CHASTAIN-SKILLMAN, INC.

CONSULTANT'S UPDATE

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NEED FOR PARTICLE SIZE SELECTIVE SAMPLING – TOTAL DUST VERSUS RESPIRABLE FRACTION

By Pabitra Josse, MS

While breathing, the particles in the air are deposited in the three principal regions of the respiratory tract: the head airways region, the trachebronchial or conducting airways region, and the pulmonary or gas exchange region. Particle aerodynamic size is the critical factor in determining the deposition sites of inhaled particulate.

Total Dust is defined as the total amount of particles inhaled and contains particles of all sizes. The Respirable Fraction consists of particles less than 5 microns in size which is deposited in the pulmonary or gas exchange region. The Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL), based upon an 8-hour Time Weighted Average, is 15 mg /m^3 for Total Dust and 5 mg /m^3 for the Respirable Fraction. However, whether or not these standards represent the measured particle (exposure) and deposited particle (dose) is a topic of discussion.

(Particle—Continued on page 4)

ENGINEER'S INSURANCE DOES NOT COVER COUNTY'S OWN NEGLIGENCE

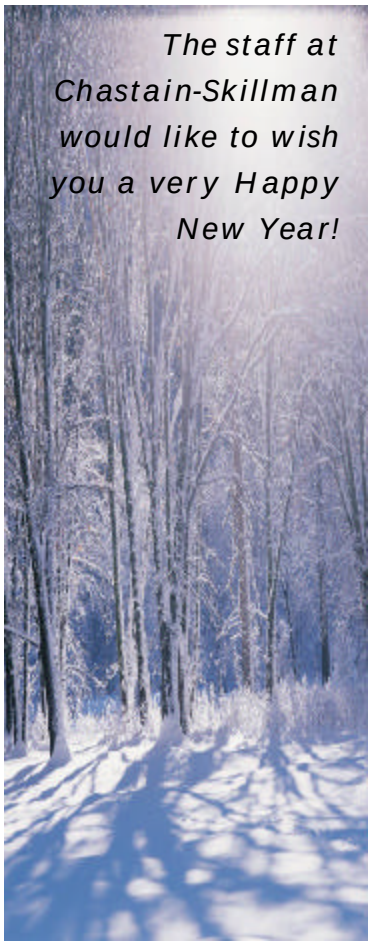
By W. Cauthan, PE

Having recently read articles in several engineering journals and periodicals on engineering contract language and indemnifications, I came across the following article in *Civil Engineering* which was of particular interest. In this case, an engineering company was sued for breach of contract by their client due to a traffic fatality occurring in a construction zone. Hancock County, Indiana claimed that the engineering company was responsible for any negligence of County employees. As detailed in the article below, the courts initially ruled in favor of the County. Upon appeal, the appellate court reversed the decision of the lower court. In reflecting upon this case, we are reminded of the importance of indemnification language in our contracts.

"An engineering firm on a county highway project did not have a contractual duty to defend the county in the event of the latter's negligence, according to the Court of Appeals of Indiana.

Hancock County, Indiana, retained United Consulting Engineers (UCE) to provide various

(Insurance—Continued on page 5)



Inside this issue:

TWO-STAGE ANAEROBIC DIGESTION TO ACHIEVE CLASS "A" BIOSOLIDS

By Harold J. Curtis, II,PE,DEE and Michael R. Leffler, PE,DEE

INTRODUCTION AND BACKGROUND

As we reported in Issue 14 of the Consultant's Update, the issue of treatment and disposal of wastewater treatment residuals, or biosolids, is becoming an increasingly critical issue for utility systems. The final outcome of the Florida Department of Environmental Protection (FDEP) rulemaking process could dramatically affect the systems and cost of how biosolids are managed. Public health issues are a critical aspect of these deliberations and one way that wastewater managers can avoid many of the concerns being discussed is to treat the biosolids to Class "A" standards as defined by the Environmental Protection Agency (EPA) and FDEP.

Progress has been made improving the technical and economic aspects of this process. Chastain-Skillman, Inc. (CSI) has been closely following this work and, in fact, has authored portions of an American Society of Civil Engineers guidance manual on the topic. Recently, CSI has worked with the City of Lakeland (City) to analyze their solids management system and propose a means of economically and reliably producing a Class "A" biosolids at the Glendale Water Reclamation Facility (GWRF). The following outlines the approach that has been taken.

