

**Airgard has the semiconductor industry breathing easier with Siemens inside.**

**Innovative pollutant control device maker depends on Siemens reliability and global reach to meet mission-critical uptime and conservation demands around the world.**

“The concentrations of toxins and corrosives in the semiconductor plant exhaust that gets pumped into our scrubbers could kill you in one breath,” explained Kris Johnsgard, who along with his brother Mark developed the first prototype of the Airgard gas scrubber in a garage 25 years ago. “But there’s nothing left of that nasty stuff by the time it gets watered down in our machine.”



While many of their friends spent free time surfing under the California sun in the mid 1980s, the Johnsgards were busy “building a better mousetrap” and wound up catching their own wave. The two were still working as semiconductor process engineers when they were hit with a rush of pent-up demand from chip and wafer

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Case Study

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makers who wanted their breakthrough pollution control device. It runs maintenance free for months instead of mere production shifts without clogging and shutting down costly operations.

Uptime is everything in the semiconductor industry. Companies could lose millions of dollars in lost product if a single process tool has to abort the production of components for any reason. "Our claim to fame is zero scrubber-related process tool downtime," said Mark Johnsgard, the oldest by a few years who remembers like it was yesterday the headaches of maintaining poorly designed scrubbers during his days as a facilities engineer.

"Sediment would build up fast and plug the drain, so we often had to jigsaw a hole in the side of the scrubber and shovel that gunk out," noted Johnsgard, whose patented design and

all Siemens control system are "delivering confidence, record uptime, and facilities cost savings in an industry still widely plagued with scrubber maintenance and reliability problems."

### Scrubbing Away the Pollutants and the Skeptics

The multimillion dollar, precision tools that make Pentium chips and integrated circuits also generate tons of volatile emissions as they add and etch layers on silicon wafers inside airtight vacuum chambers.

The dangerous gases carrying toxic sediments exit each tool through an exhaust pipe to a dedicated Airgard scrubber that douses the chemicals with high-pressure water sprays from every angle. As the gas moves through a series of scrubbing compartments, it's absorbed by the water and ultimately the factory's waste water treatment plant.

Every stage of the mission-critical cleansing process is managed and monitored by a Siemens PLC [programmable logic controller] based automation and control system operating on the Siemens Step7 software platform. "This scrubber plays such an important role in safe gas removal from customer facilities, we feature one-hundred-percent Siemens components in the control box at the heart of our machine," Kris said, as he opened the control panel on a high-end model being tested in the company's assembly warehouse in San Jose. "Scrubber uptime is a big enough challenge without having to worry about electrical components. So it's all Siemens inside."

Airgard has more than met the challenging demand for scrubber uptime and strict emissions standards. It has redefined industry expectations, scrubbing away the pollutants and the skeptics. "Critics have every right to doubt the effectiveness of scrubbers, because until we built the Airgard nothing really worked," said Kris. "Our machine doesn't require an operator. You just put the panel switches on auto, fire it up and leave it alone. The Siemens PLC runs the machine automatically and communicates with the customer's process tool 24/7, monitoring everything from pumps and water flow to chamber gas pressures" explained Mark, who noted Airgard, with its 15 employees, has doubled its sales three years in a row. "The reliability of our machine is second to none, and we can't say enough about the integral role Siemens plays in our success and global growth. Siemens control solutions are known and trusted in more countries than Coca-Cola," he added. "Anywhere I sell a scrubber, customers know they can get knowledgeable Siemens support."



The biggest names in the wafer and chip-making business are among the growing number of firms taking note and installing Airgard scrubbers in plants across the country and the

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world. "We get in the door because we've been in our customers' shoes, we've experienced their pain," Mark said.

### Thinking Inside the Box

"We added a pneumatic plunger that automatically cleans the scrubber based on PLC commands when pressures and sediment buildup get too high," explained Kris, as he pointed to one of his assembly techs building a scrubber by hand. "That's helped to push our maintenance cycles to unprecedented levels – up to 8 months when other scrubbers struggle to make it through a single day without getting choked off by waste," he added.

The Johnsgard brothers do a lot of thinking inside the box, where they religiously reengineer an increasingly sophisticated control solution. Power now enters the control box through a Siemens fuse disconnect and is distributed to Siemens motor starters, the Siemens S7 200 PLC, and a versatile Siemens SITOP power supply. "I can accept between 120 and 480 volt power to the box without any component changes or transformers," said Mark. "That's a beautiful thing."

The controller monitors inputs from a wide range of operational functions, including gas, water, power, and pump flow sensors, and shares vital communications and real-time data with the chip-making gear and operator and a series of Siemens SB2 pilot lights, push buttons, and alarms on the front of the control panel.

"Originally we had a simple relay logic-based control box, with a couple of time delay relays and a motor starter," Mark explained. "We added the automatic plunger with a bunch of new sensors and all of a sudden we needed fifteen relays and thirteen time delays and it just got out of hand. That's when we went with the Siemens PLC to effectively monitor and control what's become a much more complex system," he recalled. "The reliability of the PLC and Step 7 software is remarkable. I haven't lost one Siemens PLC or component in the field, so we don't need a big service group."



The next generation Airgard scrubbers will not only deliver unmatched reliability, they will feature a Siemens HMI [human machine interface] programmable touch screen that enables semiconductor producers to get more flexibility on the fly from their power tool scrubber and emissions control operations.

"Engineering changes are a lot of work when you've got to redo and silk screen the entire front panel, not to mention the very labor-intensive point-to-point wiring inside," explained Kurt Tahira, an account manager with Buckles-Smith, a Northern California distributor of electrical and control solutions, who along with Siemens is helping Airgard easily integrate an HMI into the newest scrubber.

"The HMI delivers so much versatility to the customer. If they want to add a sensor for a water leak fault, we just program it in with the touch screen using Step 7," Mark noted. "To make that change right now we have wire it up, drill a hole and add a new pilot



light and an ugly label to the control panel."

### Breathing Easier

Manufacturers in the semiconductor industry are enjoying the peace of mind with their Airgard gas scrubbers in place. The growing list of happy clients includes a global supplier of wafers that replaced all 27 of its old scrubbers with Airgards "when the initial three scrubbers it ordered from us went more than 8 months without any preventative maintenance," Kris noted with a big smile. "That U.S.-based plant is now exclusively Airgard and produces well over \$2 million dollars worth of additional wafers every year since installing our devices."

And while process tool uptime is the industry's nirvana, Airgard scrubbers are also delivering big environmental benefits and huge savings associated with mounting operational costs. Gas scrubbers use thousands of gallons of fresh water every day, but on average "the Airgard uses about half the water of other machines," said Kris. "Some of our big customers have 50 or more

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scrubbers tackling gas emissions in their plants, and with the help of our Siemens control system they're conserving as much as 150,000 gallons of water per day."

Sensors tell the Siemens PLC when vigorous gas scrubbing is not required during the production process, and the controller automatically cuts back on water used by the manufacturing tool. "That wafer manufacturer has a bank of water pumps supplying water to its scrubbers," explained Mark. "After installing their Airgards, they turned off two 25-horsepower water pumps that used to run 24 hours a day." The dramatic reduction in water usage also leads to significant additional savings in water treatment fees.

"Our customers are smart. They made a conscious choice to clear emissions, and dramatically increase their uptime, productivity, and yields," Mark said. "They're breathing easier with Airgard scrubbers in their plants, and there's no doubt we're more confident than ever with Siemens reliability and a world of forward-thinking capability built in to our solutions."

