ODOR CONTROL

by

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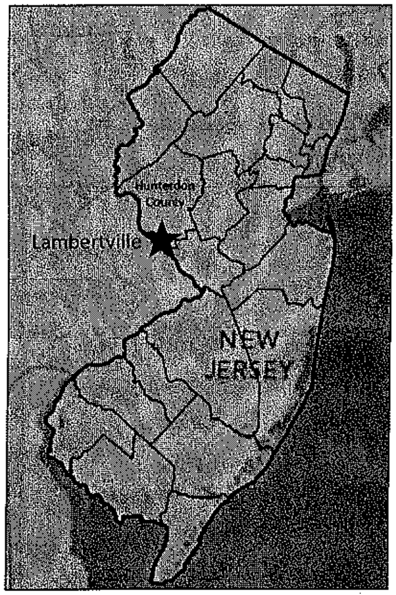
The Lambertville Municipal Utilities Authority (LMUA) and CDM Smith consulting engineers developed a biosolids management plan that guided operational and capital improvements at the community's wastewater treatment plant – and significantly reduced odor complaints. Senior Project Manager Howard Matteson of CDM Smith and LMUA Executive Director Thomas F. Horn explain how their efforts mitigated the unintended consequences of stored solids.

BIOSOLIDS MANAGEMENT AND ODOR CONTROL

Odor is a daily fact of life for wastewater treatment facilities in which on-site personnel are accustomed to tolerating most odors as a passing nuisance. Oftentimes, the strength of a given odor falls on the scale between "doesn't smell" and "kinda smells," with the basic premise being that some odor can always be detected. However, the general public does not share that tolerance for even the slightest odor emitted by wastewater treatment facilities located near residential or commercial neighborhoods.



Faced with this problem, the Lambertville Municipal Utilities Authority (LMUA) and US consulting firm CDM-Smith developed a biosolids management plan (BMP) that has significantly reduced odor complaints reported at the Lambertville wastewater treatment plant in New Jersey. The five-phase plan, not yet completed, called for replacing carbon-based odor control system with a biotrickling filter followed by a biofilter.

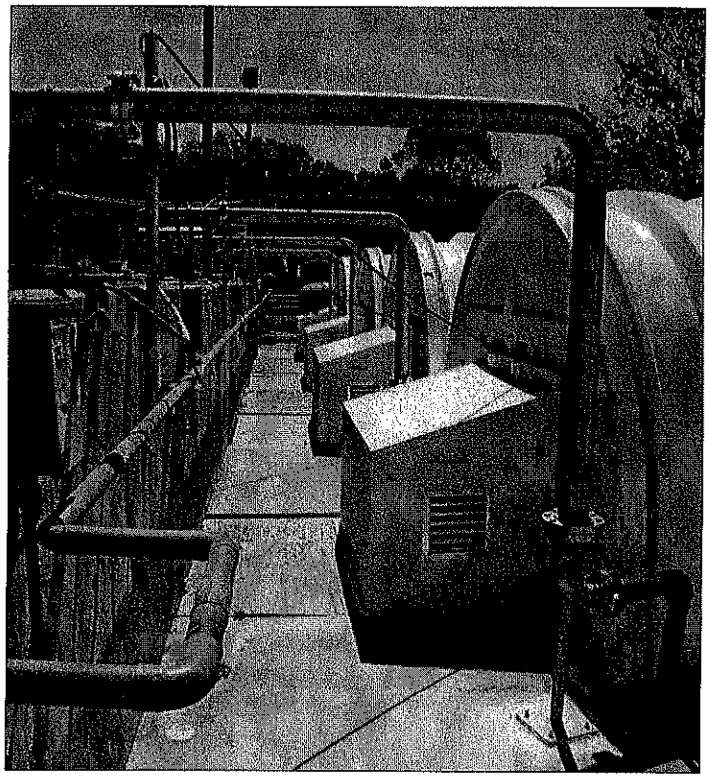
The LMUA plant is located on the banks of the Delaware River in Hunterdon County, about a half-mile from downtown Lambertville, and a quarter mile from residential neighborhoods that include homes, shops, and restaurants. In years past, the LMUA would be inundated with complaints when the wind blew odors in the direction of homes and business. At least that is the way it used to be.

