November 2000

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY

Benefits

- Saved $142,000 annually
- Reduced annual energy consumption by 56,900 million Btu
- Reduced carbon emissions

Applications

In any steam system, reducing unnecessary steam flow will reduce energy consumption and, in many cases, lower overall operating costs. This flow reduction can be achieved in many steam systems by lowering normal operating pressure in the steam header. To determine if such a cost saving opportunity is feasible, industrial facilities should evaluate the end use requirements of their steam system.

Reducing Steam Header Pressure Provides Attractive Operating Cost Savings

Summary

Nalco Chemical Company is constantly seeking ways to improve steam system performance. At Nalco's Clearing Plant in Bedford Park, Illinois, changes in some of the plant's processes led personnel to evaluate the feasibility of reducing the steam header pressure. The team decided to incrementally decrease header pressure while monitoring the effects of this change on system performance. The pressure was reduced twice, and each time the system was carefully monitored to ensure there was no detrimental impact on system operation. Nalco now operates the system at 100 psig, down from 125 psig, resulting in annual energy savings of 8%. The plant received a 1997 Chemical Manufacturers Association Energy Efficiency Award for the project.

Company Background

Nalco Chemical Company is a large producer of specialty chemicals for water and industrial process treatment systems. As a participant in the Chemical Manufacturers Association's Responsible Care®, Nalco continually searches for pollution prevention and energy efficiency opportunities.

Project Background

For many plants, lowering the nominal system pressure is achieved by reducing the boiler output, which reduces fuel consumption. Other benefits include:

Bedford Park Plant

- Decreased friction losses resulting from lower steam and condensate flow rates. Because the head loss due to friction in a piping system is proportional to the square of the flow rate, a 20% reduction in flow rates results in a 36% reduction in friction loss.
- Lower piping surface energy losses due to lower steam temperatures.
- Reduced steam losses from leaks.
- Less flash steam in the condensate recovery system, which reduces the chance of water hammer and stress on the system.

However, implementation of a significant system operating change such as lowering header pressure requires careful consideration of the potential impacts. Communication and planning across plant departments is required to minimize the risk of an unexpected problem.

Project Overview

By evaluating its steam system and end-use equipment, Nalco realized that a lower header pressure could still meet system needs. The services performed by high-level steam jets were no longer required for the products manufactured at this plant. Instead, the steam system only needed to serve process heating and low-level steam jets, which require lower steam pressure.

To minimize the risk of unexpected problems, the steam header pressure was first reduced from 125 psig to 115 psig. Changes in system operating conditions should be implemented carefully to avoid adverse affects on product quality. The participation of system operators is essential in both planning the change and subsequently monitoring the effects on system performance. At Nalco, after no problems were observed from the first reduction in header pressure, the pressure was stepped down further to 100 psig. Encouraged by the success of their efforts, Nalco is evaluating the feasibility of reducing the pressure even more.

Results

Overall, reducing steam header pressure was successful. This project did not require a capital investment and minimal downtime was necessary. The only costs associated with this project were for labor resources to analyze project feasibility, to recalibrate the flowmeter (which receives periodic calibration anyway), and to monitor system response to the operating change. Nalco realized annual energy savings of 56,900 million Btu, cutting costs by $142,000 annually. On a per pound of product basis, the amount of energy was reduced by 8%, from 2,035 Btu/lb to 1,873 Btu/lb. The decreased fuel consumption translates into an annual 3,300-ton decrease in CO_2 emissions. Additionally, by operating at lower energy levels and flow velocities, the steam and condensate systems experience less erosion and valve wear.

Industries of the Future—Chemicals

The chemicals industry is one of several energy- and waste-intensive industries that participate in OIT's Industries of the Future initiative. In December 1996, the chemicals industry published a report, entitled ***Technology Vision 2020: The U.S. Chemical Industry****, that helps establish technical priorities for improving the industry's competitiveness and develops recommendations to strengthen cooperation among industry, government, and academia. It also provides direction for continuous improvement through step-change technology in new chemical science and engineering technology, supply chain management, information systems, and manufacturing and operations.*

OIT Chemicals Industry Team Leader: Paul Scheihing (202) 586-7234

BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices focuses on plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small and medium-size manufacturers.

Project Partners

Nalco Chemical Company
Bedford Park, IL

For Additional Information, Please Contact:

OIT Clearinghouse
Phone: (800) 862-2086
Fax: (360) 586-8303
clearinghouse@ee.doe.gov

Visit our home page at
www.oit.doe.gov

Please send any comments, questions, or suggestions to
webmaster.oit@ee.doe.gov

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy, EE-20
U.S. Department of Energy
Washington, D.C. 20585

DOE/ORNL - 08
November 2000