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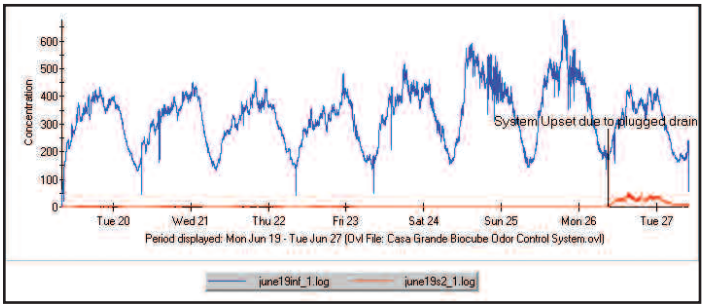
Biofiltration System Eliminates Odor Complaints for WWTP/WRF; Meets Challenge of 300-800 ppm H_2S

---Chosen Over Chemical Scrubber Option Due to Hazard and Maintenance Concerns---

Casa Grande, AZ ---Plant and operations management at a 6 mgd wastewater treatment plant (WWTP) and water reclamation facility (WRF) here report elimination of odor complaints through installation of a 9000-cfm biofiltration system. The selection of the biofiltration technology instead of an initially planned wet chemical scrubber option was driven by strong opposition from operations personnel concerned about chemical handling burdens and hazards. A successful pilot test alleviated their engineering firm's doubts about the packaged biofiltration system's ability to handle the plant's peak hydrogen sulfide (H_2S) loading. The BIOCUBE™ biofiltration system, currently operating at about 6000 cfm, was installed as a three-tower unit at the headworks in 2005.

The system consists of nine cells, each containing three trays of media, set up as three towers of three cells each. Design flow per cell is 1000 cfm. The three towers were installed over the 48" influent pipe on the south side of the headworks building.



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The installation was part of a major plant expansion designed by Carollo Engineers of Phoenix, AZ, and was recognized with a 2005 Engineering Excellence Honor Award from the American Council of Engineering Companies of Arizona (ACEC-Az).

The 6 mgd, extended aeration WWTP/WRF typically operates at about 4 mgd from October/November through April/May, when it drops to 3-3.5 mgd. The plant was originally established in the early 1970's as an aerated lagoon with facultative ponds and floating aerators. When a 1986 upgrade added a clarifier and sand filter, the county Odor Abatement Easement was at 1000'.

When design for a 1995 expansion was begun in 1992-93, the Easement was still 1000'. While a headworks building and corresponding odor control system and building was originally included in the design, it was not regarded as a major issue, due to little development close to the plant. With budget limitations also a factor, the building and odor control were left out at that time.

"The first real odor complaints started just about the time that 1995 upgrade was finished," recalled Jerry Anglin, wastewater superintendent for the City of Casa Grande. "The complaints were directly related to the direction the wind was blowing, and also were happening at the beginning and towards the end of the summer season, when it was not hot enough to keep people inside."

"By the time planning started for our 2005 upgrade in 2003," he continued, "the Easement was down to 300', and odor control was now a major issue. We asked our engineering firm to come up with a plan, and since we knew they were high on chemical scrubbers, we decided to tour a couple of installations."

"As a result, we concluded we needed to find out if there was something else we could do."

"We saw that those installations were very high maintenance, with also a high level of hazard," he said. "There was a frequent need to use acid to clean out alkali buildup, and depending on the size of the unit, you might have to get inside to do it. Head-to-toe protection was needed against burns. It's hot out here, and it would take two or three men changing out to be able to do it. Our public works director told us we were the ones who would be out there living with it, and to tell him what we wanted. Our engineers, though, weren't aware of any alternatives that could handle the high concentrations of H_2S they expected."

But Anglin noted that effectiveness of the chemical scrubber option was also a concern.

"At another installation, they had already put it in the boneyard. It just wasn't taking care of the problem, and they had been forced to try something else. They had been experimenting with a masking agent approach, and one of the operators there had also seen the Biocube technology at a show."

"We found out about a test Biocube was doing on a lift station in a high-end community nearby. While that unit was not designed for anywhere near the flow expected at our headworks, and the H_2S at the lift station was only 200 ppm compared to the almost 1000 ppm we sometimes had, we were able to set up a meaningful test on a 4" pump station pipe at the headworks."

"We were amazed to see H_2S going in at 500 ppm coming out practically non-detectable. We had confidence it could be adapted to handle the big flow. We told our engineers that was the technology we wanted, and that's what we got."

Anglin said there have been no odor complaints at all since the 2005 installation of the full-scale system, and that maintenance needs and costs have been minimal.

"We routinely check H_2S ourselves, with a dedicated, portable, in-line meter, and are typically showing 300-800 ppm going in and practically nothing coming out," he reported. "Meanwhile, the only extra maintenance has been some blower belt replacements, which are probably due to our high ambient temperatures here."

"We only had to call the vendor once, when we first went on line and some media came through and plugged up the drains, but that turned out to be just a little sloppiness when the contractor was loading the trays for the first time."

The system consists of nine cells, each containing three trays of media, set up as three towers of three cells each. Design flow per cell is 1000 cfm. The three towers were installed over the 48" influent pipe on the south side of the headworks building. Each tower is currently adjusted to handle an equal volume of about 2000 cfm, with option to increase to 3000 cfm each as the plant's customer base continues to grow.