Originally built in the 1950s as an extended aeration treatment facility, with an anaerobic digester for sludge treatment, the facility was expanded in the 1980s to accommodate flows from Stockton, New Jersey and New Hope, Pennsylvania. The expanded plant included secondary treatment with rotating biological contactors (RBCs) and a belt filter press (BFP) to process sludge from the aerobic and anaerobic digesters. The existing aeration tanks were converted to aerobic digesters during the expansion. In the early 2000s, LMUA converted the existing anaerobic sludge digester to a sludge storage tank and discontinued use of the aerobic digesters. Odor control using granulated carbon was installed at this time for the sludge storage tank and the BFP room.

LMUA installed a variety of odor control treatment systems including a misting system, temporary sludge pumps, and piping and various piping for application of magnesium hydroxide for pH control.

By 2008, much of the facility's equipment, installed in the early 1980s, needed to be replaced. Concurrent with, and related to LMUA's odor problems, various processing systems required nearly constant maintenance. Working with CDM Smith, LMUA secured funding under the American Recovery and Reinvestment Act (ARRA) of 2009 to address many of the equipment replacement needs. This included permanent piping for processing primary and secondary sludge, RBCs, electrical system, sludge pumps, and construction of a new magnesium hydroxide storage facility.

During routine maintenance on the carbon odor control system, LMUA found that the primary carbon bed on its largest unit was badly rusted, and would likely need to be replaced. LMUA asked CDM Smith to evaluate options to the existing carbon based system in lieu of straight



NEW ROTATING BIOLOGICAL CONTRACTORS

replacement. CDM Smith prepared an analysis of LMUA's odor generation potential and concluded that a biotrickling filter/biofilter offered a reasonable alternative to carbon.

At the same time, CDM Smith noted that LMUA's practice of combining primary and secondary sludge in the anaerobic digester tank (for storage), coupled with long sludge-holding times, was an aspect of LMUA's operations that needed to be looked at more closely. CDM Smith and LMUA recognized that separating the sludges and minimizing holding time would benefit the biofilter by reducing the amount of odorous compounds it treats, and would minimize odor generation potential at the plant. These few critical areas ended up being the focus of LMUA's odor control strategy.

BMP UNDERWAY

As the authority's ARRA project was almost completed, CDM Smith's review of alternatives to carbon for odor control was underway. With new equipment in place, LMUA had fewer maintenance issues to contend with and was able to focus on mitigating odors. Consequently, LMUA and CDM Smith developed a biosolids management plan (BMP) to help guide the authority's activities and expenditures, with no increase in user rates as mandated by LMUA board members.

The BMP was broken into five phases. Each phase takes advantage of benefits from the preceding phases, and makes implementing the plan easier for the staff to manage. By phasing the implementation, the authority can also fund the work from existing revenues and reserves.

Phase 1 – Replacing Odor Control: Once LMUA discovered the need to replace the carbon-based odor control system, CDM Smith was asked to evaluate alternatives. CDM Smith considered the following common design criteria for odor control systems. Ventilation rates and inlet hydrogen sulfide (H_2S) and/or odor (expressed in dilutions to threshold, D/T) concentrations are the basic criteria around which such systems are designed. Each of these criteria is detailed below:

- Ventilation rates are selected to maintain a negative pressure in the contained area (minimizing fugitive emissions), reduce concrete corrosion, provide a comfortable environment for operators and reduce explosion hazards. The selection of ventilation rates is primarily based on the requirements of the United States National Fire Protection Association (NFPA) 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

- H_2S and odor concentrations samples were collected in Tedlar bags from the existing sludge storage tank. The samples were analyzed for reduced sulfur compounds (as per ASTM D5504) and odor concentrations (as per ASTM E679 and EN 13725).

