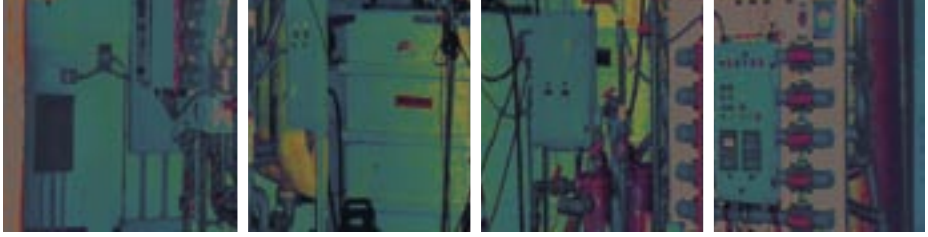


success stories

PROJECTS THAT REDUCE POLLUTION AND WASTEWATER

Highlights:

Reaction Technology needed to reduce their wastewater discharge in order to lower their sewer use fees.

REACTION TECHNOLOGY

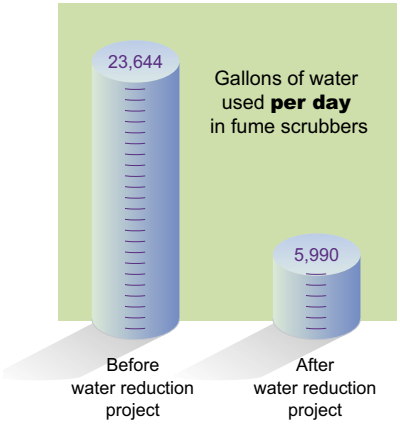
Project: Flow reduction for fume scrubbers

Equipment & installation costs: $58,000 for replacement scrubbers, parts and labor

Problems: No major problems occurred

Payback: Approximately one year, factoring in WET rebate

Water savings: 17,654 gallons per day



Reaction Technology reduced the discharge of wastewater from their fume scrubbers by over 17,000 gallons per day. This exceeded their initial estimates of the expected water savings.

Reaction Technology reduced flow rate where it counts

REACTION TECHNOLOGY is an electronics manufacturer that provides silicon epitaxy reactor foundry services to the semiconductor manufacturing industry. Silicon epitaxy is usually deposited onto silicon wafers to optimize desired electrical characteristics in semiconductor devices. Reaction Technology has facilities in Santa Clara, Sunnyvale, and San José. This *Success Story* describes a project at their main production facility in Santa Clara. The Santa Clara facility includes four two-chambered epitaxy reactors. A separate fume scrubber removes toxic gases from the air vented from each of the eight chambers. The fume scrubbers use a fixed amount of water at all times, set for the maximum loading of toxic gas in the air, regardless of whether any toxic gases were in use or not. The fume scrubbers are located on the roof of the facility, and are thus not readily in view and their water use can easily be overlooked.

The fume scrubbers — which operate at all times — contributed close to 80% of Reaction Technology's total water use.

Problem:

Like many facilities, Reaction Technology did not have a particular reason to evaluate water use throughout their facility. In fact, they did not think they were using very much water at all. Then in January 2003, Reaction Technology received a letter from the City of Santa Clara notifying them that they were discharging wastewater well above their Assigned Sewer Capacity and would be assessed an Excess Sewer Use Fee. Santa Clara would bill them incrementally and encouraged Reaction Technology to reduce their wastewater discharge in order to reduce the amount owed.

This notification triggered a review of water use throughout the facility. Reaction Technology was surprised to find that they were using an average of 27,000 gallons per day. They had a total of eight scrubbers, two older and six newer units. The two older scrubbers were set at about 3 gallons per minute (gpm) of water each while the six newer scrubbers were set at about 1.5 gpm each. Since the fume scrubbers were required to operate at all times and contributed close to 80% of the total water use, Reaction Technology decided to evaluate if the flow rates through the scrubbers could be reduced when no wafers were being processed and during production steps when only inert gases were in use.