Biocube provided blueprints for a local contractor to set concrete pads; install control panels; connect blowers to pull the odorous airstream through the cells; connect circulating pumps for the misting system, humidifiers, and drains; and connect potable water feed. They returned to set up the towers, taking about a week, and to perform startup. A ground level vault houses four influent pumps, and the entire installation is walled off, with some perimeter landscaping for additional screening.

Belt-driven blowers were used instead of the direct-drive types typically provided by the biofilter manufacturer. Dave Williams, chief operator for the WWTP, said the blower belts have been changed twice.

"During the first year, we replaced the belts for two of the three towers," he said. "We've also replaced one temperature sensor. We lube the blowers on a routine basis with the rest of the plant. The water basin for the humidifier needs flushing every couple of weeks to prevent algae buildup. That takes less than an hour for all three towers, and is purely preventive."

"We're supposed to have to replace filters for the misting system pumps in each tower once a year, but we haven't had to do it yet, and it looks like a five minute job when we do," he added. "We're showing about 760 total dissolved solids (TDS) in the potable feed for the misting system humidifier."

"Overall, if I'm feeding in 600-700 ppm of H_2S, and it's coming out tens and elevens, it's doing a great job, and there's been no dropoff in performance. We put an odor logger in-line each week, and take it to a computer to build a 7-day graph. We see spikes in the readings when a tower drops out for a drain cycle. We're probably eliminating 99% or more of the H_2S at least 80-85% of the time. In any case, we have stopped having any odor complaints at all for our plant."

"Operation of the system is simply humidifying and heating the media, and adjusting the airflow with butterfly valves," he noted. "That's a big difference than we would have had with a chemical scrubber, where in addition to the personal safety issue, we would have had to handle two different kinds of chemicals, take care of hauling hazardous waste, and constantly monitor for performance."

"We're expecting to change the biofiltration media only once every five years, in a very simple operation, compared to changing chemicals twice each year, with all kinds of difficulty and risk."

Derek S. Webb, P.Eng., Biorem's Director of Applied Technology and Emerging Markets, described the approach his company takes to solve odor problems.

"For demanding applications like this one, it is imperative that the appropriate design approach is taken with the design and configuration of the abatement device," he said. "Here, the elevated inlet concentrations of hydrogen sulphide, combined with the large diurnal variations, made this a very difficult application for most technologies. Biorem makes the effort to thoroughly understand the demands of an application, and then applies this knowledge in the sizing and specification of the most appropriate piece of equipment for the task at hand."

Russell A. Wachter, P.E., a partner at Carollo Engineering's Phoenix office, recalled the operational concerns at the plant that drove the interest in biofiltration; the cost considerations; and the concerns about its performance.

"The City was most concerned about operator safety with the chemical scrubber option, and also, being in a resource-limited staffing situation out there, they were concerned about additional workers it would have required for increased operations and maintenance," he said. "That made us look more closely at the chemical scrubber option, which we had initially favored due to its lower capital cost. Then, with the scrubber's O&M cost expected to be about 40 times greater than the biofilter, we calculated a payback for the biofiltration system."

"Regarding performance," he added, "I was comfortable with the technology because I was familiar with it from my master's degree work and several previous designs, but I had concerns about it being overloaded at this location. The plant has some pretty long detention times in its interceptors, and a fair amount of H_2S is generated in its collection system. The majority of those odors are conveyed to the plant. As a result, they get those summer peaks of upwards of 600 ppm at the headworks. The pilot testing, which responded pretty favorably, alleviated those concerns."

Wachter said the 2005 plant expansion, the second designed by his firm, consisted of adding a third process train similar to the previous two. The processes include influent pumping followed by vortex grit removal; pretreated flow proceeding to oxidation ditches and secondary clarifiers; tertiary filtration; and concluding with effluent disinfection with chlorine. Most of the treated effluent water is reclaimed for irrigation at a local golf course, and reused as cooling water at a nearby power plant.

He said Biorem and Biocube were considered as alternative biofiltration system providers during the design evaluation.

"We didn't see a great deal of difference," he recalled. "We went with Biocube because it had a smaller footprint."

The BIOCUBE is a modular tray design for eliminating H_2S in airstreams of up to 1000 cfm per module. Media in each tray contains microbes that oxidize odor-causing compounds and convert them to sulfates, carbon dioxide, and water. A patented plenum design of each tray is said to assure even air and moisture distribution, with no channeling. The technology became a Biorem product line upon the company's acquisition of Biocube Inc. in 2005.

BIOREM Technologies, established in 1991, offers a comprehensive line of biological air pollution control equipment for the abatement of hydrogen sulfide and other odor-causing compounds, as well as for volatile organic compounds (VOC's) and other hazardous air pollutants (HAP's). The firm's product mix includes several types of modular, fully integrated biofilters; custom erected, large-scale bioreactors; bioscrubbers; biotrickling filters; and several types of advanced filtration medias, as well as an array of synergistic air management technologies.

Headquartered in Guelph, ON, the company offers a comprehensive monitoring and support program for its systems, with resources including experienced engineers, chemists and industrial microbiologists as well as state-of-the-art laboratory and research facilities.

For further information about solutions to odor control problems, contact BIOREM Technologies Inc., 7496 Wellington Road 34, RR #3, Guelph, Ontario, Canada N1H 6H9, Tel. 519/767-9100, Fax 519/767-1824, info@bioremtech.com, www.bioremtech.com.