CLEAN WATER

Big Value For The Steel Industry

Presented at the 1995 Conference for the American Institute of Steel Engineers
by Ernest Tudor, Retired Senior Environmental Engineer, California Steel–Fontana Works

Introduction

The steel market continues to be very competitive and price-driven...and appears likely to remain so for a very long time. In recent years, all aspects of managing and operating a steel mill have been re-evaluated and modified to improve efficiency. Management re-organization, marketing strategies, niche manufacturing and expansion of services are just a few of the concepts that have been initiated. Some have succeeded...others have not.

Logically, the most significant advances in efficiency have come in production, where new equipment and processing technologies have promoted better steel quality and better volume/ deliveries than ever before. Among those processes promising the greatest improvements are operations involving water, such as cooling, quenching and de-scaling. With higher pressure pumps, improved spray nozzle designs and better valves/control hardware, precision equipment has become common. With sand, grit, scale, precipitated minerals, slag and other process solids, such precision can be dramatically compromised. With the increasing scarcity of water, the cost of disposal and the value of effective recycling, precision can only be accomplished with effective filtration. Now, the careful selection and expanded use of filtration can also contribute to operation efficiency.

The presence of solids in a steel mill's recirculating water is not a debate. Fresh intake water alone contains sand, silt and other potentially troublesome particulates, regardless if the source is surface water (a pond, lake, reservoir, etc.) or groundwater. Production, of course, introduces additional solids matter. And its accumulation in pits, sumps, re-use ponds and other areas further contaminates the overall mill environment.

Clean water, free of troublesome solids, is important for maintaining the precision and functionality of process equipment. Most notably, every steel mill uses spray nozzles in its operation...and, if fouled, plugged and/or abrasively worn, their distribution patterns and performance will be adversely affected. Also common is the presence of pits and sumps, where operations such as quenching result in the accumulation of unwanted solids. By examining the costs of ineffective or nonexistent filtration, the payback value of clean water can be quantified to determine its actual contribution to reducing costs and increasing efficiency.

Maintenance and shutdowns.

When, for example, the spray nozzles and/or manifolds in a de-scaling operation are plugged with the grit and scale from recirculating the process water, the situation must be addressed immediately. To ignore the problem is to compromise the quality, value and salability of the steel...an undesirable and understandably unacceptable alternative. Unfortunately, the problem can only be corrected by shutting down the process line in order to manually repair or replace the appropriate nozzle(s) or manifolds. This, of course, leads to shutdowns throughout the mill and idles a great number of people for sometimes long and costly periods of time. In fact, labor and lost productivity have been conservatively estimated to cost as much as $50,000 to $95,000 per hour.

Faced with incidental accumulation in pits or sumps, unwanted solids/sludge must eventually be removed...and such procedures are widely recognized as messy, labor-intensive and costly. When pits or sumps are intentionally meant for sedimentation, it is now acknowledged that the gradual displacement of water by solids does, in fact, reduce the liquid retention time in such vessels, thereby promoting an undesirable carryover of solids from the vessel to process use. It is also known that the solids which settle in such vessels do encourage the growth of algae and bacteria, further contaminating the liquid and creating foul odors. Though the cleaning process may be scheduled to avoid operating shutdowns, the maintenance routine is nonetheless time-consuming and often performed at overtime labor rates.

Product quality and downgrading.

Ineffective de-scaling or uneven cooling/quenching of manufactured steel is common and just cause for the reduction of top-quality product to minimum-value scrap. Worse yet, to downgrade even one or two slabs of a day's run is to risk an incomplete/short order, serious delays in delivery and/or an unacceptable variation of quality between two slabs run at different times with an even slightly different mix of materials. Customer satisfaction suffers...and a hard-earned competitive edge may be lost.

Filtration: selection and differentiation.

Concurrent with the technological advancement of process equipment for the steel industry, the world of filtration and separation has also changed...and it is wise to be aware of these changes when evaluating the prospects for up-grading or replacing such equipment. The traditional filtration of years ago is often inadequate for today's systems in many regards. A review of the common filtration selection criteria helps explain why.

Performance--The improved efficiency of today's process equipment often demands finer filtration to prevent fouling and malfunction. It is also realistic to specify two or more filtration/separation devices for the efficient removal of widely variable solids/contaminant types. Also consider pressure loss, not only for the acceptable limits of a process system, but also for the potential variation (clean vs.

dirty) that a filter might impose on that system.

Maintenance--It is significantly important to consider what steps are necessary to keep a filter operating properly for years to come. Issues including shutdowns (or duplicate hardware) for cleaning, backwashing, filter element cleaning or replacement, etc. may reveal an initially inexpensive filter as a far more costly long-term alternative.

Engineering/Installation--Consider the necessary modifications to system piping and the compatibility of the filter to the process environment. The cost of installation should be judged in the overall evaluation.

Space Requirements--Not only for factory floor space, which can vary dramatically by type of filters, but also height or potential match-up to existing piping schemes.

Liquid Loss--Once solids matter has been separated from a recycled process fluid, examine a filter's ability to discharge those solids with minimum liquid loss and optimum waste minimization. This is a particularly valuable consideration in today's water-, waste- and EPA-regulated environment.

All forms of liquid-solids filtration can and should be compared and evaluated by these five selection criteria. All five criteria should always be included in the evaluation process. Maximum value is determined by matching the benefits of the most appropriate filter to the present operating conditions of a given application. When the savings can be identified, the action can be justified.

Case Story: *California Steel, Fontana, California USA*

Both the plate mill and hot strip mill of this steel rolling facility were suffering from plugged cooling spray nozzles, plugged spray manifolds, premature wear & replacement of the nozzles, uneven cooling & product shape problems and scaling/"orange peel" quality control problems. Additionally, excessive and irregular solids loading typically overwhelmed their strainers and created yet another maintenance routine.

Investigating alternative filtration techniques to keep up with their process needs, the environmental engineer identified a centrifugal-action separator for the removal of process slag, grit and scale. A brief period of on-site testing confirmed both its performance and ability to handle the solids loading. It was also decided to convert their strainers to coarse pre-filters (1/4-inch mesh only) for purposes of keeping odd debris (paper cups, cigarette butts, wood particles, etc.) out of the system and out of the separators, which could not remove such large and light/floating debris.

The purchase of the separators was justified in a review of four key cost centers:

- Spray nozzle cleaning and replacements–By tripling the life of the spray nozzles, savings of $2,000 per week ($104,000 per year) were projected.

- Spray manifold replacements–Costs of $1,200 per week ($62,400 per year) were eliminated.

- Strainer maintenance–This weekly routine, at $500 per week ($26,000 per year) was dramatically reduced.

- Lost productivity–When full mill shutdowns are caused by plugged nozzles/manifolds and required strainer maintenance, costs were estimated at $90,000 to 180,000 per year.

Given the above, the value of the separator systems was projected to payback in only *five months*...including installation costs.

Conclusion

Water is important to the steel industry. Clean water is important for maximum operating efficiency. And today's filtration technology can make a valuable contribution to the overall competitive strategy of steel production worldwide.