Knoxville Utilities Board
2021 Biosolids Performance Report
July 2022

KUB's Biosolids Program Maintains Platinum Level Certification

For over 30 years, KUB has produced high-quality Class B biosolids, the nutrient-rich product of the wastewater treatment process. KUB's wastewater treatment plant separates solid materials from liquid waste and sends the solids to digesters where the material is heated and mixed with helpful bacteria to destroy harmful pathogens and reduce odor. After treatment and dewatering, the biosolids can be applied to soil as fertilizer, recycling essential nutrients like phosphorus and nitrogen. KUB's biosolids are registered as a fertilizer with the Tennessee Department of Agriculture and are 100 percent land applied to area farms.

KUB's Biosolids Environmental Management System (BEMS) has been Platinum Certified with the National Biosolids Partnership (NBP) since 2011. The NBP helps advance biosolids management practices and programs across the United States so that they are effective and environmentally sound. As part of KUB's NBP certification, the biosolids program undergoes annual external and internal audits. In December 2021, KUB passed a three-day biosolids program reverification audit and recertified its Platinum status through the NBP. The NBP requires that organizations undergo a reverification audit every fifth year to fully review their BEMS. In the interim years, only sections of the BEMS are audited. One minor nonconformance was identified during the audit relating to KUB's internal auditing process. The minor nonconformance was addressed by KUB and approved by the third party auditor. The 2021 external audit was held virtually for the second time due to the ongoing COVID-19 pandemic.

KUB Biosolids Internal Audit Results

KUB completes an internal audit on the BEMS. The internal audit follows the same schedule as the external audit, so interim and reverification years always reflect the same review. The purpose of this audit is to evaluate the effectiveness of the BEMS. The objective of the review is to identify system problems, improvement opportunities, and adherence to both KUB and NBP requirements. The 2021 internal audit resulted in no findings and five opportunities for improvement. Progress on these opportunities is ongoing.

Digester Cleanings at Kuwahee

Kuwahee's Anaerobic Digesters are used to digest or break down sludge that will eventually become a useful biosolid product. The breakdown of sludge is important because it reduces odors and pathogens, while also providing a stable product that makes it beneficial to KUB's farmers. In summer 2022, one of KUB's five digesters will be cleaned. Digester cleanings are important for two main reasons. First, the removal of debris from inside of the digester not only allows more capacity, but also it removes debris from the final biosolids product that ends up on farmers' fields. Second, it provides the opportunity for repairs inside the digester, which improves efficiency. At approximately 2 million gallons each, Kuwahee's digesters will continue to produce a valuable product for years to come with proper maintenance.

Emerging Topics in Biosolids

The world of science is constantly evolving, and researchers are now able to gather more data than ever before. This has led to more information gathering in the fields of water, wastewater, and biosolids. Throughout 2020 and 2021, KUB has taken a proactive approach in establishing an interdepartmental team focused on emerging regulations, contaminants, and technologies. The team has been charged with observing the regulatory and technological landscape, developing science-based communications for the community to stay informed, and keeping KUB leadership apprised of upcoming regulatory changes. The team is closely watching both state and federal decision-making and keeps open communication with regulators. KUB follows guidance set forth by the United States Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC).

KUB Committed to Community Outreach

KUB uses the following methods to inform customers, the community, and interested groups about the KUB BEMS:

Community Events

Biosolids staff and/or materials are made available at various community events. Staff members are also available to speak at schools, special events, or meetings.

Customer Communications

KUB houses biosolids content on its website at www.kub.org/biosolids, which includes a program overview, audit reports and more. KUB shares various communications materials with customers throughout the year that direct customers to this website. These materials include a biosolids brochure, newsletters, the annual Environmental Stewardship Report, employee training, and a new video highlighting biosolids used as a local television commercial and posted to social media. Through these efforts, KUB's biosolids webpage had 380 page visits in 2021 and 300 in 2020, which is triple the amount in 2019.