To maximize waste-water reduction, Reaction Technology focused on their largest users of water: the fume scrubbers.

Solution:

To maximize wastewater reduction, Reaction Technology focused on their largest users of water, the fume scrubbers. A flow meter was installed on the influent line to the scrubbers and flow readings were taken. Overall, the scrubbers used a total of nearly 24,000 gallons per day. Water flowed through each scrubber at a constant rate, regardless of whether any toxic gases were being used at the time in the reaction chambers. There were lengthy intervals when the reaction chambers were not in use or only inert gases were being used, and they were certain the flow of water could be safely reduced during these times.

Reaction Technology contacted their scrubber manufacturer and found that a water conservation modification was available. The scrubbers could be modified to reduce the water flow during idle times. However, after reviewing the design, they thought they could design and build their own control system for a lower cost. They were also concerned about using an electronic control system connected to the already complicated reactor controls. A pneumatic control system was designed, tied in to the valves for the toxic gas feed lines, that would automatically change the scrubber into high flow mode when the feed of toxic gases began. The scrubbers' high flow mode was left at the flow rate recommended by the manufacturer for safe operation.

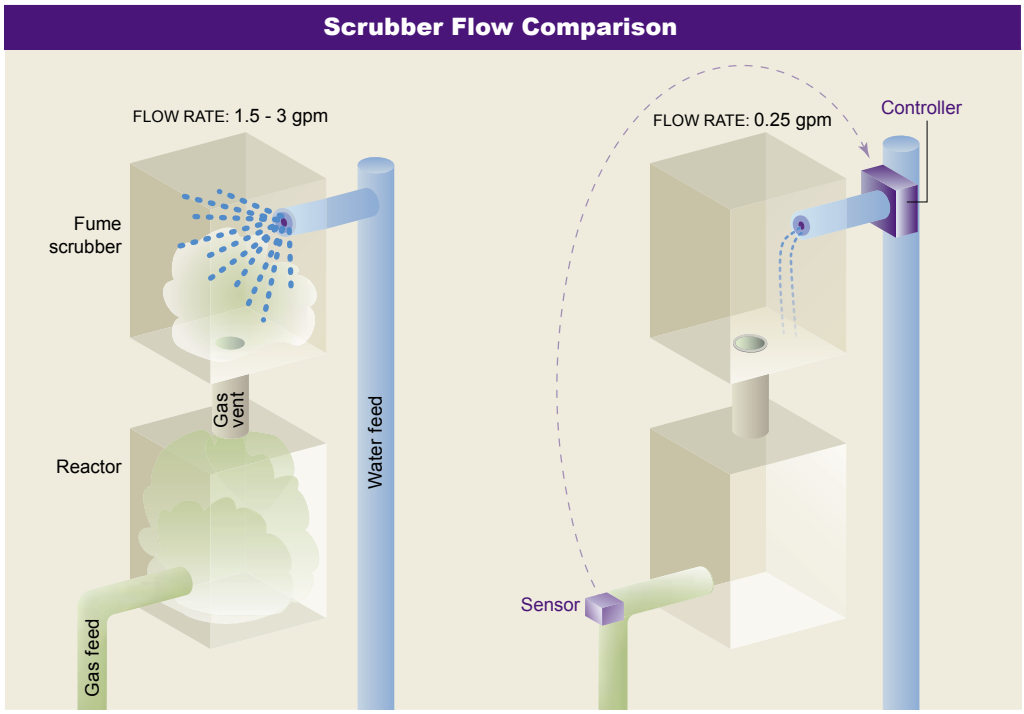
One of the newer scrubbers was retrofitted with the new control system and tested as a pilot. It was not known if the lower flowrate would allow the scrubbers to function properly, without fouling. There were also concerns that the change could cause unanticipated quality problems with the products. The scrubber did not foul during the pilot test, and extensive evaluation of the products made during this test period showed no increase in defects or impact to product quality. The two oldest, least efficient scrubbers were then replaced with new units. Then all of the scrubbers were retrofitted with the same type of flow control system that was tested in the pilot scrubber. All eight scrubbers are now equipped with the water conservation systems.