The GWRF is the City's oldest and largest wastewater treatment facility. CSI has worked with the City on numerous projects at the site over the years. With regard to the biosolids system, the GWRF has two (2) existing anaerobic digesters of sufficient size to provide ten days of residence time. One of the floating covers has been replaced within the last 3 or 4 years. The other cover is expected to be in reasonable condition, but will need to be cleaned and painted. In addition to replacing the mixing equipment, the liquid-ring gas compressors, the gas cleaning equipment, and the excess gas flares are in need of replacement. The digested bio-solids have been treated to Class "B" levels with the liquid biosolids disposal at permitted land application sites. The Glendale facility has been limited in bio-solids processing capacity for several years. The treatment facility is not yet operating at its full hydraulic capacity, but will in the foreseeable future. The plant is not expected to be expanded beyond the current capacity of 13.5 mgd. However, the existing digesters are not adequate for the solids loading at that rate. The City is currently contracting with a company to dewater and alkaline stabilize the waste activated sludge while the primary sludge continues to be anaerobically digested. The FDEP has been studying the continued land application of Class "B" biosolids as an approved disposal method. The FDEP has received many complaints and is expected to rewrite the disposal regulations to greatly reduce the application of Class "B" solids or perhaps eliminate the practice altogether. The City of Lakeland desires to be in front of the curve regarding having technology in place to produce Class "A" materials for disposal prior to restrictions being implemented by the state.

SELECTION PROCESS

The City instructed CSI to look for a treatment technology that would have a "guarantee" for producing Class "A" biosolids. Accordingly, CSI has been in negotiations with vendors relative to system design that would allow them to provide a bond (or some other financial security) to assure the City that the Class "A" requirements as defined by the EPA PFRP (Process to Further Reduce Pathogens) would be met and the system would be easily permitted. The City stipulated that the digestion process would be sized to treat the biosolids produced for the treatment facility when operating at full design hydraulic and organic loadings. CSI considered only proven processes and focused on anaerobic digestion systems in response to City preferences. Because of the reported ease of operation and excellent performance associated with it, CSI recommended the Egg-Shaped Digester (ESD) for treating the higher loading rates expected. With the use of the existing digesters, the two-stage anaerobic digestion process (thermophilic/mesophilic) meets the requirements, including a process guarantee. The ESD also provides for a smaller footprint on the treatment plant site. Other high temperature and two stage processes were investigated (and would provide the needed guarantee), but did not offer the needed processing increase at similar cost.

SELECTED SYSTEM

The selected system consists of a combination ESD Thermophilic First Stage and existing (conventional) Mesophilic Second Stage and was determined to meet all of the established criteria for the processing of sludge including: ease of operation, effective mixing of the biosolids, sufficient residence time to meet processing requirements, a reasonable fit of the tankage in the site space available, and the process guarantee for the production of Class "A" biosolids. Part of the requirement for producing the Class "A" biosolids is the operation of the system in a batch mode. To avoid the possibility of short-circuiting of under-treated biosolids (at the thermophilic temperature), a sludge feed storage tank (FST) is included and provides a vessel for storage of the thickened, waste activated sludge and the primary sludge. Ancillary equipment includes the hot water boiler for heating the inlet sludge and maintaining the temperature in the ESD, heat exchangers for heating and cooling the sludge, associated pumps for recirculation and transfer, gas type (Cannon) mixers for mixing in the mesophilic tanks, gas compressors for moving the gas to the mixers and the boiler, digester gas cleaning equipment, excess gas flares when not all of the generated gas is used for heating, and controls for automatic operation of the system.

(Biosolids—Continued on page 3)

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FINAL DESIGN

- ESD Sizing – 268,362 gallons, 36' major diameter by approximately 65' overall height. This provides approximately 2.07 days of sludge residence time at the ultimate sludge production rate of 120,000 gallons per day. This time is required to meet the Class "A" processing requirement.
- FST Sizing – 49,900 gallons, 12' diameter by 65' overall height. This tank is sized to store the sludge as produced so that it can be pumped down routinely to batch feed the first stage of digestion.
- Mesophilic Tank Mixing – Each of the existing mesophilic digesters will be fitted with 8- 24" diameter Cannon mixers. These mixers will produce sufficient energy to achieve 90% equivalent mixed volume in each digester.
- Heat Exchangers (Heating and Cooling) – Heat exchangers will be provided with the ESD to be used in the recirculation mode to maintain the ESD in the thermophilic temperature range. A heat exchanger utilizing two water to sludge heat transfer passes to take advantage of the heat in the thermophilic sludge to pre-heat the feed sludge, as well as cooling the sludge to mesophilic temperature. During warm weather operation, it may be necessary to further cool the sludge being transferred, so a separate water to sludge heat exchanger is being provided that uses plant effluent water for cooling purposes.
- Other Equipment:

  Gas Compressors – 230 scfm at 8.6 psig
  Hot Water Boiler – 3,400,000 BTU / hour
  Digester Gas Cleaning
  Excess Gas Flares
- Control Room – The existing digester control room will be renovated and the new control system will be installed. The control system will include the motor control centers for some of the new equipment and programmable logic controls for automatic operation of the sludge digestion system including the ESD, pumps, boiler, mixing system, compressors, etc.
- Process Control – Sufficient controls will be provided by both system vendors to assure that the complete sludge digestion process can be automated. Little operator interface will be needed, except for final sludge load-out.

