



APPLICATION FOR COMPONENT ADDITION TO NRCS

NRCS Practice Standard 316

For Acceptance of Forced Air Animal
Composting Technology

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APPLICATION FOR COMPONENT ADDITION TO NRCS Practice Standard 316:

Forced Air Animal Composting Technology

REQUEST

As dairy farms face increasing scrutiny from environmental, regulatory, and legal stakeholders regarding nutrient management and animal mortality disposal, the search for practical, sustainable solutions has intensified. Among the available options, composting systems—particularly those utilizing forced aeration—are gaining attention for their potential to safely, efficiently, and cost-effectively manage animal mortalities, particularly large animals. However, producers often rely on information from equipment providers, which can limit the objectivity needed to evaluate these systems' true performance and benefits.

Recognizing this challenge, Newtrient—building on its collaborative framework with Washington State University—has adapted its technology evaluation process to align with NRCS Conservation Practice Standard 316: Animal Mortality Facility. Originally developed in the context of NRCS Waste Treatment (CPS 629), the framework has been modified to support consistent, science-based assessments of composting technologies that use forced air to accelerate biological decomposition and enhance compost quality.

Forced air animal composting systems represent a meaningful evolution in mortality management. By using controlled aeration, these systems optimize microbial activity, reduce odors, minimize pathogen risks, and produce a stabilized compost product that can be safely used or land applied. Unlike traditional burial or incineration methods, forced air composting supports circular nutrient reuse while lowering biosecurity risks and aligning with on-farm sustainability goals.

To evaluate the viability of this approach, Newtrient conducted a field-based review of an advanced forced aeration composting system in commercial dairy conditions. The assessment focused on operational feasibility, environmental outcomes, integration with existing farm practices, and the quality of the resulting compost. Additionally, the evaluation considered the system's scalability and potential to meet NRCS objectives related to environmental protection, animal health, and resource conservation.

This report is submitted for review under NRCS CPS 316 and is intended to inform further consideration of forced air composting technologies for broader application. Based on our findings, these systems offer a promising solution for managing large animal mortalities in a way that is both environmentally responsible and operationally practical for today's dairy producers.

BRIEF DESCRIPTION OF COMPONENT CLASS

Composting is a natural biological process where microorganisms break down organic material into stable compost, primarily occurring in aerobic (oxygen-rich) conditions. Forced air composting enhances this by mechanically delivering oxygen evenly through the compost pile, overcoming the oxygen limitations of traditional static piles. This results in faster, more complete decomposition.

During composting, microbes consume oxygen and generate heat, water, and carbon dioxide. Maintaining temperatures above 130°F for at least five consecutive days is crucial for destroying most pathogens, with forced aeration systems typically achieving 140-150°F for 10 or more days, improving pathogen reduction and lowering processing time.

Effective composting requires controlling key factors including nutrient balance (carbon to nitrogen ratio), moisture content, aeration (porosity), and temperature. Proper management ensures rapid decomposition, minimizes odors, and prevents nuisances while producing a safe, usable soil amendment.

DETAILED DESCRIPTION

Forced air animal composting systems enhance traditional composting by actively supplying oxygen throughout the organic material, creating optimal aerobic conditions for rapid and efficient decomposition of animal mortalities. These systems typically include an aeration manifold or perforated floor beneath a compost pile or within a dedicated vessel, connected to a blower or fan that forces ambient air upward through the compost matrix. The airflow is carefully regulated to provide sufficient oxygen to sustain microbial activity while removing carbon dioxide and excess moisture, both critical factors for maintaining process efficiency and pathogen reduction.

Unlike passive static piles, forced aeration overcomes oxygen limitations by mechanically delivering fresh air at timed intervals and controlled volumes, ensuring even oxygen distribution and maintaining compost temperatures consistently in the ideal range of 140°F-150°F for 10 or more days. This elevated temperature profile is key to accelerating organic matter breakdown and effectively inactivating disease-causing organisms.

Moisture management is equally important; too little moisture slows microbial activity, while excess leachate can create anaerobic conditions and odors. Advanced forced air composting systems can incorporate closed-loop leachate capture and recirculation, maintaining moisture balance within the compost pile, minimizing runoff, and reducing odor emissions. This design contributes to cleaner, more manageable operations with reduced environmental impact.

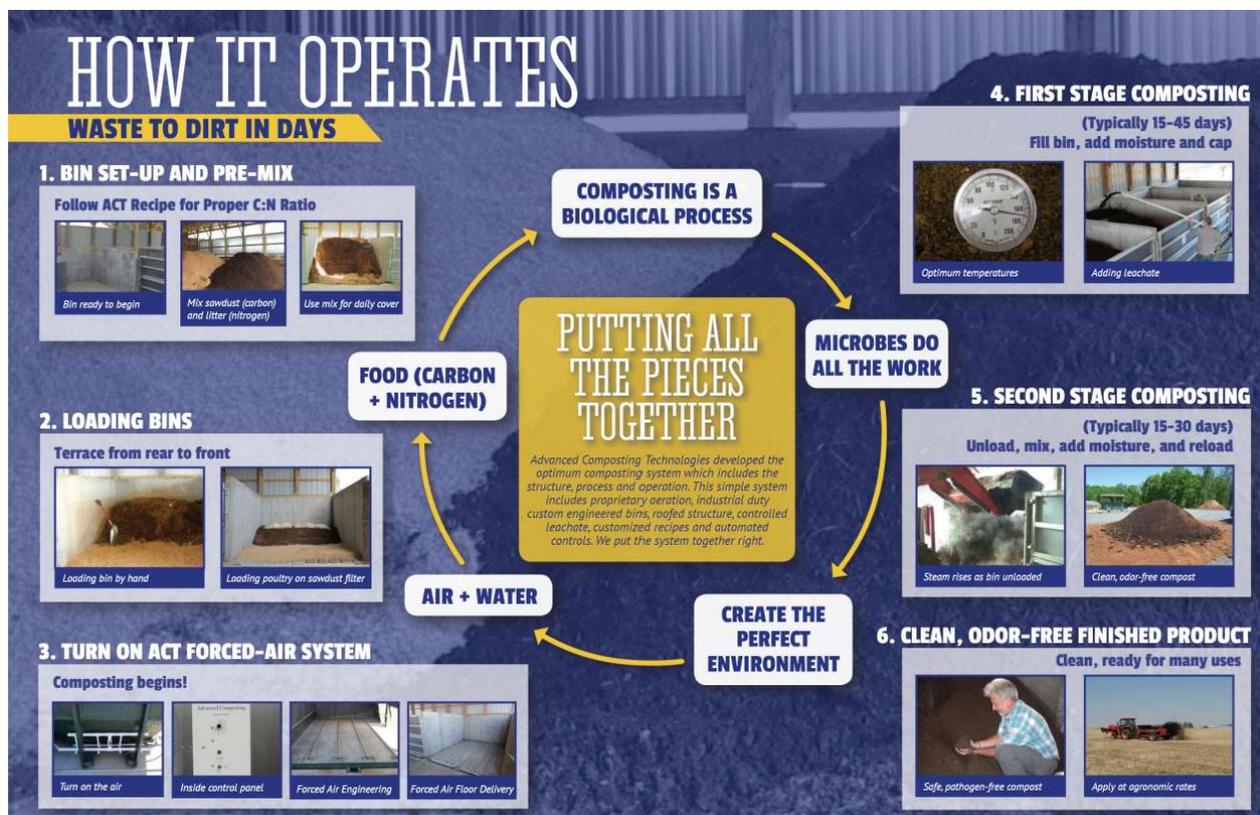


Figure 1: Flow diagram of the Advanced Composting Technologies process.

THE PROCESS

The forced air composting process begins with preparing the composting bin or vessel to support optimal air flow and moisture management. A layer of sawdust or similar carbon-rich material is first applied to the bin floor, acting as both a filtration base and a support for air distribution.

(Optional Step: Mortality Preprocessing)

In some systems and for the system that Newtrient evaluated, producers may choose to use a mortality preprocessing unit, such as a specialized mixer or grinder, to break down carcasses and blend them with carbon material (e.g., sawdust) prior to bin loading. This optional step enhances decomposition by increasing surface area, ensuring a more uniform mix, and reducing the volume and number of bins or floor space required. Farms using this approach often report reduced labor, faster composting, and elimination of leachate and odors.



Figure 2: ACT "Compost Special" Mixer.

If bins are used, waste materials, primarily animal mortalities, are then loaded into the bin from back to front, otherwise a windrow is created over the forced air system. As loading begins, the forced air system is activated to immediately supply oxygen to the developing compost pile. Each layer of waste is thoroughly covered with a carbon-to-nitrogen (C:N) ratio balanced bulking mix to promote microbial activity, absorb moisture, and control odors.

If the pile appears dry, leachate or water may be added to maintain the ideal moisture content. Once active composting has begun, operators monitor and record key parameters, primarily temperature and moisture, on a daily basis to ensure that the composting environment remains in the optimal aerobic range.

As new mortalities are added daily or as necessary, the bin continues to be filled incrementally, or windrow length is increased. Each addition is immediately covered with a fresh layer of carbon-rich material to maintain aerobic conditions and minimize odor.

Once the bin reaches capacity, the top is capped with a final thick layer of sawdust or similar carbon-bulk material to insulate the pile and lock in heat.

With aeration maintained and monitoring ongoing, the composting process typically continues for 15 to 45 days. For the system evaluated, aeration was continued for 16 days. This represents the primary composting phase. The material is then moved to a non-aerated secondary composting phase continuing for 15-45 days, this evaluation was for another 16 days. By the end of this period, the bin or pile will contain clean, stable, and odor-free compost that is ready for curing or direct use, depending on the intended application.

HOW PROPOSED SYSTEM ACCOMPLISHES PURPOSES OF THE STANDARD

The forced air animal composting system directly supports the goals of NRCS Conservation Practice Standard 316 (Animal Mortality Facility) by providing a controlled, biosecure method for managing animal mortalities while reducing odor, protecting soil and water resources, and minimizing the spread of pathogens.

Using a mechanically aerated composting process, this system creates and maintains aerobic conditions that accelerate the natural breakdown of carcasses. Consistently high internal temperatures, typically between 140°F and 150°F, are sustained for extended periods, promoting effective pathogen destruction and reducing the potential for disease transmission on the farm or to surrounding environments.

By eliminating the need for burial or rendering, forced air animal composting significantly reduces the risk of leachate contamination that can threaten soil and groundwater quality. The system's ability to control and recirculate moisture also minimizes runoff and enhances environmental protection. When utilizing the shredder/grinder system, the leachate collection and recirculation system is eliminated. Water may still need to be added if the moisture level gets too low. Additionally, the structured composting process prevents anaerobic zones, limiting odors that often arise from unmanaged or improperly handled mortalities.

