not uncommon when the race to get the project up and running gets difficult and the riderless horse limps back to the starting gate.



*Slippery on Ice*

These problems are not new; they have been around for a long time. In the past they could usually be countered by using plenty of labor. With rods and hand shovels and wheelbarrows, and in later times compressed-air lances, the ore could be kept moving and the mess minimized. However, the high ore grades and low tonnages treated in those earlier days meant the burden imposed could be more easily accepted. Nowadays we are no longer dealing with hand-pushed rail cars and stamp mills, but with enormous trucks and huge crushing plants and grinding mills. Plugging

the system is practically intolerable; trips to the farrier must be limited!

Fortunately, the ingenuity of man is such that problems imposed by weather and ore characteristics can usually be countered, but closing the stable door after the horses have bolted can be exceptionally difficult... and costly. Better to have made provision for these problems ahead of time: better not to have put the cart before the horse!

Perhaps feasibility studies for mining projects should include a separate section, of the same significance as Ore Reserves or Mining, devoted solely to the weather and ore characteristics, one that addresses the impact of these concerns in all aspects of the project, somewhat similar to the way Operating Costs is inclusive of all aspects of the project. For the punters, it would help minimize the risk of many a hefty wager.



*Dusty on Wind*

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■ **WBG WORKING TOWARDS MINING STANDARDS**

A recent World Bank Group sustainability study suggests that the organization not support mining operations that use cyanide, dispose of tailings in rivers or the ocean, or involuntarily relocate communities. The study asserts that the World Bank should help mining companies contribute to poverty alleviation in developing nations by improving public and corporate governance, implementing much more effective social and environmental policies, and respecting human rights. A number of the study’s findings coincide with corporate governance, sustainability, environmental and social policies already being used by major mining companies.

**Minerals Corner—**

**Mineral Ludlamite**  
 $(Fe, Mg, Mn)_3(PO_4)_2 \cdot 4H_2O$ ,  
**Hydrated Iron Magnesium**  
**Manganese Phosphate**

Ludlamite is a classic phosphate mineral. It is best known in shades of green that vary from bright green to apple green to greenish-white. Ludlamite occurs in two distinct environments. The first is in the upper oxidized portion of hydrothermal mineral deposits in association with other phosphates. The second is as an alternative product of primary phosphate minerals in complex pegmatites. Ludlamite is found in only a few locations, the most famous being the Wheal Jane Mine in Cornwall, England. It was first discovered there in 1876 and is named for Henry Ludlam, a British collector of fine rare minerals. Ludlamite can also be found in La Union, Spain; Rapid Creek, Yukon Territory, Canada; Chihuahua, Mexico; Hagendorf, Germany; Cobalt, Idaho; North Groton, New Hampshire; and Custer County, South Dakota, USA.

**TABLE 1**  
Major Difficulties of Severe Weather Unrelated to Ore Characteristics

	Problem	Resolution
<b>RAIN</b>	Open pits flooded Ponds overflow Access impeded: Fords impassable Bridges flooded Pipelines torn out	Use diversion ditches Use oversized ponds and diversion ditches  Keep dozers on hand Build high-level bridges Locate out of flood paths Bury deep Establish barriers downstream of pipe river crossings
<b>SNOW</b>	Access impeded: Roads choked  Vision limited Snow-entrained lenses in stockpiles Avalanche damage  Road/rail/conveyor cuts snow filled Roof damage by snow load	Locate roads to minimize drift accumulation Locate roads to maximize sun exposure Use snow fences Keep snow-removal equipment on hand Allow for operations shut-downs Clear snow away before moving Locate facilities underground Use avalanche guns Use tunnels Design for expected snow loads
<b>ICE</b>	Pipes frozen Power lines downed	Bury deep; heat-trace where exposed Use emergency generators
<b>WIND</b>	Buildings damaged, especially roofs Maintenance hindered Plastic liners damaged	Design for expected wind loads Enclose equipment and/or buildings Provide adequate ballast

**TABLE 2**  
Interaction of Weather Conditions and Ore Characteristics

	<b>MUDDY</b>			<b>SLIPPERY</b>	
	Problem	Resolution		Problem	Resolution
<b>RAIN</b>	Roads muddy  Ditches carrying muddy water	Use articulated trucks Use truck wash system Capture mud with hay bales	<b>RAIN</b>	Vehicle tires slip Belt drives slip	Use deep treads Use rubber-covered drive pulleys
<b>SNOW</b>	Same problems and resolution as shown for RAIN, as snow melts		<b>SNOW</b>		
<b>ICE</b>	None		<b>ICE</b>	Vehicle tires slip Belt drives slip	Apply sand to roads Keep belts running
<b>WIND</b>	None		<b>WIND</b>	None	
	<b>STICKY</b>			<b>DUSTY</b>	
	Problem	Resolution		Problem	Resolution
<b>RAIN</b>	Mud sticks to truckbeds Coarse-ore stockpiles don't flow Primary crushers plug Fine-ore stockpiles rat-hole and plug Mud sticks to belts Belt transfer chutes plug Screen decks plug  Secondary crushers plug: Vertical-shaft rotary impactors Cone crushers	Use plastic liners Use front-end loaders Use toothed-rolls Use gyrating-bottom bins Use good scrapers Use plastic liners Avoid fine screening Use special screens  Do not install Consider water-flush Consider SAG milling Consider washing plant	<b>RAIN</b>	None	
<b>SNOW</b>	Same problems and resolution as shown for RAIN, as snow melts		<b>SNOW</b>	None	
<b>ICE</b>	Broken rock frozen Belt carry-back Ice accumulation on return idlers	Eliminate or limit stockpiles Use good scrapers Use good scrapers	<b>ICE</b>	None	
<b>WIND</b>	None		<b>WIND</b>	Roads dusty Fine ore stockpile dusty Crushing plant dusty: High dust levels Equipment maintenance Lube contamination Tailing containments dusty	Apply water to roads Enclose stockpile  Oversize dust collection Use isolation dampers on ducting Isolate and enclose lube systems Cover with soil & seed; keep wet