CONCLUSION

Things to Consider to Get Right Fit – Is it expected that Class "A" biosolids will be required? Is anaerobic digestion currently being used for solids stabilization? Is the treatment system foot print to be kept as small as possible? Is biosolids treatment expansion to be considered?

The process employed to get the right fit for this project included answering the questions listed above. Also, each system vendor was asked to make separate presentations to the owner and engineer explaining how their process would meet the requirements of the project. Following the individual meetings, joint meetings were held to determine the areas of responsibility for each member of the team, including equipment supply, process control, and confidentiality agreements, if necessary. Once the areas of supply were established, it was necessary to develop a team approach so that design efforts could be directed to the engineer to assemble a biddable set of documents. The owner set the criteria for the bidding process, realizing that the vendor responsible for the ESD and the vendor providing the process guarantee needed some sort of assurance that their engineering efforts would be paid for by some means.

Future Considerations – It is expected, though not part of the guarantee, that there will be some improvement in digester gas production. If this is the case, rather than burning the excess, perhaps some cogeneration with the city owned electric utility may be feasible. There is also consideration being given to installing biosolids dewatering equipment. During the recent rain events and hurricanes, disposal of liquid sludge became very difficult. Dewatered cake could allow for fewer trips to the land application sites and could potentially pave the way for further treatment to obtain a recyclable product (pelletizing).

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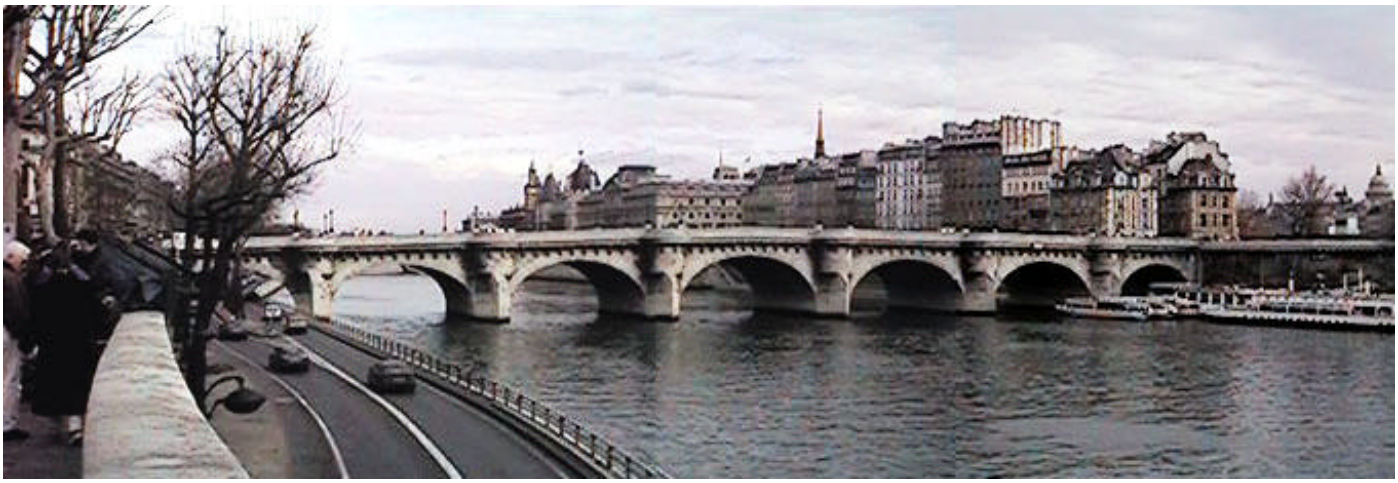
LAKESIDE VILLAGE BRIDGE – STRUCTURAL DESIGN LINKS PAST AND PRESENT

By Paul H. Racette, PE

Located in south Lakeland, FL, the new Lakeside Village Shopping Center will pay its respects to the history of downtown Lakeland, as well as to some of the most famous bridges of Europe, by employing an "arched profile" structural design. This beautiful and distinct structure will reflect the style found in the arches of the Lake Mirror Promenade, among other buildings in downtown Lakeland. Covering a span of 440 feet, the bridge will cross the south lake, and will measure 44 feet wide. This arched structure will be easily visible from the Polk Parkway and North Frontage Road, which borders the southern boundary of this Castro-Oakbridge Venture, LLC project.

