Polarized Air Ionization Technology

Dennis Tulenko, REM, TEI

Original paper co-authored with Mike Carver, PE, MWRD

Polarized air ionization technology produces positively and negatively charged oxygen molecules, or ions, but no ozone. This Swiss technology has been successfully applied at commercial manufacturing buildings, wastewater treatment facilities, and "sick buildings" in Europe for over twenty years. Ionized air effectively oxidizes most air contaminants including hydrogen sulfide, ammonia, volatile organic compounds (VOCs) and other toxic gases. In addition to providing odor control and a safer work environment, air ionization has also been shown to prevent the corrosion of electronics and other equipment. Systems employing this technology have now been provided in the United States, and pilot and full-scale performance data have been obtained from these operations. Operating installations in the United States include wastewater treatment plant lift stations, sludge processing rooms and sludge holding tanks. These facilities report critical odor reduction, and lower operation and maintenance cost than "end of pipe systems" such as chemical scrubbers and biofilters.

The ionizers themselves are small, portable modules that can be installed as self-contained recirculation units complete with fan. Alternately, the modules can be mounted in the ductwork on the fresh air supply side of an existing ventilation system. Each duct mounted ionizer module is 25 x 8.8 x 8.4 inches and weighs only 16 pounds. System sizing depends on the volume of air being treated and the contaminant concentration. Typically, two modules will treat a 25-foot. diameter sludge storage tank, while a large commercial manufacturing facility or dewatered sludge processing building may require a dozen or more modules.

A recent Denver Metro Wastewater Reclamation District (MWRD) project involved a major upgrade to high-solids centrifuges. Dewatered sludge, produced by these machines, is transferred onto an open serpentine conveyor belt and transported through a conveyor section to a biosolids storage building. Here, the biosolids are unloaded into large hoppers for storage and ultimately trucked off site. Main interests in air ionization included worker safety, the protection of infrastructure and odor control, all being of equal priority.

An initial pilot test of air ionization technology was conducted in 1999 at MWRD for the Dissolved Air Flotation (DAF) control room. Trans-Tech supplied the ionization hardware, while MWRD technicians and engineers performed the field testing using a Barneby and Cheney field scentometer. A recirculation style ionizing unit was employed in the pilot test. Baseline odor levels were measured with the ionizer off and field scentometer testing yielded a baseline odor level of 15 dilutions to threshold (D/T) - (D/T are the number of dilutions of odor-free air required to just detect an odor.) The ionizer was then turned on and allowed to operate for twenty-four hours. The field scentometer showed that odor was reduced to less than 2 D/T, almost non-detectable.

A second demonstration scale test was run in 2001, where ionizing modules were positioned in fresh air supply ducts. Recirculation style ionizers were also directed to blow ionized air at the sludge drop zones. For this test, the air change rate was held constant at six (6) air changes per hour. As in the first pilot test, H_2S levels were measured before and after engaging the air ionizers. The ionization reduced the H_2S levels from four PPM to zero in the aisles and from forty-two to six PPM or less at the drop zones.

The technology was approved for application at the 26,800 cfm sludge processing building basement and the 16,700 cfm biosolids storage building and conveyor section. The final system would be specified at the recommended air ventilation rate of twelve (12) air changes per hour.

MWRD contracted with Trans-Tech in August 2002 to supply the systems. A 20,200 cfm air handler, with high efficiency filters, was installed on the roof of the sludge processing building (photo 1) to provide supply air to the basement through an ionization plenum.

For the sludge processing building basement, a total of twenty-four ionizer modules are installed in two separate plenums. The plenum shown in photo 2 houses eighteen (18) modules. An additional plenum, supplying 6,600 cfm of air, houses six (6) modules. Both plenums


Photo 1

are positioned on the centrifuge room floor directly above the basement. The ionizer modules are flange mounted to the plenum and can be removed for routine maintenance in a few minutes.

Ionized air is discharged over the walkways on one side of the basement via carefully designed and positioned air registers, while spent air is exhausted from the other side of the basement. An air ventilation rate of twelve (12) air changes per hour is maintained. Additional ionized air is discharged through ducts mounted directly at the sludge drop zones (Photo 3).

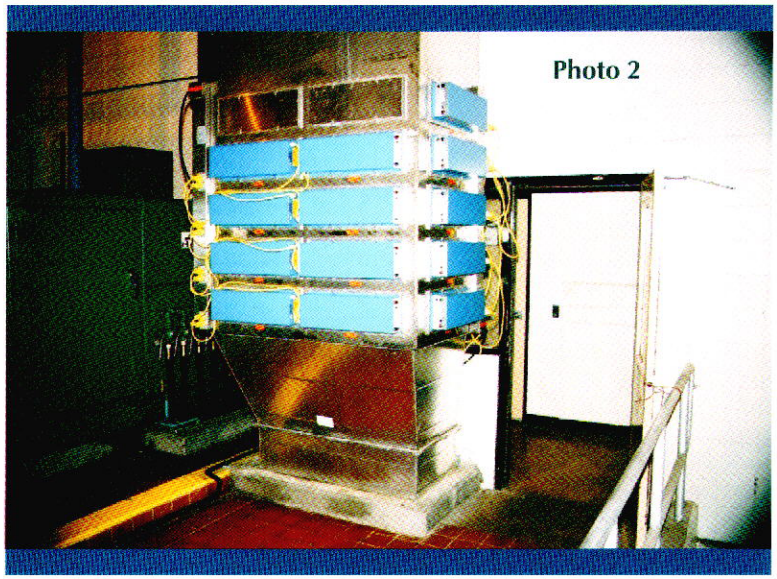
Photo 2

At the biosolids storage building, a single plenum of twenty-four (24) ionization modules is employed. For the conveyor section, four (4) shelf mounted units are positioned at intervals along the conveyor.

After startup, compliance testing for H_2S levels was conducted. An Industrial Scientific multi-gas monitor, with a range of 1 to 100 ppm, was used to measure H_2S levels. This meter was selected as it does not have an interference with the sulfate ion, which is the final product of the ionization reaction.

The air ionization system success was based on achieving a requirement of less than 4 ppm H_2S in the walkways and general work areas. The compliance testing demonstrated that air ionization reduced H_2S to non-detectable concentrations in all areas including the sludge processing building basement walkways, fresh sludge drop zones at the conveyor belt, biosolids storage building penthouse and directly above the drop zone where sludge drops from the conveyor belt into the biosolids storage hoppers. The system passed compliance testing and subsequent performance testing showed that all working areas of the basement were below hydrogen sulfide detectable levels – meeting goals of providing increased worker safety, the protection of infrastructure and odor control. This air ionization process has provided the Metro District with a successful odor control system that has improved the worker health and safety in these two biosolids processing buildings. ❖

Dennis Tulenko is president of Trans-Tech Energy and Environmental, Inc. and is a well recognized authority in the application of commercial air ionization systems and indoor air quality. Dennis can be contacted at 412.366.9177 or dmttei@aol.com. Mike Carver is a District Project Manager with Metro Wastewater Reclamation District, Denver, CO.


Photo 3