The resulting compost is a stable, humus-like material that can be safely applied to cropland, further supporting nutrient recycling and sustainable land management. This method is adaptable to various farm sizes and configurations, making it a practical and scalable solution for livestock producers seeking to improve mortality management while meeting environmental compliance goals.

Newtrient (<https://www.newtrient.com/>), a company sponsored by the dairy industry and committed to enhancing value and sustainability in manure management, has conducted a thorough assessment of technology systems and practices within the field, focusing on their impact on critical environmental metrics, specifically water quality. The information

in this report is based on a Virginia Cooperative Extension (Virginia Tech and Virginia State University) evaluation of the technology at a commercial dairy in Rockingham County, Virginia.

As part of a broader evaluation effort, Newtrient and its partners, including researchers from Virginia Cooperative Extension, reviewed additional innovations in forced air animal composting technology. In particular, the evaluation included systems developed by Advanced Composting Technologies (ACT), a leader in composting innovation. In 2017, ACT introduced its “Compost Special” Mixer, a pre-processing unit designed to shred mortalities and blend them with carbon sources such as sawdust prior to bin loading or windrowing.

In support of this discussion, Appendix A provides a summary of the environmental benefits of forced air animal composting systems, including their effectiveness in reducing odors, improving water quality, and minimizing the risk of pathogen transmission, core objectives of NRCS Conservation Practice Standard 316. Appendix B includes a technology evaluation of forced air animal composting systems, including those utilizing advanced preprocessing equipment such as ACT’s “Compost Special” Mixer. These findings highlight key benefits and challenges. Appendix C contains the final report from a field study conducted by Virginia Cooperative Extension and Animal Mortality Composting Subject Matter Expert (USDA Contractor), offering deeper insights into system performance, and the operational advantages of integrating forced aeration with mortality preprocessing technologies.

Reducing nutrient content, organic strength

Forced air composting reduces the organic strength of animal mortalities by accelerating aerobic decomposition. In the ACT system evaluation, the preprocessing grinder/mixer created a uniform blend of mortalities, manure, and carbon, enabling rapid breakdown during the aerated primary phase and continued stabilization during the secondary static phase.

Nutrient results, however, showed substantial variability, across sampling dates. Total N in Trial 1 ranged from 1.67% to 3.93%, and C:N ratios varied from 11.0 to 20.8 during the primary phase. Trial 2 showed similar fluctuations. This variability was attributed to incorporating the entire carbon cap and base material when transitioning from primary to secondary composting, which introduced fresh C and diluted N.

Despite this variability, the compost still moved toward a more stable, humified organic material with lower biological oxygen demand (BOD) and fewer readily available nutrients. The result is a material with reduced nutrient-loading risk during land application and a lower likelihood of runoff or leaching compared to raw mortalities or unstable waste.

Reducing odor and gaseous emissions

Odor and gaseous emissions are significantly reduced in forced air animal composting systems due to the maintenance of aerobic conditions and controlled moisture levels. By preventing the formation of anaerobic zones, which are typically responsible for strong, unpleasant odors, these systems drastically reduce the release of ammonia (NH₃), hydrogen sulfide (H₂S), and volatile organic compounds (VOCs). The use of carbon-rich cover material, combined with consistent airflow and proper temperature management, further suppresses odors and limits emissions of greenhouse gases (GHGs) such as methane (CH₄). In operations using preprocessing mixers, odor is minimized even during bin loading, improving air quality and reducing nuisance concerns for nearby communities.

During the evaluation, no leachate nor notable odors were observed, even during loading. The preprocessing step created a uniform, porous blend that supported consistent aeration throughout the primary phase. The carbon cap effectively suppressed surface emissions, and the system maintained aerobic conditions throughout the process.

Facilitating desirable waste handling and storage

The structured, bin-based nature or windrow of forced air composting improves the manageability of animal mortalities, offering a clean, organized, and biosecure method of waste handling. Daily additions can be easily incorporated without disrupting existing material, and aeration eliminates the need for frequent turning. The end product, a stable, low-odor compost, can be stored for extended periods or land-applied when agronomically appropriate. Systems incorporating preprocessing technologies further simplify handling by reducing bulk volume, eliminating leachate, and decreasing the labor required for daily loading.

The ACT system enabled efficient, clean handling of approximately 12,000 lb. batches with a single loading event per bin. No leachate was observed, and the roofed pad supported year-round operation. After the primary phase, material was transferred to secondary static piles, where decomposition continued without mechanical aeration. The end product was low in odor, fully decomposed in soft tissue, and suitable for storage until field application.

Producing value added byproducts that facilitate manure and waste utilization

The final product of forced air animal composting is a nutrient-rich, humus-like compost that serves as a value-added soil amendment. This material enhances soil structure, improves water retention, and returns stabilized nutrients to the soil in a form less prone to volatilization or runoff. The use of advanced preprocessing technologies can improve the consistency and appearance of the compost, making it more marketable or desirable for use in diversified agricultural operations. By converting animal mortalities into a usable

resource, forced air composting supports a circular nutrient economy and helps producers derive value from what would otherwise be a disposal challenge.

Finished compost from both trials met 40 CFR 503 Class A pathogen reduction criteria, with nondetectable *Salmonella* and very low fecal coliform levels. All soft tissue was degraded during the primary phase, and bones were softened and reduced in size by the end of secondary composting. These few remaining bones could be added to the next composting mix for complete breakdown. Nutrient values were variable but within the expected range for mortality-based compost.

RANGE OF VOLUMETRIC AND MASS FLOW CAPACITIES AS WELL AS HYDRAULIC RETENTION TIME

The following section provides an overview of key operational parameters related to the performance of forced air animal composting systems. These ranges may vary based on facility design, animal size and type, bin configuration, and the inclusion of preprocessing technologies.

- *Volumetric Flow*: In forced air composting, volumetric capacity is determined by the size of the composting bins, vessels, or floor space and the volume of mortality and carbon material added daily. Typical systems are designed to handle daily volumes ranging from 1-10 cubic yards per bin per day, depending on farm size and composting frequency. With multi-bin systems, total system capacity can be scaled to handle 20-200+ cubic yards per week. For windrow systems adequate aerated floor space should be provided for the expected mortality rate.
- *Mass Flow*: Mass input is highly variable and depends on animal size, mortality rates, and the use of preprocessing. A single bin may accommodate 0-10,000 pounds of mortalities per day when combined with appropriate carbon materials. Use of a preprocessing grinder/mixer (e.g., ACT “Compost Special” Mixer) can increase the effective mass flow capacity by reducing particle size and improving material compaction, allowing more material to fit within a single bin while accelerating decomposition increasing exposed mortality surface area for bacterial breakdown.
- *Hydraulic Retention Times (HRT)*: While not directly applicable to composting systems due to the absence of a continuous liquid phase, an equivalent metric is active composting duration or residence time. For forced air systems, this typically ranges from 15 to 45 days, depending on the system’s aeration rate, pile temperature, carbon source, and preprocessing use. Systems with preprocessing units often achieve full decomposition and pathogen kill at the lower end of this range due to improved aeration and surface area exposure.

DESIRED FEEDSTOCK CHARACTERISTICS

The efficiency, odor control, and pathogen reduction performance of a forced air animal composting system depend heavily on the quality, consistency, and composition of the feedstock, primarily the animal mortalities and the associated carbon material used for bulking.

To maintain aerobic conditions, achieve proper decomposition rates, and produce a stable end product, certain feedstock characteristics are critical. These include both the nature of the mortalities being composted and the carbon source used to balance the compost mix. In systems using a preprocessing unit (e.g., a mortality grinder/mixer), achieving these characteristics becomes easier and more consistent, further optimizing system performance.

Key desired feedstock characteristics include:

1. Appropriate Carbon-to-Nitrogen Ratio (C:N):

An initial mix with a C:N ratio between 30:1 and 35:1 is ideal to support microbial activity and minimize odor and ammonia volatilization.

2. Optimal Moisture Content:

The feedstock mixture should maintain a moisture content between 50% and 60%. This balance supports microbial activity while avoiding excess leachate or anaerobic conditions.

3. Sufficient Porosity and Structure:

Bulking materials such as sawdust, wood shavings, or straw are needed to provide airflow pathways throughout the pile and prevent compaction.

4. Bulk Density:

Bulk density should remain below 640 kg/m³ (1,100 lbs./yd³) to ensure adequate pore space for oxygen movement and effective aeration.

5. Particle Size:

Particle size generally ranges from 0.8 to 1.2 cm (1/8 to 1/2 inch), depending on the materials used. Smaller particle size improves microbial access and speeds decomposition, especially when preprocessing is applied.

6. pH:

The composting environment should have a pH between 6.5 and 8.0 to optimize microbial diversity and activity.

7. Pathogen-Containing Material:

The system is designed to handle whole animal mortalities, including bones and soft tissues. However, any large or non-compostable items (e.g., metal ear tags) should be removed prior to loading.

8. Oxygen Concentration:

Oxygen levels should be maintained above 10% to ensure aerobic conditions and efficient decomposition.

9. Stable Temperature and Load Rate:

To maintain continuous operation, daily load rates should match the bin design and aeration capacity, and the compost mix should be introduced at a relatively consistent temperature and composition. Temperatures between 140°F and 150°F (60°C to 65°C) sustained over several days promote pathogen destruction and rapid organic matter breakdown.

EXPECTED SYSTEM PERFORMANCE

Forced air animal composting systems are designed to efficiently decompose animal mortalities while minimizing environmental impacts and improving waste management. By maintaining optimal aerobic conditions, moisture, and temperature, these systems significantly reduce organic material volume, stabilize nutrients, and destroy pathogens. The process concentrates nutrients in the finished compost, producing a safe, odor-free, and valuable soil amendment.

- *Changes in form or handling characteristics*

Forced air composting transforms whole animal mortalities into a stable, humus-like material with greatly improved handling characteristics. The original high-moisture, biologically active tissues are broken down into a dry, friable compost that is significantly reduced in volume and free of recognizable animal remains. The finished product is easily handled with conventional equipment, can be stored or stockpiled with minimal odor or leachate risk, and is suitable for land application, curing, or blending with other soil products.

In the study, these expected handling improvements were largely confirmed: all soft tissue was fully decomposed by the end of the primary composting phase in both trials, and the secondary phase further broke down bone material. Although small, softened bone fragments (6-8 inches or smaller) remained, the compost matrix itself was uniform, low-moisture, and easily handled with no observed leachate production. These findings support improved material stability and handling while also highlighting that complete bone size reduction was not fully achieved within the evaluated cycle length.

- *Nutrient fate or end use projections*

Throughout the composting process, nutrients from the mortalities, particularly nitrogen (N), phosphorus (P), and potassium (K), are retained in organic forms within the compost matrix. While some nitrogen may be lost through volatilization (primarily as ammonia), the majority is stabilized and becomes plant-available over time. The end use of the compost is typically as an agricultural soil amendment, where it can improve soil health, organic matter content, and nutrient availability. The nutrient value of the compost can be tailored by adjusting the C:N ratio and bulking materials used during processing.

