



WATER MANAGEMENT

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We have heard often in our professional careers about the need to resort to fundamental principles to resolve recalcitrant technical issues. That statement of course assumes we understand what those fundamental principles are and how they apply on a daily or long term basis to a specific environmental or operational issue under consideration. Based on issues that have arisen at several mining operations during the course of personal consulting over the past year, it has become obvious there is a definite need to reconsider this sage advice. Of particular importance are technical issues related to water quality, management, and treatment at mining operations. In the end ignoring fundamental principles can and has led to operational and environmental problems manifesting themselves in losses of production, permitting delays, exceedance of water quality standards, inadvertent releases to the environment and finally legal and other regulatory entanglements. In some instances the end result is the expenditure of large amounts of precious capital to resolve issues that could have been resolved by only stepping back a moment and relying upon those principles.

A successful mining operation is one that promotes integration between its mining, process, and environmental components, and synergy between the respective personnel involved with these areas of responsibility. It is human nature to focus on individual tasks and responsibilities and as a result lose the balance associated with keeping an eye on the big picture.

From the consulting viewpoint, we can be too focused on the clients' immediate demands and suggest technical solutions that revolve around our individual or firm's expertise and experience instead of "thinking out of the box" to provide alternative outcomes. Being creative for the sake of being clever is not typically a successful strategy, as often the most elegant solution is the simplest although not necessarily the most novel. Our job is to find robust management and engineering solutions to technical problems that enhance the operators ability to do their job in the most effective and efficient manner.

The mining industry on its best day will be criticized for something it did or did not do. Some of that criticism is justified but much of it is not. At the heart of most of the environmental and operational issues seen at mining operations is the fundamental lack of understanding of the

dynamic water balance and in turn its impacts on the resultant water management system. A water balance is just that, a balance between obtaining and maintaining the optimal volume of water required to achieve production goals while minimizing the volume of excess contaminated water that may have to be treated and disposed of in some manner. Superimposed on the internal operational water balance is the external one associated with nature. Ultimately associated with the comprehensive water balance is the corresponding mass balance based on considerations of water quality.

The concept of the “zero water balance” is alluring as it suggests there will not be a need for a discharge during the mine life and therefore the arduous process of permitting one and dealing with the potential political fallout and associated environmental and human health issues can be circumvented. More often than not it is the associated water quality issues that become the focus and basis of an attack on a particular mining project. The historical perspective of the water balance and management system was related strictly to production and not to the subsequent environmental concerns of the operation. Although the purpose of a mining operation is to produce metals and minerals, nonetheless in the 21st Century the “tail wags the dog”.

A mining operation is unlike any other industrial, manufacturing, or large retail endeavor which has a fixed footprint on the landscape. It cannot be situated at the most practical or desirable location due to the manner in which ore bodies were originally produced within the Earth over geologic time. The ever increasing demand for metal and minerals is requiring the mining industry to enter into more remote and extreme landscapes often with very difficult climactic, geological, social, logistical, and infrastructural constraints and conditions. Rapidly declining ore grades are requiring much larger operations which in most cases rely on open pit or cast mining techniques which produce large amounts of waste that must reside on the surface. The days of the cozy out of view underground mine in which the waste could be backfilled are nearly gone.

The ever increasing footprint of the open pit mine and the accompanying waste rock disposal areas create a dynamic water balance and management situation that must be constantly evaluated and updated to optimize water usage and to avoid being blindsided by an unnoticed issue. The issues associated with water balances and management are further complicated when a heap leach pad or pads are introduced into an operation. Within the ever growing leach pad there is an ever increasing “invisible” water balance which at some point after many years of mining must be unraveled and ultimately dealt with during decommissioning and closure. The long term issue of waste rock disposal is an important corollary to the overall water management discussion, as a poor design can lead to acidic metals containing drainage requiring very long term and costly treatment.

In gold mining, the advent of the International Cyanide Management Code and Institute has put renewed emphasis on water balances and management issues to further reduce the risks for potential inadvertent release of solutions into the environment. In the mining industry well over three quarters of all major environmental incidents involve a tailings dam mishap or release of solution through a conveyance breach due to the lack of secondary containment. In the case of the tailings dam mishap nearly all of the incidents are the result of water mismanagement or the lack of proper treatment. Of the dozens of gold mining operations current certified or seeking certification there has not been a major environment incident globally for more than a half a decade. This achievement is a tribute to the industry accepting responsibility for potential risks and actually implementing an approach to further reduce them. Although we do not have to take responsibility for the existence of risk, we certainly have to take responsibility for ignoring it.

Variable climactic conditions come into play as the footprint of the mining operation expands over time. Although concerns over climate change are constantly being brought forward, development of a robust and dynamic water balance which has been thoroughly interrogated over the broad range of historical conditions will easily encompass the possible micro changes expected to arise from global warming during this century.

At the fundamental level the goal is usually to “keep clean water clean” and use the minimal amount of fresh water. Various internal mine and process waters can often be blended and recycled to avoid the need for more fresh water or treatment and a discharge. However, many operations are located in climates characterized by only wet and dry periods and further diligence is needed operationally to smooth out the water balance on an annual basis. Clearly, a review of internal and external water balances for new and existing mining operations will yield improvements that can be measured in dollars and make sense. The water management system is much more than a collection of pumps and valves. This review should also take into consideration of the manner in which the operational water balance and management system will suit closure, as mistakes made during operations can lead to unexpected and devastating expenditures when either a temporary shutdown or decommissioning and closure finally arrive. In the end the one aspect of a mining operation that brings all of its physical and personnel components into perspective and highlights their interdependent relationships is water management.