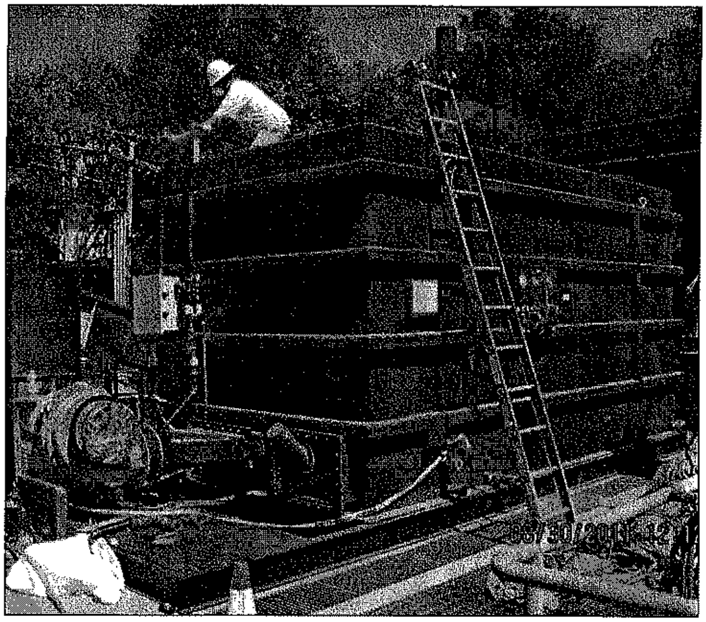
Location	Hydrogen Sulfide (ppm)	Methyl Mercaptan (ppm)	Dimethyl Mercaptan (ppm)	Odor, (D/T)
Sludge Holding Tank	23	7.8	Not Detected	23,000

The sampling results show that high concentrations of reduced sulfur compounds in the sludge storage tank can cause odor and corrosion issues. A design ventilation rate of 12 air changes per hour (ACH) was selected to reduce the expected corrosion and would require 1,400 cubic feet per minute (cfm) of odorous air to an odor control system.

Three types of odor control systems were considered: carbon adsorption, biofiltration, and chemical scrubbers. CDM Smith concluded that a biotrickling filter followed by a biofilter was the best option for LMUA, and offered the lowest long term costs, especially when considering the reduction in operation and maintenance costs over the life of the unit.

In the biofiltration process, odorous air is passed through an organic and/or inorganic media that supports a population of microorganisms. The pollutants in the air stream are absorbed onto the media, where microorganisms feed on them in an aerobic environment. While the biological reactions are complex, simpler and less odorous compounds are formed in the process. Nutrients, to support biological growth, may be available in the organic media or may have to be supplied if inorganic media is used. The air must be warm and should be humidified for effective biofiltration.

Two discrete biological processes take place during the biofiltration process. H_2S is converted to sulfuric acid, and organic compounds are oxidized. H_2S removal will cause the pH of the media to drop, eventually inhibiting the oxidation of organics. The media has a finite life and must be replaced after either the pressure drop increases to a point where the fan will not properly operate or the environment becomes unfit for microbial growth. The environment of the media can be optimized by monitoring critical nutrients for sustained growth and maintaining the system pH. Typically, inorganic media comes with a 10-year warranty and organic media needs to be replaced every three to four years.



NEW BIOFILTER / BIOTRICKLING FILTER INSTALLATION

LMUA procured and installed a biotrickling filter/biofilter following the recommendation of CDM Smith. The authority was able to partially fund the purchase and installation of the biotrickling filter/biofilter with funds remaining under the ARRA loan, and a unit was installed in late 2011. The biofilter/ biotrickling ductwork was installed to integrate with the relocation of the sludge storage in later phases of the BMP.

Phase 2 – Concrete Repair: CDM Smith and LMUA recognized that in order to further mitigate odor generation potential, the primary and secondary sludges should be separated while they were stored prior to treatment with the belt filter press.