Study data show that while nutrient retention followed expected patterns, nutrient concentrations were not stable across the system. Total N values fluctuated widely within and across phases (e.g., 1.67%-3.93% in Trial 1 primary material; 1.41%-1.95% in Trial 2 primary material), and C:N ratios shifted upward when fresh carbon materials were incorporated during turning. These results indicate that end use nutrient projections for land application remain valid, but nutrient predictability is reduced, and compost users should expect variability depending on how carbon caps and bases are incorporated.

- *Macro-nutrient reductions or transformations*

Macronutrients undergo partial transformation during composting. Organic nitrogen is mineralized into ammonium (NH_4^+), some of which may volatilize as NH_3 , while the remainder becomes part of the stable organic nitrogen pool. P and K are largely conserved in the compost and remain in bioavailable forms. Overall, composting reduces total nitrogen through volatilization but improves nutrient stability and uniformity in the final product, making nutrient release more predictable when applied to soil.

The study's N data confirms active macronutrient transformation but also shows substantial variability in NH_4^+ and organic N levels from sample to sample, reflecting the influence of carbon additions and mixing events. For example, NH_4^+ -N concentrations ranged from 0.026% to 0.177% in Trial 1 primary samples and showed similarly variable patterns in Trial 2. These shifts suggest N transformation occurred as expected, but uniformity in the final product is less predictable than generalized models assume, and batch-specific testing may be necessary for precise nutrient planning.

- *Pathogen reductions or eliminations*

Forced air composting systems are highly effective at pathogen reduction due to the sustained high temperatures achieved during the process. With proper management, internal pile temperatures exceed 140°F (60°C) for 10 or more consecutive days, which is sufficient to inactivate most bacteria, viruses, and parasites. In addition to thermal inactivation, microbial competition and decomposition byproducts contribute to pathogen destruction. When properly monitored and operated, these systems meet or exceed established standards for pathogen reduction in composted materials.

The study confirmed this performance: *Salmonella* was not detected in any sample across both trials, and fecal coliform levels were either non-detectable or well below the Class A threshold of 1,000 Most Probable Number per gram of total dry solids, with only a single low-level detection still within allowable limits. These results, combined with documented sustained thermophilic conditions, demonstrate that the system reliably achieved Class A pathogen reduction, with no data suggesting performance gaps.

- *Air quality*
 - Compared to traditional static or anaerobic disposal methods, forced air composting significantly reduces air emissions. The aerobic environment minimizes the production of CH₄ and H₂S, while consistent oxygenation limits the release of VOCs. Some NH₃ emissions may occur during the active phase, but they are typically mitigated through proper C:N ratio balancing and carbon cover materials. Systems with preprocessing mixers also reduce emissions during loading by eliminating the need for turning and minimizing odor release.

While the study did not directly measure air emissions, observed system behavior provides indirect evidence consistent with reduced odor and minimized anaerobic conditions. No odor problems were reported during any phase of the trials, including during unloading, and no evidence of anaerobic zones, such as wet pockets, seepage, or incomplete tissue breakdown, was identified. The consistent aeration performance and absence of leachate or odor generation support the inference of low emissions, but the lack of quantified NH₃ or VOC measurements means these benefits remain qualitative rather than empirically confirmed within this evaluation.

- *Water quality*
 - Water quality impacts in well-managed forced air composting systems are minimal. Moisture is consumed through microbial activity and evaporated by the heat generated during composting. Leachate generation is rare due to the absorbent carbon base layer and careful moisture management. When present, any leachate is often recirculated into the composting pile to maintain optimal moisture levels. By preventing excess liquid accumulation and promoting evaporation, these systems protect surface water and groundwater resources from nutrient contamination.

Study observations aligned closely with these expectations. Across both trials and all composting phases, no leachate or liquid runoff was observed, despite warm summer conditions and active moisture release during thermophilic phases. The roofed pad and well-balanced carbon mix consistently prevented excess free liquid, and no water quality related concerns, such as pooling, seepage, or nutrient-rich effluent, emerged. These findings strongly support the system's effectiveness in minimizing water quality risks.

PROCESS MONITORING AND CONTROL SYSTEM REQUIRMENTS

Effective process monitoring and control are critical to ensuring optimal performance, reliability, and biosecurity in forced air animal mortality composting systems. Maintaining precise control over key environmental and operational parameters prevents process upsets, reduces odors, limits pathogen survival, and maximizes compost quality. Continuous and proactive oversight allows operators to respond promptly to deviations, ensuring aerobic conditions and efficient decomposition throughout the composting cycle.

Required Monitoring:

During system operation, the following parameters must be routinely monitored:

- Compost pile temperature, recorded at multiple depths and locations to ensure consistent heat distribution.
- Moisture content, to maintain levels that support microbial activity without causing excess leachate or dryness.
- Oxygen concentration within the compost pile to confirm aerobic conditions are maintained.
- C:N ratio of incoming feedstock and overall pile to optimize microbial activity and minimize odors.

- Airflow rates and forced air system functionality to verify adequate oxygen delivery.
- Visual inspection for leachate accumulation, odor, and physical condition of the compost pile or bins.

Required Control:

Operators must actively manage and adjust the following during operation:

- Forced air flow rates and distribution schedules to sustain aerobic conditions and prevent anaerobic zones.
- Moisture content by adding water or recirculating leachate as needed to maintain target moisture ranges.
- Feedstock loading rates and layering to maintain proper C:N ratio balance and prevent compaction.
- Temperature management by adjusting aeration and bin capping to retain heat and promote pathogen kill.
- Removal or treatment of any contaminated or non-compostable materials detected during operation.

Equipment Included for Monitoring:

Typical monitoring tools and sensors integrated into the system may include:

- Temperature probes or wireless thermal sensors placed strategically within the composting mass.
- Moisture sensors or handheld moisture meters for pile sampling.
- Oxygen sensors for real-time measurement of aeration efficiency.
- pH sensors to measure the acidity or alkalinity of the material.
- Flow meters and pressure gauges on forced air blowers and distribution systems.
- Visual and olfactory inspection protocols documented for quality assurance.

Equipment Included for Controlling:

To manage composting conditions, the system commonly includes:

- Automated or manual forced air blowers with adjustable flow control and timing functions.
- Moisture application systems or leachate recirculation pumps to regulate pile hydration.
- Feedstock mixers or preprocessing units to ensure homogeneous material blending.

- Temperature alarms and control systems to alert operators of deviations from target ranges.
- Physical covers or insulation layers to maintain temperature and moisture.

TYPICAL OPERATIONS/MAINTENANCE PLAN WITH MONITORING REQUIREMENTS AND REPLACEMENT SCHEDULE

Forced air animal mortality composting systems are designed to efficiently and safely convert mortalities into stable, nutrient-rich compost while minimizing odors, emissions, and environmental risks. Maintaining system performance relies on consistent operation, proactive monitoring, and routine maintenance to ensure proper aeration, moisture balance, temperature control, and overall compost quality.

Below is an outline of a typical operations and maintenance plan, including key monitoring requirements and suggested component replacement schedules.

System Monitoring

Routine and frequent monitoring is critical to maintaining adequate aerobic conditions, promoting efficient decomposition, and preventing operational issues.

- **Temperature:** Monitor compost pile temperature at multiple points daily to ensure it remains within the target range of 140°F to 150°F (60°C to 65°C) for effective pathogen destruction.
- **Moisture Content:** Check moisture levels regularly (daily to weekly) using handheld meters or sampling to maintain 50-60% moisture, adjusting water or leachate recirculation accordingly.
- **Oxygen Levels:** Monitor airflow rates and oxygen concentration within the pile or system to confirm aerobic conditions are sustained.
- **pH:** Monitor the pH of the material to optimize microbial diversity and activity.
- **Airflow System:** Inspect forced air blowers and distribution systems daily for proper operation, airflow consistency, and absence of blockages.
- **Physical Inspection:** Conduct visual inspections for leachate accumulation, odors, bin integrity, and presence of non-compostable materials.
- **Feedstock Quality:** Confirm consistent feedstock composition and appropriate C:N ratio during loading to maintain process stability.

Typical Maintenance Activities

Routine maintenance keeps the system operating efficiently and extends equipment lifespan.

- **Forced Air System:** Clean and inspect blowers, filters, ducts, and air distribution pipes monthly or as needed to prevent clogging or mechanical failure.
- **Leachate Management:** If utilized, check and clean leachate collection and recirculation components regularly to avoid blockages and maintain moisture control.
- **Temperature Sensors and Monitors:** Calibrate or replace sensors annually or if inconsistent readings are observed.
- **Feedstock Preprocessing Equipment:** Maintain grinders, mixers, or conveyors per manufacturer guidelines to ensure uniform feedstock preparation.
- **Structural Components:** Inspect compost bins, covers, and flooring for damage or wear; repair as needed to maintain containment and airflow.
- **Record Keeping:** Maintain logs of all monitoring data, maintenance activities, and any operational issues for performance review and regulatory compliance.

Replacement Schedule

- **Forced air blowers:** Typically replaced every 5 to 7 years, depending on usage, maintenance, and operating conditions. Proper upkeep can extend blower life.
- **Air distribution pipes and ducts:** Replacement generally occurs every 7 to 10 years or sooner if damage or wear compromises airflow.
- **Temperature and moisture sensors:** Calibrated regularly (at least annually); replaced every 1 to 3 years or sooner if readings become inconsistent or faulty.
- **Feedstock preprocessing equipment (grinders, mixers):** Replaced or overhauled every 3 to 5 years per manufacturer recommendations and operational wear.
- **Bin structural elements (covers, liners, flooring):** If utilized, typically replaced every 7 to 10 years, depending on material type, environmental exposure, and physical wear.

CHEMICAL INFORMATION

- Forced air animal mortality composting is a biological process that relies primarily on natural microbial activity to break down organic materials. This system does not require the addition or use of chemicals to facilitate decomposition, control odors, or manage pathogens. Instead, it depends on maintaining optimal environmental

conditions such as temperature, moisture, aeration, and C:N ratio balance to promote effective composting.

No chemical additives or treatments are involved in the forced air animal composting system and therefore are no concerns related to chemical residues, handling, storage, or disposal within the composting process. This makes the technology environmentally friendly and reduces potential risks to workers, livestock, and the surrounding ecosystem.

Any adjustments to moisture content or odor control are managed through physical means, such as adding water, leachate recirculation, or incorporating carbon-rich bulking agents like sawdust or wood shavings, rather than chemical interventions.

ESTIMATED INSTALLATION AND OPERATION COST

Equipment and Installation Capital Costs

As of 2025, the estimated cost for an ACT forced air large animal mortality composting system base unit is \$211,869.40. Storage area cost is approximately \$60.36/ft², which includes primary, secondary, and curing areas. Use of a diesel-powered unit increases the capital investment by \$6,000. Additional cost for the optional preprocessing equipment (shredder/grinder) for one to five mortalities per week would be \$85,000 and \$105,000 for more than five mortalities per week. Costs may vary due to market conditions, project specifics, customizations, and anticipated ancillary structures.

