Design for water management

by A.J. Burger*

Various definitions of sustainability have been proposed over the years. Some of these are rather elaborate and non-specific. Considering the sustainable use of water—a primary resource—it is true that water can never be destroyed, but it certainly can be 'used up' at specific locations. Industrial activities account for approximately 23% of worldwide water consumption and the availability of clean water at specific locations is seriously reduced by such activities. This reality is becoming a fundamentally important consideration when designing a new minerals processing plant. The South African authorities also force action in this regard by applying the 'polluter pays' principle.

High-end purification processes such as desalination are not only expensive and energy inefficient, but they also produce concentrates that are difficult and expensive to dispose of. Therefore, water consumption should primarily be minimized by clever design and implementation of effective water management systems. The following basic aspects should perhaps be highlighted:

- *Effective management and measurement*—It is not possible to control consumption without effective measurement. Flow measurement at points of use enables the enforcement of accountability. It also enables true assessment of daily and shift-based water needs per plant area, or per machine
- *Recycle used water and use high quality water only where necessary*—Activities such as flushing of equipment, washing of floors, quenching, dust suppression, etc. do not necessarily require clean water. Used water can be recycled successfully, sometimes with basic precleaning, for such non-core activities. In addition, the minimum acceptable water quality for any specific process should be well understood (as early as in the design phase) and high quality water should only be used where absolutely necessary. Pinch-technology can be used in a successful manner to optimize water use
- *Separate water circuits*—It is wise to incorporate several water circuits in the plant, with different water quality standards applicable to each circuit. The typical 'industrial water', 'fire water' and 'potable water' approach may be extended into a more elaborate system where, for example, water is categorized according to various levels of salinity, thus enabling maximum use of recycled saline water before potential desalination
- *Bank water and don't dump prematurely*—Excess storm water can be collected and stored for later use. Cooling circuits should operate at maximum cycles of concentration and materials of construction should make provision for this
- *Treat early and separately*—Early treatment of contaminated water before being blended in with other effluents often simplifies the treatment process. For example, an effluent with a high dissolved organic content should rather be treated separately before being mixed with a high-salinity effluent.

After optimization of water consumption, including primary treatment and recycling of effluent, final desalination of high-salinity effluent is sometimes unavoidable. Membrane-based and thermal desalination technologies are well-established, but can provide endless problems if not well-designed and well managed. Therefore, related design and pre-treatment requirements require thorough consideration by experienced design engineers. ◆

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