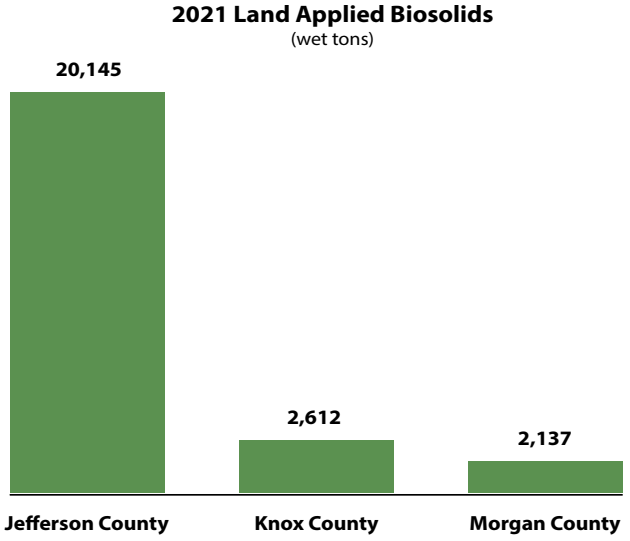
Interested Farmer Relations

KUB's website (www.kub.org/biosolids) offers a wealth of information about the biosolids program for farmers or other interested parties, including links to more information from the NBP, the National Association of Clean Water Agencies, the Water Environment Federation, and the EPA. In addition to the website material, KUB employees perform field evaluations every quarter, which promotes stronger relationships with our farmers.

Farmers may call KUB's Customer Information Center (865-524-2911) or e-mail the KUB Biosolids Mailbox at biosolids@kub.org if they have specific questions or are interested in scheduling a farm visit to determine eligibility for biosolids application.

East Tennessee Farmers Benefit from KUB Biosolids

KUB beneficially reuses 100% of its Biosolids. KUB contracts with Synagro Technologies for dewatering, transportation, and land application. Synagro's highly trained staff ensures that the company's work maintains compliance with applicable federal, state, and local regulatory requirements. KUB performs site visits and inspections when Synagro is land applying to ensure that the relationship between the farmers, Synagro, and KUB is maintained. A farmer receiving KUB's Biosolids stated, "Appreciate KUB giving us the opportunity to work with them. KUB probably has as good of a land application contractor as you are going to find. In addition to providing biosolids in a proper manner, they maintain excellent communication with the farmer." In addition, Synagro works with the EPA, NBP, and applicable regulatory agencies to be proactive in meeting changing rules and regulations. KUB is extremely grateful for the service Synagro provides.



In 2021, 19 farms received 24,894 wet tons of biosolids, spread over 1,528 acres of land. As shown in the figure, Jefferson County received the largest amount of biosolids. There are currently 52 farms approved for KUB Biosolids and permitted by TDEC.

2021 Goals Achieved, Continuous Improvement in 2022

The KUB BEMS goals and objectives were developed to seek continual process improvement and enhance biosolids quality. Each year, KUB develops these goals and objectives as part of the NBP requirements. These goals are recorded and assessed throughout each year and at an annual third party audit of KUB's BEMS. The program goals reinforce KUB's commitment to environmental performance, regulatory compliance, relations with interested parties and quality biosolids management practices.

In 2021, KUB achieved the following:

- Maintained average fecal coliform levels under 200,000 Most Probable Number (MPN) in all reporting periods.
  - 200,000 MPN is 1/10 of the regulatory limit.
- Maintained volatile solids reduction above 50 percent in all reporting periods except one.
- Continued improvement through the use of the capital project close-out process and the asset management program.
- Began training Plant Operators on the new Biologically Enhanced High Rate Clarifier (BEHRC) at Kuwahee.

Some of KUB'S 2022 goals and objectives include:

- Participate in TVA's Demand Response Program to reduce pressure on the region's electric grid during periods of peak demand.
- Maintain fecal coliform under 200,000 MPN and volatile solids reduction of 50 percent or higher throughout the year.
- Update the hardware and software that operate the dewatering centrifuges.
- Continue education on the BEHRC and optimize the process area.