Operation and Maintenance Costs (O&M)

- ***Electrical***— The primary electrical costs are associated with powering the forced air blowers that provide aeration throughout the composting bins or floor. Energy usage varies depending on system size, blower capacity, and operational hours but typically represents a moderate portion of total O&M expenses. Efficient blower operation and proper maintenance help minimize electricity consumption.
- ***Preprocessor (Optional)*** – For operations choosing to preprocess mortalities both electric and power take off (PTO) diesel options are available. Follow the recommended loading rates to exceed capacity requirements. Clean unit following each use to optimize system performance. Ensure adequate PTO horsepower is available to operate preprocessing unit.
- ***Labor*** — Labor costs include time spent on daily monitoring of temperature, moisture, and airflow; loading and covering mortalities with carbon material; maintaining equipment; and recording operational data. Systems with preprocessing mixers may reduce labor demands by simplifying feedstock

preparation and minimizing manual turning. Overall, labor requirements are moderate and can be optimized through automation and good management practices.

- **Maintenance Replacement** — Maintenance expenses cover routine cleaning, inspection, and repair of blowers, air distribution components, sensors, and feedstock processing equipment. Periodic replacement of sensors, blower parts, and structural elements is necessary to maintain system performance and prevent downtime. Scheduling preventive maintenance reduces the risk of costly breakdowns and extends equipment lifespan.

EXAMPLE WARRANTY

Warranty information for forced air animal mortality composting systems varies by manufacturer and system design. However, typical warranties generally include the following provisions:

1. Warranty Coverage

Most warranties cover defects in materials and workmanship for a period of 1 to 3 years from the date of installation or purchase, depending on the manufacturer and system type.

2. What Is Covered

- **System Components:** Coverage typically includes key mechanical and electrical components such as forced air blowers, control systems, aeration distribution infrastructure, preprocessing equipment, and structural elements like bin liners or covers.
- **Repair or Replacement:** Defective parts identified within the warranty period are usually repaired or replaced at no cost to the owner. Terms concerning labor, shipping, and installation costs vary and should be reviewed in the warranty documentation.

3. What Is Not Covered

- **Improper Use or Maintenance:** Damage resulting from misuse, neglect, incorrect operation, or failure to follow recommended maintenance protocols is excluded.
- **Environmental or External Damage:** Damage caused by natural events (e.g., storms, flooding), power surges, or accidents is generally not covered.
- **Normal Wear and Tear:** Expected wear from regular use, including blower motor degradation or wear of structural components due to weather exposure, is excluded.

- **Unauthorized Repairs or Modifications:** Any repairs or alterations made by unauthorized personnel may void the warranty.

Owners should carefully review the specific warranty terms provided by their composting system manufacturer or vendor at the time of purchase to understand the full scope of coverage and responsibilities.

RECOMMENDED RECORD-KEEPING FOR FORCED AIR COMPOSTING SYSTEMS

Accurate and consistent record-keeping is essential to ensure the effective operation, environmental compliance, and continuous improvement of forced air animal mortality composting systems. Detailed records allow operators to track system performance, identify operational trends or issues early, document pathogen reduction, and maintain transparency for regulatory or third-party review.

The following records are recommended for routine documentation:

- **Temperature logs** – Record internal compost pile temperatures daily at multiple depths and locations to verify sustained thermophilic conditions ($\geq 140^{\circ}\text{F}$ for ≥ 5 consecutive days).
- **Moisture content readings** – Document moisture levels regularly (e.g., weekly or as needed), especially after rainfall, leachate application (if applicable), or material additions.
- **Oxygen and airflow monitoring** – Log blower operation times, airflow rates, and oxygen concentration readings (if measured) to confirm aerobic conditions are maintained.
- **Feedstock inputs** – Track the quantity and type of mortalities and carbon sources added to each bin or pile, including date and estimated C:N ratio.
- **Leachate management (if applicable)** – Document any collection, recirculation, or treatment of leachate, including volume and handling procedures.
- **Turning or loading activities** – Note when bins are loaded, capped, or transitioned to curing, and any operational adjustments made.
- **Equipment checks and maintenance** – Keep records of inspections, maintenance performed, calibration of sensors, and any equipment malfunctions or repairs.
- **Odor or emission incidents** – Record any observed odors, complaints, or off-site impacts, including corrective actions taken.

- **Final compost product characteristics** – Log date of bin cleanout, appearance, odor, and any laboratory testing results (e.g., pathogens, nutrient content).

ALTERNATIVES FOR THE USE OF BYPRODUCTS

Forced air composting of animal mortalities results in a stabilized, nutrient-rich compost that can serve a variety of beneficial purposes. Properly managed, the final compost product is clean, odorless, and virtually free of pathogens, making it a valuable byproduct with multiple potential uses both on and off the farm. State regulations should be thoroughly reviewed for acceptable animal mortality compost off-farm applications.

The following are common and alternative uses for compost generated from forced air animal mortality systems:

- **Soil amendment for crop production**
Compost can be applied to fields to improve soil organic matter, structure, and water-holding capacity while gradually releasing nutrients.
- **Pasture or forage land improvement**
Applying compost to grassland areas can enhance soil fertility and boost forage productivity over time.
- **Landscaping and turf applications**
The stable, screened compost may be used in non-agricultural settings such as parks, golf courses, and commercial landscaping.
- **Nursery and greenhouse media blending**
Compost can be mixed into potting soils or propagation mixes to improve microbial health and reduce reliance on synthetic inputs.
- **Erosion control and reclamation**
Compost may be used in erosion socks, filter berms, or as part of land reclamation projects to stabilize soils and promote vegetation.
- **Off-farm sale or distribution**
Farms may package and sell finished compost to local gardeners, landscapers, or municipalities, creating a new revenue stream.
- **Internal reuse in feedstock blends**
A small portion of finished compost may be reused as a bulking agent in new compost piles, especially in cold or low-carbon conditions.

INDEPENDENT VERIFIABLE DATA DEMONSTRATING RESULTS/CREDENTIALS

Appendix A is a summary of the expert opinion and technical data available for this class of technology and how it relates to key performance indicators within NRCS Standard 316 (Animal Mortality Facility). This information is available through Newtrient.

Appendix B provides a summary of data from a Newtrient-managed third-party review of a forced air animal composting unit with a compost special grinder/mixer located at a commercial dairy farm in Rockingham County, Virginia. The data comes from a system performance analysis conducted by Virginia Cooperative Extension but has not been peer-reviewed.

Appendix C contains the full Virginia Cooperative Extension report detailing the third-party review at the commercial dairy in Rockingham County, Virginia.

CONTACT INFORMATION—VENDOR

1. While not an absolute conclusive list, the list below identifies vendors that are active in the application of this class of technology on manure projects within the U.S.

Advanced Composting Technologies, INC.

Address: P.O. Box 2440, Candler, NC 28715

Phone: 828-665-8600

Website: <https://advancedcomposting.com/>

Contact: arendon@advancedcomposting.com

Company Information: The Advanced Composting system uses forced air and an air distribution system to facilitate the timely replenishment of oxygen throughout the mixture for maximum composting efficiency. The ambient air is forced up through the mixture, and the amount of air is carefully calibrated to provide just the right amount needed to purge the carbon dioxide and replace it with fresh air, which contains about 18% oxygen. ACT's proprietary system of forced aeration provides exactly the right amount of air needed, which speeds up the process and makes turning the compost mixture a thing of the past. The right amount of moisture is also critical to the composting process. Capturing and controlling excess moisture, or leachate, is very important. ACT's system of closed-loop leachate control (if applicable) ensures that moisture is collected, controlled, and circulated back into the composting material. This not only helps the composting process; it also greatly reduces the mess and virtually eliminates the odor typically associated with composting systems that have been used in the past. ACT's proprietary composting facility offers a turn-key and easy to use system that ensures optimum conditions in the compost pile at all times. The company has introduced a preprocessing system

to grind and mix mortalities with carbon material. This reduces overall composting time and virtually eliminates the need for a leachate collection system.

CONTACT INFORMATION—USER

Commercial large animal mortality composting facilities presently operating in the U.S. with this class of technology are identified below. The list is a best effort but may not be completely inclusive of all installations.

Forced Air Animal Mortality Composting Technology

North Carolina State University Animal and Poultry Waste Management Center Processing Facility – Raleigh, NC

Windcrest Holsteins – Rockingham County, VA

OTHER CONSIDERATIONS

While the preceding sections address the 15 core items required in a third-party technical evaluation following the NRCS 629 methodology, additional observations and insights from the evaluation of forced air animal mortality composting systems may assist NRCS, producers, and other stakeholders in understanding the broader context of system implementation.

The following considerations may influence the feasibility, adoption, and long-term success of these composting technologies:

- **Variability in Nutrient Dynamics Across Composting Stages**

Although nutrient levels fell within expected ranges for mortality compost, the evaluation showed substantial variability in total N and C:N ratios across sampling dates. Total N ranged from 1.67% to 3.93% in Trial 1 and 1.41% to 1.95% in Trial 2, with corresponding C:N ratios spanning 11.0-20.8 and 21.0-28.6, respectively. This variability is likely due to the incorporation of fresh carbon from caps and base layers during turning and moving to different stages, which dilutes N and resets portions of the compost profile. While not detrimental to compost quality, these shifts make nutrient predictions for land application less precise.

- **Presence of Residual Bone Fragments After Secondary Composting**

Although soft tissue was fully decomposed and bones were substantially softened by the end of secondary composting, both trials still produced small residual bone fragments (6-8 inches or smaller). These pliable, degraded pieces may warrant consideration in field applications where equipment damage is a concern. Additional curing or screening could reduce fragment size but would add

operational steps. Even so, the system performed markedly better than traditional static pile composting, which typically leaves larger, sharper bones after longer processing cycles.

- **Site Planning and Infrastructure**

Proper siting of composting bins, vessels, or floors is essential to prevent leachate runoff, facilitate equipment access, and maintain compliance with state and local regulations. Proximity to mortality generation points (e.g., barns) also affects labor efficiency.

- **Weather and Seasonal Impacts**

Cold weather may slow microbial activity, requiring additional insulation, longer retention times, or modifications to loading practices. High rainfall areas may require improved leachate management or covered bins.

- **Regulatory Compliance and Reporting**

While composting meets mortality disposal requirements in many states, local permitting and record-keeping requirements vary. Producers should ensure systems are designed to meet applicable animal health, waste management, and air quality regulations.

- **Community and Environmental Perception**

Properly managed forced air systems can reduce odor and eliminate visible carcasses, improving the perception of on-farm mortality management and minimizing concerns from neighbors or local officials.

- **Scalability and Customization**

Systems can be scaled to match the size of the operation, and manufacturers may offer modular or mobile configurations to accommodate future growth or multi-site operations.