The bridge design utilizes arched profile, architectural pre-cast panels. This same arch design will also be prominent in the design of the buildings of Lakeside Village. Access across this concrete structure to the 120-acre site, will lead visitors to the Lakeside Village Lifestyle Center, an area of shops, theaters, offices and major anchor stores whose initial phase will cover some 512,000 square feet.



The arched style structural design of the Lakeside Village bridge can be seen in one of the famous bridges of Paris, France, the **Le pont Neuf** bridge. Le pont Neuf was completed in 1605.

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(Particle—Continued from page 1)

As previously mentioned, the aerodynamic size of inhaled particles determines the depth of penetration and area of deposition within the respiratory tract. The larger particles are deposited in the respiratory tract proximal to the head airways region and are likely to be expelled during sneezing and coughing. Therefore, measuring Total Dust concentration for exposure to particulates might not always correlate well to the dose resulting in an insufficient evaluation of the hazard from exposure to a particular aerosol. It is impossible to expel smaller particles that are deposited in the pulmonary region. Although these small particles may represent a small total mass, they can cause severe damage depending upon their chemical properties. Therefore, measuring the Respirable Fraction is a better method for determining exposure, since the Total Dust measure does not correspond to the total concentration of the particles actually deposited in the lungs.

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consulting services in relation to the replacement of a bridge over a creek. The contract required UCE to indemnify the county against any damage to life and property arising from UCE's negligence or the negligence of its agents or employees. The contract also required UCE to obtain insurance covering all operations under the contract, whether performed by itself or by its subcontractor. UCE procured insurance covering both itself and the county.

In July 1999, Kyle Vandagriff drove through the construction zone and collided with oncoming traffic. He died as a result of the injuries he sustained. Vandagriff's representatives sued the county, UCE, a subcontractor, and the state, alleging all were negligent in failing to implement measures that would have protected drivers in the construction zone. The county sued UCE alleging that the latter had breached its contractual duties to defend and indemnify the county and purchase insurance for it. The trial court ruled for the county; UCE appealed.

UCE argued that the trial court had erred in finding the UCE had a duty to defend the county in the lawsuit and that UCE was required to purchase insurance on behalf of the county. The court reviewed the contract between UCE and the county and concluded that nothing in the contract indicated the UCE was responsible for defending the county against its own negligence. According to the court, the contract provisions required UCE to defend the county only for damages that arose from UCE's negligence. The trial court's decision was thus reversed."

Source: 'Engineer's Insurance Does Not Cover County's Own Negligence', *Civil Engineering Magazine*, December 2004, Vol 74, pp. 72

United Consult. Eng'rs. V. Board of Com'rs, Court of Appeals of Indiana, June 14, 2004 (CE/02/D-$10).

Ron Cauthan is a Principal/Senior Project Manager for Chastain-Skillman's Civil Engineering Department in Sebring. His work focuses on private and municipal roadway and drainage projects. Ron received a Bachelor of Civil Engineering Degree from The Citadel in 1975. He can be reached at (863) 382-4160 or rcauthan@chastainskillman.com.

ANNOUNCEMENTS

At its December 2004 graduation ceremonies, the University of South Florida conferred a Ph.D. on Jim Chastain, President of Chastain-Skillman, Inc. His dissertation topic entitled "A Heuristic Methodology for Locating Water Quality Monitoring Stations to Detect Contamination Events in Potable Water Distribution Systems" focused on devising a means of efficient sampling to detect intentional or unintentional contamination of our drinking water systems. Although a registered engineer in three states with over 30 years of consulting experience, Dr. Chastain chose to perform his research through the College of Public Health rather than the College of Engineering. He explained as follows, "Generally speaking, the primary focus of engineering education is to teach computational and design techniques necessary to meet specific criteria. The emphasis of public health, on the other hand, is to understand and develop the key criteria or outcomes that the engineer uses as the basis of design. Environmental projects are complex and multidimensional. I feel it is important to develop skills associated with both design and context aspects of the problem." Consistent with this philosophy, Chastain-Skillman, Inc. not only employs a full staff of civil and environmental engineers, but also 11 public health specialists who possess MPH or CIH designations. In this way, we feel we provide an additional level of sophistication to protect our clients and deliver higher value in our work product.

This newsletter is provided solely for informational purposes and presents only highly condensed summaries relating to the topics presented. Therefore, it should not be relied upon as a complete record for purposes of regulatory compliance, nor is it intended to furnish advice adequate to any particular circumstances. For additional information on any of the topics in this newsletter, please contact the author, or Allan Duhm, (863) 646-1402, or e-mail us.

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