KUB Verifies Quality

Parameter	EPA Ceiling Limits	2021 KUB Data
Arsenic (ppm**)	75	10.8
Cadmium (ppm)	85	1.4
Copper (ppm)	4,300	277
Lead (ppm)	840	23.3
Mercury (ppm)	57	0.99
Molybdenum (ppm)	75	21.5
Nickel (ppm)	420	22.7
Selenium (ppm)	100	6.4
Zinc (ppm)	7,500	818

** ppm: parts per million. One part per million is equivalent to a single penny in $10,000.

Continued Work on the Sludge Thickener Line Helps Alleviate Grease Issues

In the Spring of 2020, Kuwahee began having unprecedented issues with grease accumulating on the insides of the thickener sludge discharge piping that leads to the gravity belt thickener wet well. There were also thickener sludge pump issues due to the grease. This led to an inability to efficiently move thickened primary sludge to the digesters, where sludge is processed into biosolids.

Plant Operations and Maintenance crews set up an above ground bypass line to allow them to clean all the piping without a process shutdown. Most of the piping was cleaned, but Maintenance ran into issues cleaning some of the piping due to the 90 degree turns the piping makes. It was decided to smooth out the pathway of the line and add cleanout locations.

The pathway of the line was changed to directly cross under Joan Cronan Way, instead of turning parallel to an existing road within the plant. There was a duct bank that the line needed to cross at the generator building, and eventually it was decided that the line needed to be buried under it for safety.

During this time, it was also decided to add Variable Frequency Drives (VFDs) to the thickener pumps to slow down the flow and allow for more consistency. The older on/off timer system allowed for long periods of stagnation in the pipes, which was likely allowing the grease to harden in the piping. This initiative had mixed results and it was discovered that the pumps didn't operate well at slower speeds, and grease still formed on the inside of the pipes. Plant Operations and Maintenance tried a hybrid VFD/timer scheme, but the process is currently back to the 100% pump speed on/off timer method of pumping thickener sludge. Experimentation may continue in the future. After the grease issues reappeared, the bypass line was installed a second time and is currently in use. The discharge pumps and piping were cleaned again.

Grease issues can severely impact WWTPs and will ultimately cause extra maintenance and replacement of equipment. These equipment replacements can be costly, so it is important to remember to always "Can the Grease" that is used in the home or elsewhere. For more information on KUB's Grease Program, please visit KUB.org.

KUB Ensures Excellence

Biosolids produced in Tennessee are monitored for compliance based on the EPA Part 503 Biosolids Rule (40 CFR Part 503). KUB produces Class B biosolids. Pathogen Reduction requirements are met by anaerobically digesting sludge and reducing colony forming units by at least 2,000,000 per gram. Vector Attraction Reduction requirements are met by reducing volatile solids by at least 38 percent.

As illustrated in the table below, KUB monitors its biosolids much more frequently than industry regulators require.

Monitoring Category	EPA Part 503 Monitoring Frequency	KUB Monitoring Frequency
Pathogen Reduction	Once every 60 days	Monthly
Vector Attraction Requirements	Once every 60 days	Monthly
Regulated Pollutant Limits (metals)	Once every 60 days	Monthly
Total Solids, pH	N/A	Monthly
Nutrients	N/A	Monthly

Note: Based on biosolids production of equal to or greater than 1,500 dry metric tons but less than 15,000 dry metric tons.

Fast Facts

- 100 percent of KUB's biosolids produced in 2021 were land applied.
- KUB provides approximately 25,000 wet tons of Class B biosolids to local farmers as a fertilizer annually.
- KUB's biosolids are certified as fertilizer by the Tennessee Department of Agriculture.
- KUB has operated a biosolids beneficial reuse program for over 30 years.

Connect with KUB and learn more.

biosolids@kub.org • www.kub.org/biosolids