- **Producer Training and Engagement**

Success depends on operator understanding of composting principles and system requirements. Training on monitoring, troubleshooting, and bin or pile management is critical, particularly during the first season of implementation.

- **Economic Return**

While upfront costs may be higher than passive methods, long-term savings can result from reduced hauling and rendering fees, improved nutrient recycling, and the potential for revenue from compost sales.

Conclusion

The forced air animal mortality composting system evaluated in this report demonstrates strong potential as a reliable, environmentally sound, and scalable solution for on-farm mortality management. By maintaining aerobic conditions and optimizing temperature, moisture, and airflow, this technology effectively transforms animal mortalities into a stabilized, nutrient-rich compost product with minimal odor, reduced pathogen risk, and no leachate discharge when properly managed.

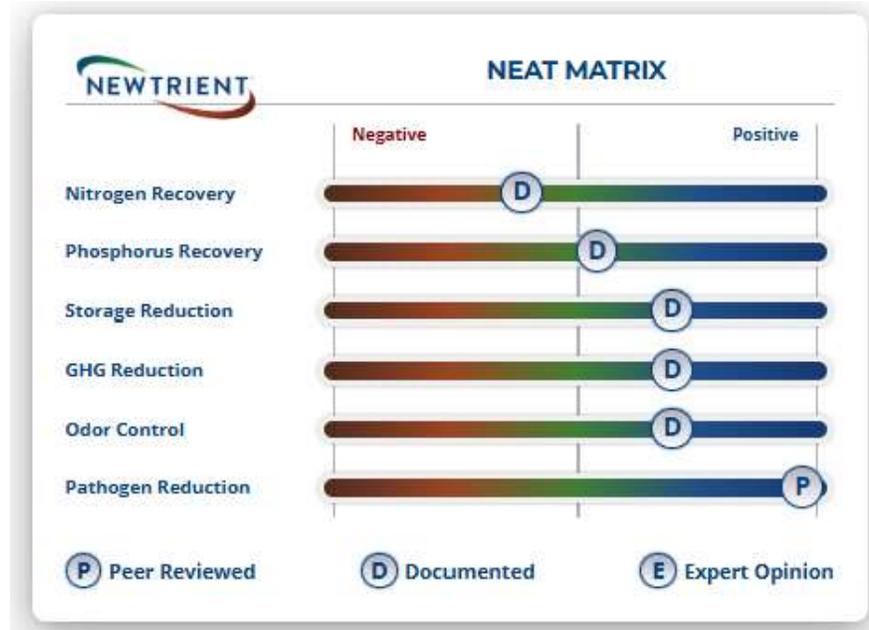
The system aligns well with the objectives of NRCS Conservation Practice Standard 316 (Animal Mortality Facility), offering producers a practical alternative to burial, incineration, or rendering, particularly in regions where those options are costly, limited, or environmentally burdensome.

Its performance is enhanced by consistent operation, diligent monitoring, and, where applicable, the use of preprocessing technologies like mortality mixers that improve feedstock uniformity and reduce labor. With proper training, routine maintenance, and thoughtful siting, the system can serve farms of various sizes and species types, including poultry, swine, beef, equine, and dairy, while meeting both regulatory and sustainability goals.

As producers seek reliable, low-impact solutions for animal mortality, forced air composting offers a proven approach that protects environmental resources, supports biosecurity, and creates value-added byproducts. Continued technical support, economic evaluation, and adaptation to site-specific conditions will further strengthen its role as a key tool in sustainable livestock management.

Appendix A

NEWTRIENT CRITICAL ANALYSIS – COMPOSTING TECHNOLOGY



Overall Summary

Forced air animal mortality composting is a proven biological treatment system that transforms on-farm mortalities into a stable, nutrient-rich compost product through a controlled aerobic process. By using a system of perforated floors or ducts to actively supply oxygen to the composting mass, forced air composting accelerates decomposition, enhances pathogen destruction, and significantly reduces odor and leachate generation compared to traditional static pile methods. This makes it especially well-suited for farms seeking environmentally responsible, cost-effective alternatives to burial, incineration, or rendering.

The system requires a balance of carbon-rich bulking material and moisture to maintain proper composting conditions. When operated correctly, with regular monitoring of temperature, moisture, and airflow, it can consistently reach thermophilic temperatures ($\geq 140^{\circ}\text{F}$) necessary to destroy pathogens and break down soft tissues and bones within 30 to 45 days. The addition of preprocessing technologies, such as a mortality grinder/mixer, further improves system efficiency by homogenizing the feedstock, reducing bin space requirements, and eliminating leachate altogether.

Forced air composting is adaptable to a range of livestock operations, including poultry, swine, beef, equine, and dairy, and is especially valuable in regions where traditional

mortality disposal options are limited, restricted, or costly. The final compost product can be reused on-farm as a soil amendment, incorporated into nutrient management plans, or sold offsite as a value-added product. It is essential to review mortality state regulatory requirements.

While the system does not recover energy or separate nutrients for concentrated fertilizer production, it excels in biosecurity, simplicity, and environmental protection. With relatively low ongoing operational costs (mainly electricity and labor), no chemical inputs, and straightforward infrastructure, forced air composting is an accessible and sustainable mortality management option. Widespread adoption depends on proper training, supportive regulations, and producer awareness of its operational and environmental benefits.

Appendix B

Third-Party Review of Forced Air Animal Composting Technology – Rockingham County, VA (Report Summary)

University Partner

Robert Peer, Retired
Agricultural Program Coordinator
Virginia Department of Environmental Quality
Animal Composting Subject Matter Expert
USDA Contractor

Robert Clark
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115 Hutcheson Hall, Virginia Tech
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Blacksburg, VA 24061

OCTOBER 2025

BACKGROUND

Effective mortality management is critical for protecting water quality, reducing disease transmission, recovering nutrients, and maintaining operational efficiency on livestock operations. Traditional disposal methods, including burial, rendering, and static pile composting, can introduce environmental risks, involve lengthy treatment times, or pose biosecurity challenges. As farms grow and consolidate, many producers face tighter operational constraints and increasing demand for more controlled and predictable mortality management solutions.

Forced aeration composting systems have emerged as a practical alternative for improving decomposition efficiency, accelerating pathogen reduction, and enhancing nutrient recovery. These systems integrate mechanical mixing, controlled aeration, and structured loading protocols to maintain consistent composting conditions. The Advanced Composting Technology (ACT) system builds on these principles by combining a grinder/mixer, forced air primary composting bins, and a static secondary composting stage to convert animal mortalities into stable, land-applicable compost.

INTRODUCTION

The ACT system was evaluated on a commercial dairy in Virginia to assess its performance under typical farm conditions. Two complete composting cycles were conducted during summer months, allowing for observation of temperature behavior, physical breakdown, and compost characteristics across both primary and secondary stages.

The evaluation focused on key benchmarks commonly used to understand mortality composting performance, including sustained thermophilic temperatures (heat from active microbes), uniform carcass decomposition, and reduction of biological indicators. Findings from temperature monitoring, pathogen

testing, nutrient analysis, and on-farm observations demonstrate that ACT's enhanced composting process provides a controlled, efficient, and sustainable approach for handling routine dairy mortalities. These results indicate that the system can offer producers a predictable and biosecure solution for on-farm mortality management and nutrient recovery.



Figure 1: Trial #1 Compost Mixture Placed in Bin Prior to Capping.

THE PROCESS

The ACT system integrates mechanical preprocessing, forced air bin composting, and static secondary composting into a single workflow for managing dairy mortalities. The process is designed to maintain optimal oxygen, moisture, particle size, and carbon (C)-to-nitrogen (N) ratio balance to support rapid decomposition and reduce pathogen risk.

Preprocessing begins with a grinder/mixer, where mortalities are combined with carbon material and finished compost in a typical 3:2:1 ratio (e.g., 1,500 lbs. mortality, 1,000 lbs. bulking agent, 500 lbs. compost). Mixing for 20-30 minutes produces a uniform blend with smaller particle size, balanced moisture, and improved airflow.

The blended material is then loaded into forced air composting bins, capped with a clean carbon bulking material, and composted for approximately 16 days, as recommended by ACT. This phase generates rapid and sustained thermophilic conditions, while moisture is contained. After primary composting, material is transferred to a static pile for an additional 16 days, where natural airflow continues to maintain elevated temperatures and support decomposition.

Finally, the compost is moved to a covered storage area for approximately 60 days, where moisture and odor are managed until the material is ready for land application. The resulting compost is stable and suitable for use on cropland or pasture under standard nutrient management practices.



Figure 2. Trial #1 Compost Mixture Placed in Bin after Capping and with Temperature. Locations Flagged.

METHODOLOGY

Trials were conducted at a dairy farm in Rockingham County, Virginia, at 1,050 ft. elevation. Environmental conditions included daytime temperatures near 90°F and nighttime temperatures around 68°F. The site featured six ACT forced air composting bins (12,000 lb. capacity each), an ACT grinder/mixer system, a dedicated secondary composting area, a covered concrete floor for all operations, and a 60-day compost storage capacity. Temperature monitoring occurred from August 11 to September 24, 2025.

Each trial used approximately 12,000 lbs. of mixed material, consisting of 3,000 lbs. dairy mortality (two adult cows, two calves), 3,150 lbs. carbon source (double-ground mulch), 4,050 lbs. bedded pack dairy manure, and 1,800 lbs. fines from manufactured wood waste. Mixtures were blended for approximately 20 minutes per batch and moisture adjusted to 35-50%. Prepared mixtures were loaded into aerated bins and capped with fresh carbon material.

Temperature verification followed Natural Resources Conservation Service (NRCS) Conservation Practice Standard (CPS) Code 316 Animal Mortality Facility. During the primary phase (forced aeration, 16 days), temperatures were monitored at depths of 12, 24, and 36 inches using two probe sites per bin and calibrated ReoTemp 36-inch compost thermometers. During the secondary phase (static pile, 16 days), temperatures were monitored at 18 and 36 inches, including the carbon cap. These procedures ensured regulatory-compliant and consistent temperature measurements throughout the composting cycle.

Composite samples from both primary and secondary phases were collected for laboratory nutrient profiling, including organic nitrogen (N), ammonium nitrogen ($\text{NH}_4^+\text{-N}$), nitrate nitrogen ($\text{NO}_3^-\text{-N}$), total nitrogen (N), C:N ratio, phosphate (PO_4^{3-}), potash (K_2O), moisture, and pH. Samples were also collected for pathogen testing (fecal coliform, *Salmonella* spp.) to verify compliance with regulatory requirements.

Visual inspections were conducted during each composting phase to document procedures for evaluating soft tissue, bone integrity, and remaining structural fragments. Leachate monitoring procedures were implemented throughout the trials to determine if additional leachate management measures were necessary.