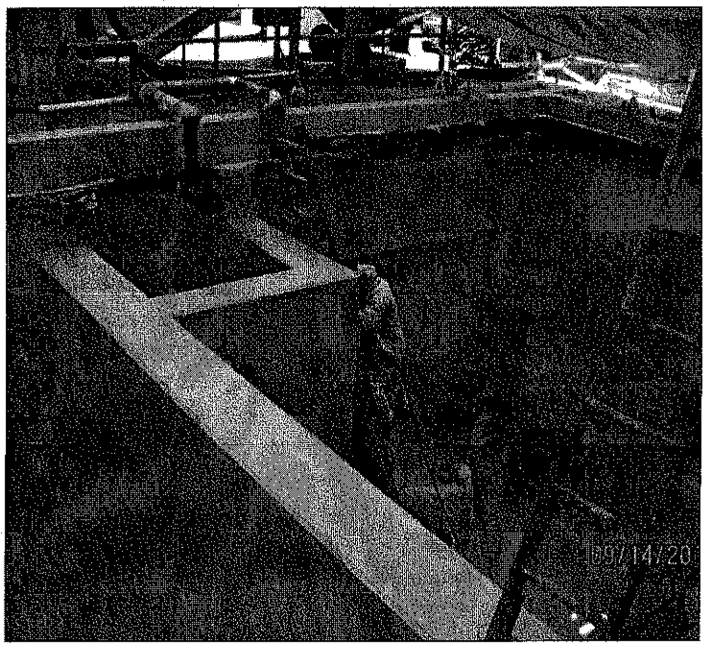
CDM Smith performed a structural assessment of the tanks in early 2011 and found the interior coating was in poor condition. Hammer soundings conducted along all tank walls revealed a number of unsound concrete locations and numerous horizontal and vertical cracks that appeared to be due to shrinkage and/or construction joints. Engineers also noted some of the cracks were damp and had moderate buildup of efflorescence.

CDM Smith recommended removal and replacement of unsound concrete, repair of cracks using polyurethane chemical grout injection, and application of a structural high build epoxy polymer coating for concrete protection.

Based on CDM Smith's recommendation, LMUA proceeded with the tank repairs. The authority combined this work with the procurement and installation of the biotrickling filter/biofilter, paying for it, in part, with funds remaining under the ARRA loan. This work was also completed in late 2011.

Phase 3 – Concrete Dividing Wall Construction: As part of CDM Smith's prior analysis, LMUA knew they needed to separate primary and secondary sludges to minimize odor generation potential. As part of the work associated with the concrete rehabilitation, the authority constructed a dividing wall within the new sludge storage tank, creating two separate compartments within the tank. The new compartments provide enough volume for several days of sludge storage.

LMUA combined this work with the procurement and installation of the biotrickling filter/biofilter, and the concrete repair work. It was partially paid for with funds remaining under the ARRA loan. Similar to Phases 1 and 2, this work was also completed in late 2011.



REHABILITATION OF THE NEW SLUDGE STORAGE TANK.
NOTE: NEW DIVIDING WALL IN THE FOREGROUND.

"CDM Smith and LMUA recognized that separating the sludges and minimizing holding time would benefit the biofilter by reducing the amount of odorous compounds it treats, and would minimize odor generation potential at the plant. These few critical areas ended up being the focus of LMUA's short term odor control strategy."

Phase 4 – Cover Installation: In order to mitigate odor generation potential, LMUA has contained the new sludge storage tanks with an aluminum cover. The new ductwork for the biofilter/biotrickling filter was arranged to integrate easily with the new aluminum cover to be installed under this phase.

Phase 5 – Ancillary Equipment Installation: The last phase of the BMP includes the installation of mechanical and electrical ancillary equipment to support the new sludge storage tankage. This includes new progressing cavity BFP sludge feed pumps, refurbishment of an existing blower, submersible mixer for the primary sludge compartment, and modifications to existing piping and associated instrumentation and controls. CDM Smith and LMUA are currently finalizing the bidding documents for this work. Bidding is anticipated before the end of the year.

SUMMARY

In response to elevated odor complaints from the community, LMUA and CDM Smith developed a BMP to guide operational and capital improvements at the Lambertville wastewater treatment facility. The BMP was divided into five manageable phases, some of which have already been completed. ARRA funding was used for part of the improvements, and LMUA will fund the remaining costs out of savings (e.g. elimination of costs for carbon replacement) and the existing capital fund. In addition, the authority strategically applied odor-mitigating chemicals throughout the collection system.

In conclusion, the LMUA addressed and reduced complaints through prudent planning and efficient use of funds. Implementing the BMP has addressed (and reduced) odor complaints from the community, and demonstrated that effective capital planning and project execution can support operational improvements and reduce long-term costs, all while maintaining rates paid by existing users.

LMUA recognizes that odors are a fact of life for wastewater treatment facilities, but they also recognize odors should not be a fact of life for the community or a nuisance issue that negatively affects residents' quality of life. The BMP represents their proactive approach to dealing with this issue and is only one element in their ongoing work to minimize odor generation throughout their facility. The BMP shows that development and execution of a well thought out strategy can have a positive impact on the facility, and also the entire Lambertville community.