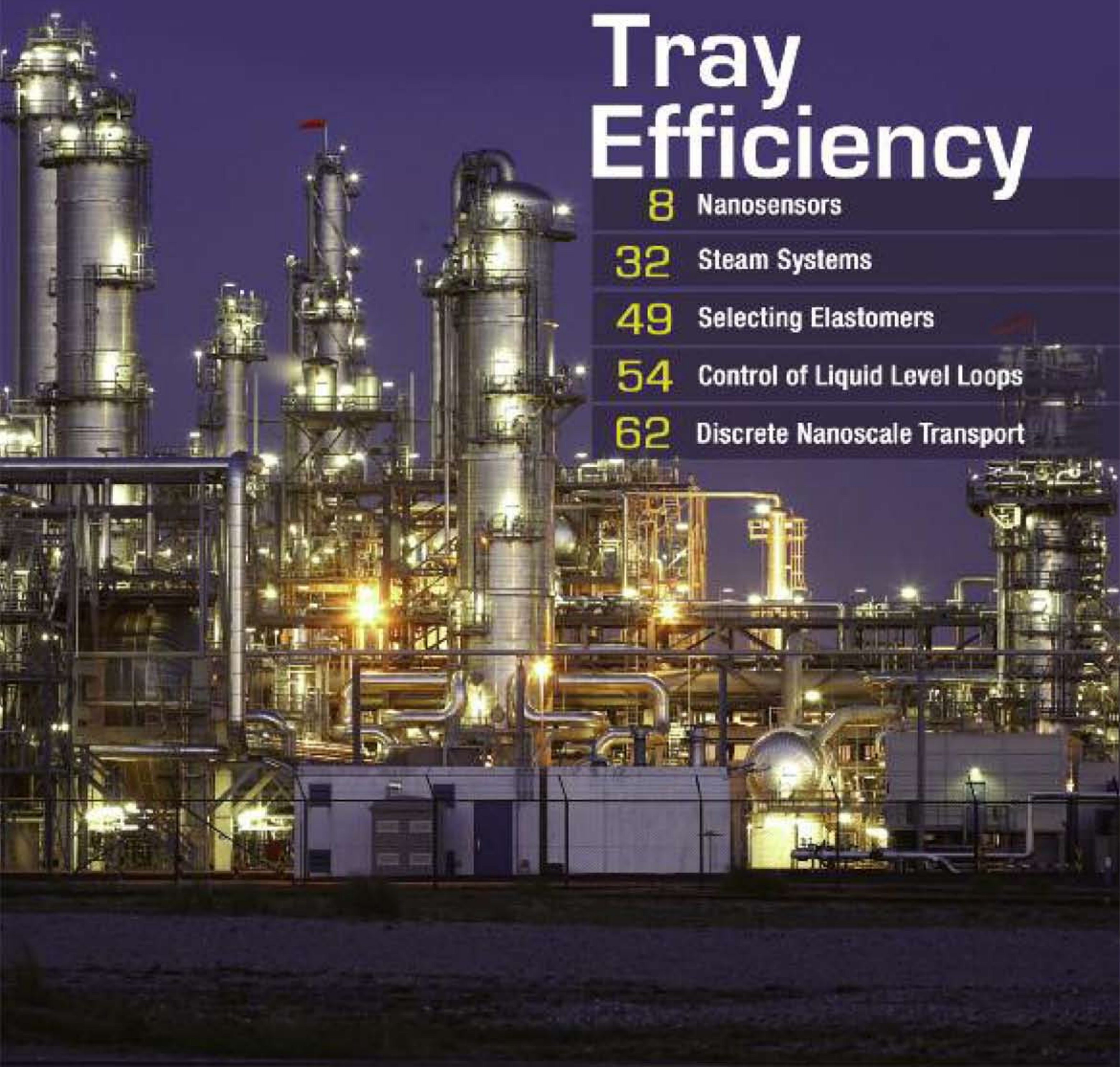
June 2008

CEP

Chemical Engineering Progress

An AIChE Publication

www.aiche.org/cep



Tray Efficiency

Optimize the Entire Steam System

JAMES R. RISKO is the president of TLV Corporation (13901 South Lakes Drive, Charlotte, NC, 28273; Phone: (704) 597-9070; E-mail: Risko@TLVengineering.com). He is active in the Fluid Controls Institute, having previously served as its chairman, standards chair, and chair of the Secondary Pressure and Steam Trap sections. He is an Association of Energy Engineers-certified energy manager, and holds two BS degrees from Kutztown Univ. in mathematics/education and business administration/accounting. He also holds an MBA from Wilkes Univ.