DISCUSSION OF RESULTS

The evaluation of ACT's mortality composting system across two full cycles provides a comprehensive understanding of system performance under commercial dairy conditions. Temperature data, nutrient dynamics, pathogen testing, and carcass breakdown collectively demonstrate the effectiveness of ACT's integrated approach and its potential operational and environmental benefits.

KEY BENEFITS OF MORTALITY COMPOSTING

Reliable Thermophilic Temperatures

The ACT system demonstrated a consistent ability to achieve and maintain thermophilic temperatures well above the NRCS CPS 316 requirement of sustaining at least 130°F for five consecutive days. Across both trials, temperature curves in Figures 3-6 show rapid heating within the first 24-48 hours and stable thermophilic activity throughout the full 16-day primary and secondary cycles. Trial 1 achieved average temperatures of 153.9°F during the primary phase and 143.1°F during the secondary phase, while Trial 2 maintained averages of 151.5°F and 146.0°F, respectively. These consistently high temperatures confirm effective aeration, robust microbial activity, and reliable regulatory performance under real farm conditions.

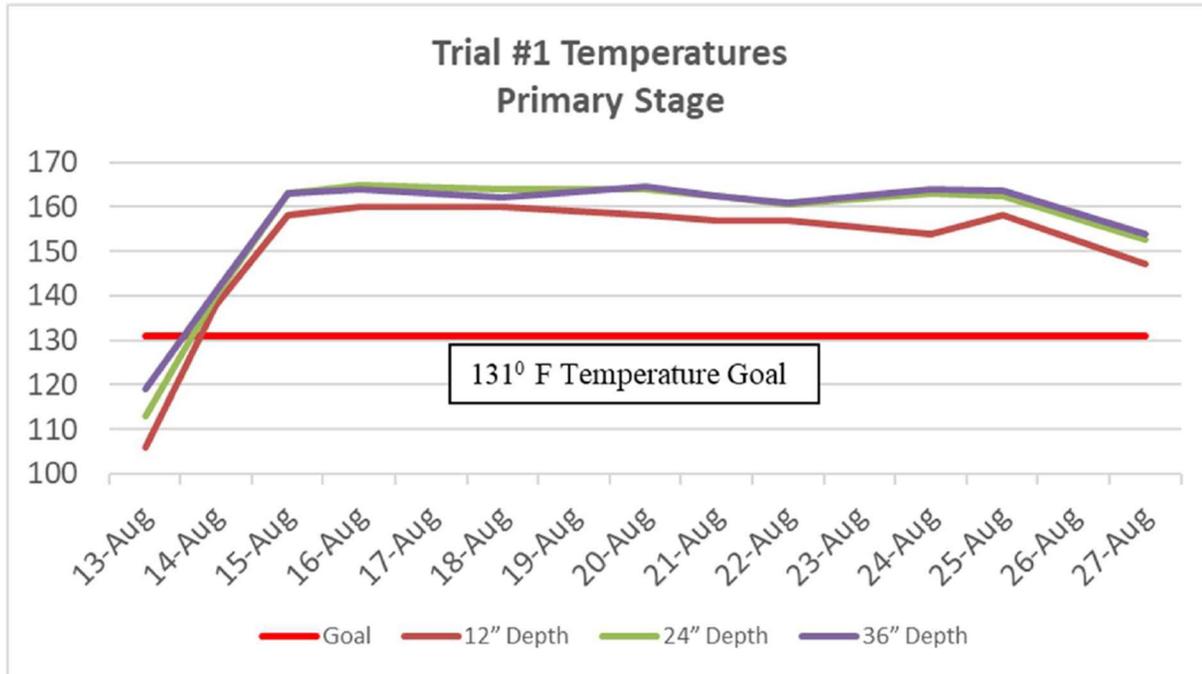


Figure 3. Trial #1 Temperatures Primary Stage.

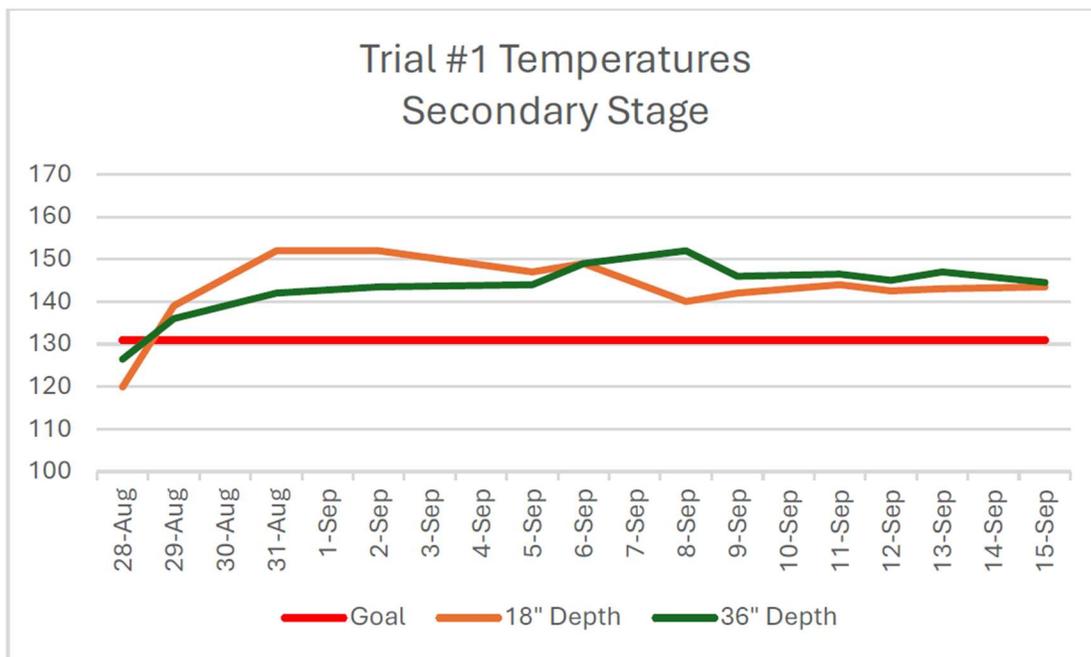


Figure 4. Trial #1 Temperatures Secondary Stage.

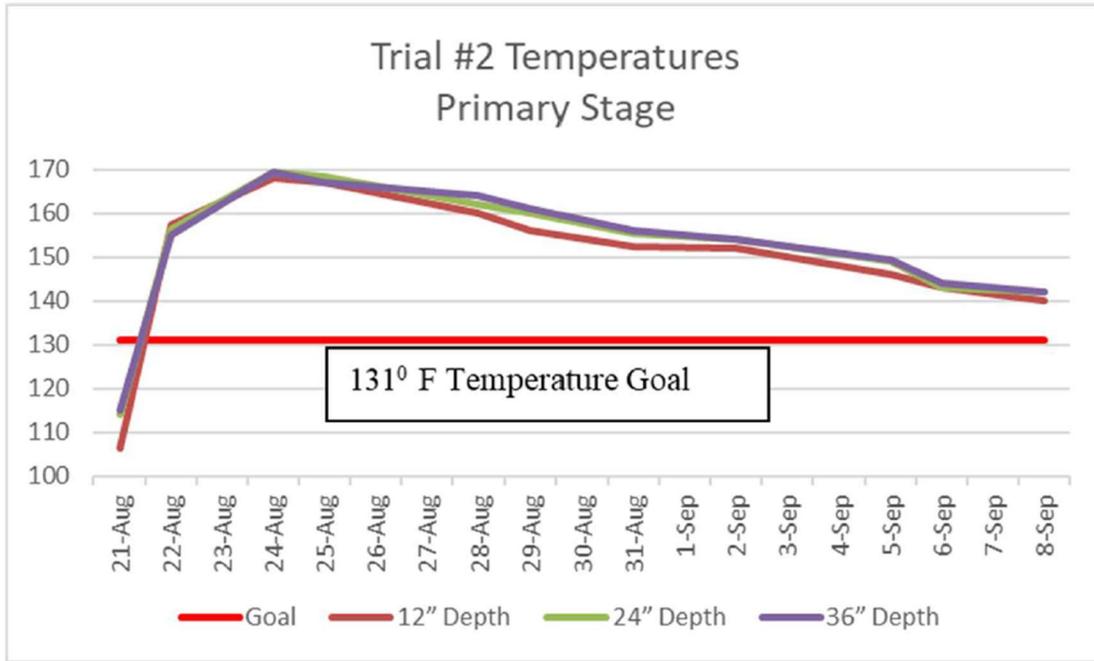


Figure 5. Trial #2 Temperature Primary Composting (131° F Temperature Goal).

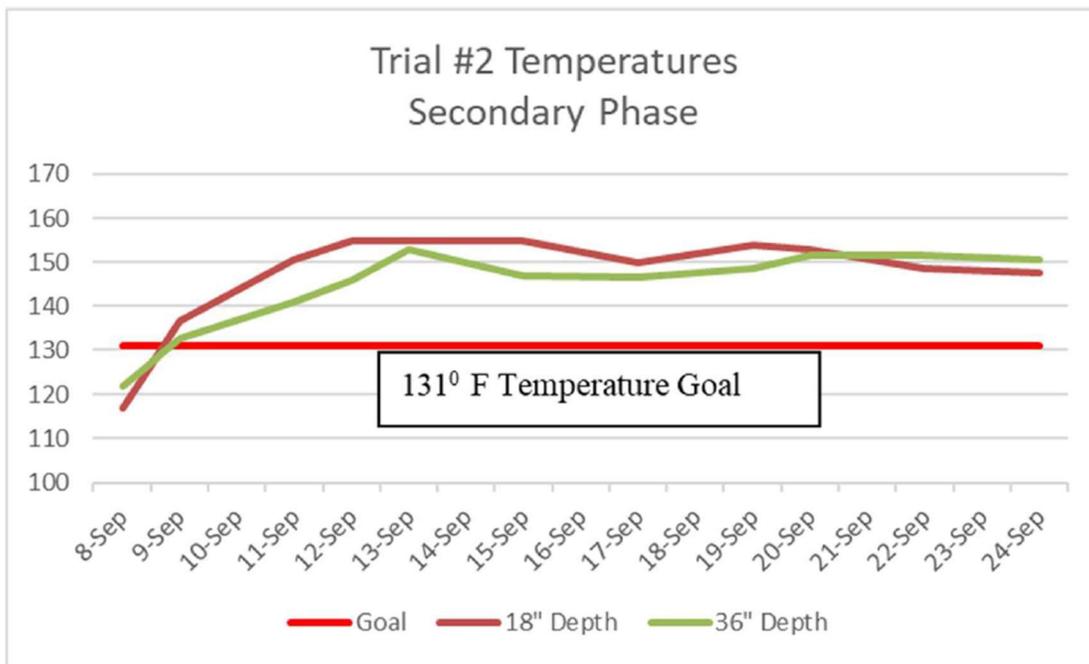


Figure 6. Trial #2 Temperatures Secondary Composting.