Results:

Reaction Technology reduced the discharge of wastewater from their fume scrubbers by over 17,000 gallons per day. This exceeded their initial estimates of the expected water savings. The water use in each of the scrubbers was reduced from a constant rate of either 1.5 or 3 gpm to 1.5 gpm during toxic gas use and only 0.25 gpm otherwise. Scrubber performance has not been reduced by the new flow rate, and no clogging of the scrubber media has taken place.

The total cost of the project was about $58,000, including the design work and the purchase and installation of the two new scrubbers, all the control systems, and plumbing. The two new scrubbers comprised about two thirds of the total cost. A significant cost savings was achieved from the reduction in water purchased, sewer use fees, and caustic soda used to neutralize the scrubber wastewater. In addition, this project qualified for a rebate of approximately $29,000 (50% of the project cost) through the San Jose/Santa Clara Water Pollution Control Plant's Water Efficient Technology (WET) program. The project will pay for itself in about one year, after factoring in the rebate.

From the first notice of the high water usage to the completion of the final installation of the replacement scrubbers took less than one year. The project went so well and reduced so much water that Reaction Technology plans to retrofit the scrubbers at their other facilities.



BEFORE PROJECT
***High flow** at all times*

AFTER PROJECT
***Low flow** when toxic gases are not in use*

Challenges:

Reaction Technology was concerned with two main issues during their planning and implementation of this project:

1. Preventing any interference with the electronic controls of the reactors by their scrubber control circuits
2. Preventing blockage problems in the fume scrubbers caused by the reduced flow rate of water.

By keeping the control circuit pneumatic and tied to the gas valves they were able to ensure that the reactor electronics were completely segregated and protected from the new control circuit. By modifying one reactor and monitoring it closely they were satisfied that the reactors would not be fouled with solids due to the reduction in flow. The scrubbers are located on the roof of the building, so additional effort was required to transport materials to the work location and to monitor the performance of the scrubbers after they were modified.

Summary:

Reaction Technology reduced their total water usage by over 65%. Controls were installed on each of their eight fume scrubbers that automatically adjusted the flow rate to a minimal level when no toxic gases were present in the air evacuated from their epitaxial reactors. The entire project was conceived, designed, and implemented in less than a year. The project will pay for itself in about a year. The installation of the control systems was accomplished with in-house labor, and no major delays or problems were encountered.

Thanks to Dave Sallows, consultant to Reaction Technology, for his assistance in the preparation of this case study.

The project went so well and reduced so much water that Reaction Technology plans to retrofit the scrubbers at their other facilities.

success stories

The San Jose / Santa Clara Water Pollution Control Plant discharges treated wastewater into South San Francisco Bay. This area of the Bay is shallow, with a limited amount of tidal and tributary flushing. This creates unique challenges for the Plant in protecting the health of the South Bay. The Plant has been ordered by the Regional Water Quality Control Board to reduce its dry weather effluent flow, as well as the amount of copper and nickel discharged, in order to preserve endangered species' habitat and to meet state and federal water quality objectives.

To comply with these and other regulatory requirements, the City of San José has implemented a variety of programs improving water quality in the South Bay. These success stories demonstrate ways local companies have been able to reduce wastewater discharge or pollutants from their facilities.

San José offers financial incentives and other programs to encourage the implementation of such projects, including Water Efficient Technologies (WET). The WET program offers rebates of up to $50,000 for reductions in wastewater discharge. Participants must apply before beginning a project, and they must document the amount of wastewater reduced as a result of the project.

For more information on WET or project success stories, call (408) 945-3700 or go to www.slowtheflow.com.

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

SAN JOSE/SANTA CLARA
WATER POLLUTION
CONTROL PLANT

In accordance with the Americans with Disabilities Act, City of San José Environmental Services Department materials can be made available upon request in alternative formats, such as large print, audio tape or computer disk. Requests may be made by calling (408) 945-3000 (V) or (800) 735-2929 (CRS).

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