Rising energy costs for oil and natural gas put increasing pressure on the profit margins of chemical plants, challenging facilities to improve (or even maintain) profitability. This is especially an issue for those plants that not only use gas for firing boilers or furnaces, but also for process feedstock. One way to reduce operating costs (and increase profitability) is to optimize the plant's steam system to cut steam and condensate loss, lower CO_2 emissions through reduction of generated steam, optimize all steam-using applications, and ultimately enhance the energy balance of the plant.

What is necessary to optimize a steam system?

Optimization of a steam system requires that the three main components of the system — condensate discharge locations (CDLs), steam-using applications, and steam generation and balance — are all individually optimized.

CDL optimization begins where steam traps are installed, but performing this task alone is insufficient. A steam trap could be operating properly while significant steam loss occurs elsewhere — *e.g.*, leaking out through a flange, valve seal, bypass, or bleeder valve. For this reason, the focus must be on CDL management, rather than just steam trap management.

Proper CDL management calls for removing condensate from locations where adequate drainage is needed. The CDLs were created to remove condensate, so there should not be any locations where condensate is backing up in the system due to blocked traps or plugged drains. Optimizing the CDL drainage process requires finding a way to remove condensate without wasting steam from any piping component. In a standard steam system, this means effective management of the CDLs (including the steam traps and associated piping) on the steam distribution headers, tracer lines and equipment. Roughly 80–90% of CDLs are steam-main drip traps and tracer traps, but the largest individual savings are often found in steam-using process equipment applications.

All steam users should have a proactive and responsive steam-trap management program to ensure that all CDLs are operating properly. In a typical facility, the condition of all CDLs is monitored to ensure proper drainage without steam leakage. Normally, all CDLs should be checked at least once per year. More-critical or severe-service applications, such as those using superheated steam, or flares, turbines, and process equipment, should be checked more frequently. Failed CDLs, whether due to steam leakage or blockage, should be repaired immediately. After such a program is implemented and the CDLs are optimized, the optimization program should focus on steam-using equipment applications and the steam balance.

What can be done with steam-using equipment?

Plant operators continually strive for efficient process operations, yet experience has shown that many steam-using applications are not optimized. Examples include stratified heat-exchange equipment, in which flooding blocks and in effect removes valuable heat-transfer area, flares whose pilots might be extinguished, and turbines that are damaged by water hammer.

A lack of optimized performance can affect large-scale operations, such as distillation or evaporation towers, and small-scale processes, such as vacuum systems, reboilers, vaporizers, heat exchangers and flares. With these steam systems optimized, it is possible to improve yields while reducing operating costs.

Other opportunities are found in steam-using equipment that are not directly process-related, but that affect process operation. Such equipment could include steam turbines for compression, power, or drive purposes, preheating operations, and waste-heat boilers and steam generators.

How can steam-using applications be optimized?

To optimize steam-using applications, a plant manager should ensure the maximum heat transfer possible, without wasting energy, at the lowest cost for steam, and without backing up condensate into the system. Essentially, this requires disentrainment of condensate from certain steam flows, or removing condensate as it forms without leaking steam. Opened bypass valves, open steam-bleed valves, system water hammer and visible wasted condensate are the most obvious signs that the installed system is not optimized.

An opened bypass valve usually indicates that the installed drainage device on the equipment cannot perform its role (so operators open the bypass to compensate). Wasted steam can represent an extraordinary annual expense. Bleeders are often visible at turbines or in certain steam-jacketed tracing applications. This, too, is a sign that the operators may not have sufficient confidence in the installed CDL, so they bleed valuable steam to achieve the required system operation and availability.

Correcting these issues will improve drainage, but not necessarily the application. Optimizing an application involves reviewing the steam balance to uncover any possibilities to use the lowest-cost steam available. The system is optimized when the equipment is properly drained, without steam or condensate loss, and with the lowest-cost steam utilized in the process.

Although plant personnel want optimized systems, they often are without the time or specialized knowledge to improve drainage of certain applications. This is where trained specialists can be useful to improve operation while reducing costs.

At least one manufacturer provides Association of Energy Engineers-certified services to help optimize steam-using equipment applications and large-scale steam processes. They typically review specific equipment and data, then create a drainage option report to improve performance and reliability, and encourage low-cost operation. Steam system optimization can significantly increase profits and operations, while reducing steam generation and emission of greenhouse gases. CEP