Strong Pathogen Reduction Meeting Class A Standards

Pathogen testing demonstrated that the ACT system effectively reduces fecal coliform and *Salmonella* to levels compliant with 40 CFR 503 Class A standards. Laboratory analyses show that fecal coliform levels were either non-detectable or well below the 1,000 Most Probable Number per gram of total dry solids threshold, with only one detectable result across all primary samples, but still within acceptable limits. *Salmonella spp.* was not detected in any samples during either trial. Combined with the documented temperature performance, these results confirm that ACT's composting process consistently achieves Class A pathogen reduction suitable for land application.

Agronomically Useful Compost

Although N concentrations and C:N ratios varied across sampling dates and between composting phases, the resulting nutrient values fell within ranges commonly found in mortality-based compost (Tables 1-4). These characteristics indicate that the finished material can be incorporated into nutrient management plans as an organic soil amendment.

Date	Organic N (% DB)	Ammonium N (% DB)	Nitrate N (% DB)	Total N (% DB)	C:N
8/14/2025	3.75	0.177	0.004	3.93	11.0
8/20/2025	1.67	0.049	0.001	1.72	13.7
8/22/2025	1.88	0.035	0.001	1.92	20.8
8/25/2025	2.05	0.080	0.001	2.13	19.8
8/28/2025	1.81	0.026	0.001	1.84	20.0

Table 1. Trial #1 Primary Composting Nitrogen (N) Analysis.

Date	Organic N (% DB)	Ammonium N (% DB)	Nitrate N (% DB)	Total N (% DB)	C:N
9/1/2025	1.48	0.106	0.001	1.59	28.0
9/9/2025	1.79	0.077	0.001	1.87	21.1
9/15/2025	1.87	0.050	0.001	1.92	20.8

Table 2. Trial #1 Secondary Composting Nitrogen (N) Analysis.

Date	Organic N (% DB)	Ammonium N (% DB)	Nitrate N (% DB)	Total N (% DB)	C:N
8/21/2025	1.91	0.035	0.001	1.95	21.0
8/25/2025	1.41	0.049	0.001	1.46	28.6
9/1/2025	1.41	0.064	0.001	1.47	25.5
9/5/2025	1.67	0.105	0.001	1.77	24.4
9/8/2025	1.49	0.043	0.001	1.53	26.3

Table 3. Trial #2 Primary Composting Nitrogen (N) Analysis.

Date	Organic N (% DB)	Ammonium N (% DB)	Nitrate N (% DB)	Total N (% DB)	C:N
9/19/2025	1.84	0.036	0.001	1.88	21.20
9/24/2025	1.03	0.047	0.001	1.08	37.68

Table 4. Trial #2 Secondary Composting Nitrogen (N) Analysis.

Thorough Decomposition and Controlled Environmental Conditions

The combined preprocessing and forced aeration system produced a uniform composting mixture that decomposed quickly and thoroughly. All soft tissue was fully broken down by the end of the primary composting phase, and bone material was significantly softened and reduced in size by the end of secondary composting. Throughout both trials, no leachate or liquid runoff was observed, even under warm summer conditions, reflecting the effectiveness of the roofed pad, carbon cap, and moisture-balanced composting mix. Together, these outcomes demonstrate a controlled, contained process that supports efficient decomposition while minimizing water quality risks.

EVALUATION KEY CHALLENGES AND ISSUES

Variability in Nutrient Dynamics Across Composting Stages

While overall nutrient levels were consistent with expectations for mortality compost, the evaluation documented notable variability in N values and C:N ratios across sampling dates. As shown in Tables 1-4, total N during the primary phase fluctuated from 1.72% to 3.93% (dry basis) in Trial 1 and 1.46% to 1.95% in Trial 2. Similarly, C:N ratios ranged widely—from 11.0 to 20.8 in Trial 1 primary samples and from 21.0 to 28.6 in the Trial 2 primary phase. This variability appears to be linked to the incorporation of the carbon cap and base material during pile turning between primary and secondary phases, which introduces fresh carbon and resets part of the composting profile. While not detrimental to compost quality, these shifts complicate predictions of nutrient concentrations for land application planning.

Presence of Residual Bone Fragments After Secondary Composting

Although all soft tissue was fully decomposed by the end of the primary stage and bone material was significantly softened by the end of the secondary stage, both trials showed that small bone fragments (6-8 inches) remained. While these fragments were pliable and structurally degraded, their presence may require consideration when applying compost to fields where equipment damage may be of concern. Additional curing or mechanical screening could further reduce bone size but would add operational steps. The system's performance still represents substantial improvement over traditional static pile composting, which often leaves larger, sharper bone fragments after much longer cycles.

IMPLICATIONS

The evaluation demonstrates that the ACT enhanced composting system can process dairy mortalities efficiently while maintaining environmental containment. Across two full cycles, the system achieved rapid thermophilic temperatures, Class A pathogen reduction, and produced stable compost suitable for integration into nutrient management plans. The shortened composting cycle, combined with the containment of leachate, supports improved operational efficiency and minimizes potential excess nutrient runoff or leaching.

While this evaluation was limited to a single commercial dairy site, the results indicate that mechanically preprocessed, forced aeration composting can provide a consistent and predictable method for on-farm mortality management. Expanding evaluations across multiple sites, herd sizes, and climatic conditions would provide additional insight into system performance under variable dairy production scenarios. Overall, the findings suggest that enhanced composting approaches like this can be a practical, environmentally responsible option for dairy farms seeking to manage mortalities safely and effectively.

For additional information on the vendor, environmental impacts, financial implications, and mortality composting technology, visit the ACT Vendor Snapshot on the [Newtrient website](#).

This study was funded by the Natural Resources Conservation Service (NRCS) through a Conservation Innovation Grant (CIG). The views and findings presented in this publication are those of the author(s) and do not necessarily reflect the official views or policies of NRCS or the U.S. Department of Agriculture.

Appendix C

Third-Party Review of Forced Air Animal Composting Technology – Rockingham County, VA (Full Report)



Evaluation of Advanced Composting Technology's Enhanced Forced Aeration Composting System Complimented with Grinder/Mixer System

Peer, Robert; Clark, Robert

Consultant; Virginia Cooperative Extension

Funded by the USDA Natural Resources Conservation Service (NRCS) through a Conservation Innovation Grant (CIG)

Abstract: *On-farm composting of animal mortality is becoming more popular for economic, bio-security related, and nutrient recovery-based reasons. There are several different technologies and methods available for composting animal mortality. This research will focus on a combination of forced air bin and static pile composting.*

These methods combined with a mixer/grinder system make up Advanced Composting Technology's (ACT) current system. For this evaluation the ACT system was operated within the guidelines provided for NRCS NC approval and ACT protocol (See Appendix A). A commercial dairy farm was selected for ACT technology evaluation.

The farm uses ACT grinding/mixing equipment to combine mortality with an appropriate carbon source prior to composting.

Temperatures were recorded at the farm as the compost went through two heat cycles. The first cycle of 16 days was subject to forced aeration. The second cycle of 16 days was subject to static conditions in a pile. These evaluation times were based on reduction percentage compared to

traditional static pile composting. In addition to the Virginia Tech monitored compost cycles, data, and samples were collected from the recently completed compost cycles managed by the farm independently. Samples were collected and analyzed for nutrient, heavy metals, and pathogen reduction analysis. The ACT technology readily satisfies the requirements of NRCS Conservation Practice Standard (CPS) Code 316 for two separate trials at this site.

Composting is a natural biological process where organic matter decomposes into a nutrient rich humus-like material. The bacteria that drive the composting process requires certain conditions to properly thrive. Three of the most important being moisture, organic material with the proper composition of carbon and nitrogen, and oxygen. If any of these three conditions are not optimal, then the composting process is limited and/or stops. As the bacteria actively break down organic matter they generate heat. This heat is crucial for proper pathogen control that is needed for safe application and usage of mortality-based compost. The United States Department of Agriculture (USDA) has criteria for composting systems to ensure properly

finished compost. The criteria that apply to this evaluation of the technology come from the NRCS CPS Code 316, Animal Mortality Facility. The evaluation focused on two provisions of the standard to verify that no visible pieces of soft tissue are present in the finished compost and that the temperature be maintained at greater than 130F for at least five days as an average through the compost mass followed by a compatible time and temperature for secondary composting stage.

Materials and Methods

Evaluation Sites

The evaluation of two separate trials were conducted at one site. The site was located at Windcrest Holsteins Dairy Farm near Timberville in Rockingham County, VA. Average ambient temperatures in this area were 90F during the day and 68F at night in this area during the time of the evaluation. The average elevation above sea level for this area is 111 feet. Temperature recordings for this evaluation were started on August 11, 2025, and continued through September 24, 2025 (Figures 1, 2, 3, and 4).

Evaluation Design

The evaluation site was equipped with Advanced Composting Technology's (ACT) forced air bins and grinding/mixer systems. The site is a commercial dairy farm. The system includes grinding/mixing equipment, six composting bins capable of holding 12,000 pounds each, the capability for secondary treatment, and the ability for 60 days of storage. The entire system has a concrete floor and is under roof. At the site daily mortality was loaded into the grinder/mixer on a weight-based mixture of 3:2:1 with bulking material/carbon source and finished (hot) compost material (See Appendix A and D). For both trials, the bulking/carbon materials consisted of fines from a door manufacturer waste, double ground mulch. Bedpack dairy manure was also added for additional nitrogen. The grinder/mixer's intended purpose is to decrease overall mortality particle size and thoroughly mix in the carbon material. For any material to be composted, this grinding/mixing

procedure occurs only once, as one of the earlier steps in the ACT composting process. Following this process, the material mix is loaded using a tractor mounted front end loader into one of the forced air compost bins (Figure 5). The material is capped with a carbon material in a depth appropriate for covering any flesh (Figure 6). This cap is critical for vector and odor control. The material then composts while having air forced throughout from perforated pipes in the floor. This is called the primary composting process. ACT's protocol for the dairy farm calls for this process to run for the duration of 16 days (See Appendix A) with temperatures recorded at depths of 12, 24, and 36 inches (Figures 1 and 3). A temperature probe is inserted at these depths at two locations in the bins.

The secondary treatment uses static air composting as the material is formed into a pile. The shape of the compost pile creates a condition where the chimney effect pulls cooler, oxygen rich air from the sides and the bottom of the pile. As the bacteria driving the composting process generates heat, the warmer moist air exits through the top of the pile. A compost pile's health and performance can quickly be determined with temperature measurements. This secondary treatment process was recorded for 16 days with temperatures taken at depths of 18 and 36 inches (Figures 2 and 4). The top dressing of carbon (carbon cap) is included in all temperature probe depth measurements.

Sample and Data Collection

The final product from both evaluations were inspected for any visible soft tissue. Temperatures were recorded to ensure that the USDA NRCS CPS criteria from Animal Mortality Facility Code 316 were met. This criteria requires that the composting facility will have the capacity to maintain compost temperatures of 130F or greater for at least five days as an average throughout the compost mass followed by a compatible time for secondary composting. Temperatures were taken with two ReoTemp 36 inch compost thermometers. The thermometers were calibrated at the beginning of the trials and prior to the secondary cycle. Nutrient and pathogen samples were taken from several locations of the compost bin or pile and then mixed to ensure representative sampling. Any specific lab recommendation or

guidelines were strictly followed. A lab in Harrington, Delaware, was used for nutrient analysis and pathogen analyses.

Procedure for Loading the Bins

For each trial, approximately 3,000 lbs. of dairy cows (two mature cows and two baby calves) were ground for 20 minutes in the grinder/mixer with 4.5 cubic yards of double ground mulch (700 lbs./cu.yd. or 3,150 lbs.), 4.5 cubic yards of bedpack dairy manure (900 lbs./cu.yd. or 4,050 lbs.), and 3 cubic yards of fines from a door manufacturer waste (600 lbs./cu.yd. or 1,800 lbs). This is a total of 12,000 lbs. per trial.

Carcass Decomposition Evaluation

Although not the main objective to these trials, it is important to the producer to end up with a compost that can be readily applied to crop, hay, and pasture fields. Large sharp bones are aesthetically unpleasing to neighbors and can damage tractor and equipment tires. The compost will be evaluated for the presence of both soft tissue and bones at the end of both the primary and secondary cycles for both trials.

Results

During both evaluations, the mixer/grinder systems were observed being loaded with farm mortality, carbon material, and finished compost using a front end loader tractor. Farmer records and visual loading confirm bin capacity of 12,000 pounds when bins are loaded to operational levels. During the evaluations it was noted that there was no need for additional measures for leachate capture or control. There was no visible leachate noted during the primary or secondary composting stages.

Time and Temperature

The primary and secondary composting masses more than exceeded the USDA NRCS CPS Code 316 guidelines for time and temperature. Figures 1 and 2 show temperature recordings from the primary and secondary composting bins during the first trial. The primary bin from this evaluation measured an

average temperature of 153.9F over 16 days of monitoring. The secondary composting stage of this evaluation met NRCS requirements as well by averaging 143.1F over the 16 days of monitoring.

Figures 3 and 4 show the temperature recordings from the primary and secondary composting during the second trial. The primary bin from the second trial evaluation also met NRCS requirements by having an average temperature of 151.5F over 16 days of monitoring. The secondary compost also met the temperature requirements with an average of 146.0 over the 16 day monitoring period.

Nutrient Levels and Pathogen Reduction

Samples were taken from both evaluation sites and sent to AgroLab Laboratories for analysis on nutrient levels and pathogen reduction. Tables 1, 2, 3 and 4 show the nitrogen analysis. We anticipated seeing nitrate levels increase and the C:N ratio decrease. However, there was no noteworthy change. When the material was turned between the primary and secondary composting stages, we incorporated all of the base and cap. This likely increased the C:N and added a lot of energy to the piles. Also, there was no remarkable change in Phosphate, Potash, Moisture or pH in the samples from the beginning of Phase #1 through the end of Phase #2. The samples compost nutrient level results from the monitored finished Trial 1 and Trial 2 can be seen in Appendix B. All finished compost from both trials were also analyzed for pathogen reduction using the 40 CFR 503 Class A Compost method/standard and the results are in Appendix C. For the purposes of this evaluation, this standard states that compost/ bio-solids can only be classified as Class A material if fecal coliform density is less than 1,000 Most Probable Number (MPN) per gram of total dry solids (1,000 MPN/g TS) and has been treated based on time and temperature requirements described earlier.

Only one fecal coliform result for the primary cycle in both trials was detectable and that was below the limit.

Fecal coliform results for the secondary cycle for Trial 1 were not detectable.

Fecal coliform results for the secondary cycle in Trial 2 were not detected at the beginning of the cycle but were detected at the end.

The mortality compost was tested for Salmonella as that is a concern for application of mortality compost on pasture and hay fields. Salmonella was not detected for either trial.

Carcass Decomposition

There was no soft tissue detected at the end of the primary cycle for both trials. There were some small (6-8 inch or less) bone fragments remaining at the end of the primary cycle for both trials. Most of the bone fragments at the end of the secondary cycle for both trials were soft and showed evidence of degradation.

Summary

Processing cattle mortality through the vertical grinder system prior to composting resulted in a blend that composted very rapidly. Both trials achieved temperatures well above the minimum standard required by NRCS. There was no leachate observed.

Although we did not make a direct comparison in this trial, we believe that both the overall time required to fully eliminate all flesh through composting and the amount of bone decomposition was more rapid in this trial than what we have observed in other composting trials using unprocessed cattle. We estimate that the vertical grinder system was at least two times faster than we have previously observed in composting unprocessed cattle.

Figure #1: Trial #1 Temperatures Primary Stage

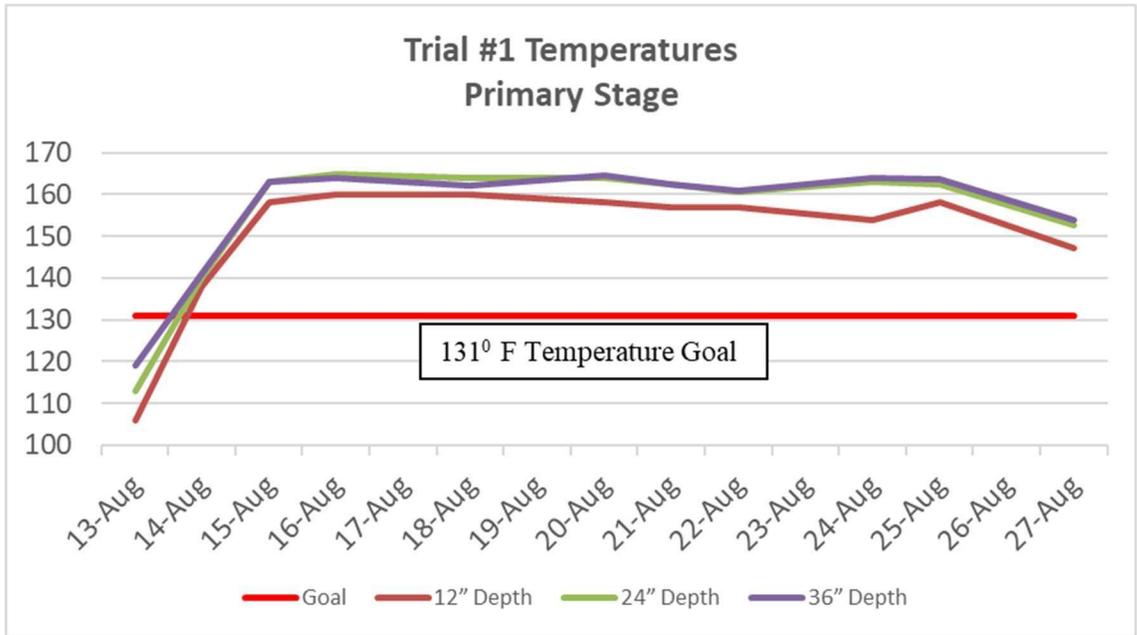


Figure #2: Trial #1 Temperatures Secondary Stage

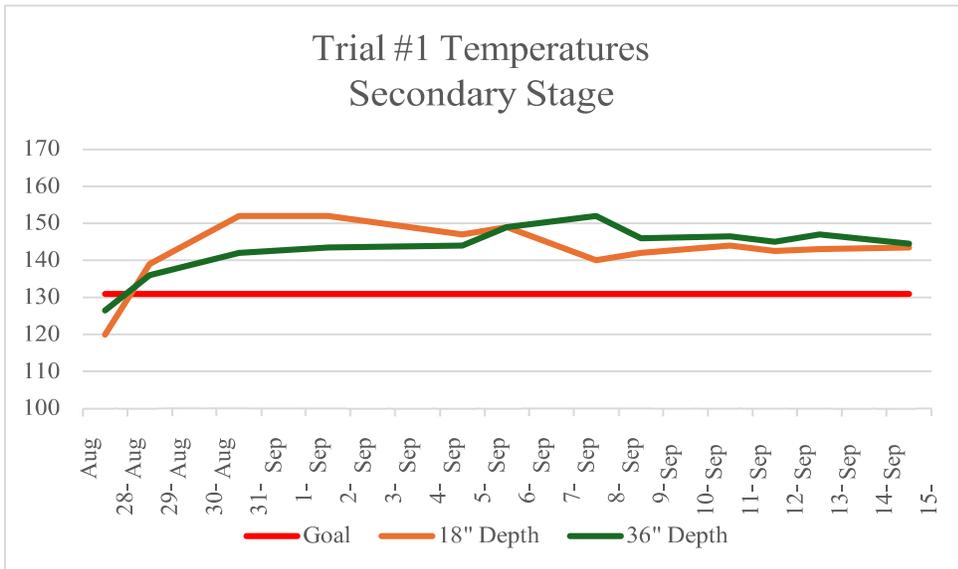


Figure #3: Trial #2 Temperature Primary Composting

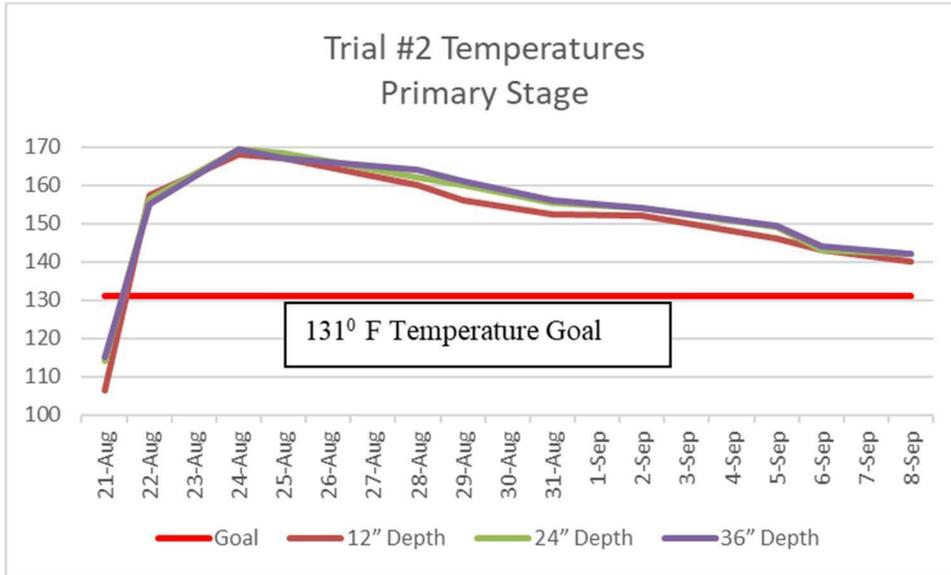


Figure #4: Trial #2 Temperatures Secondary Composting

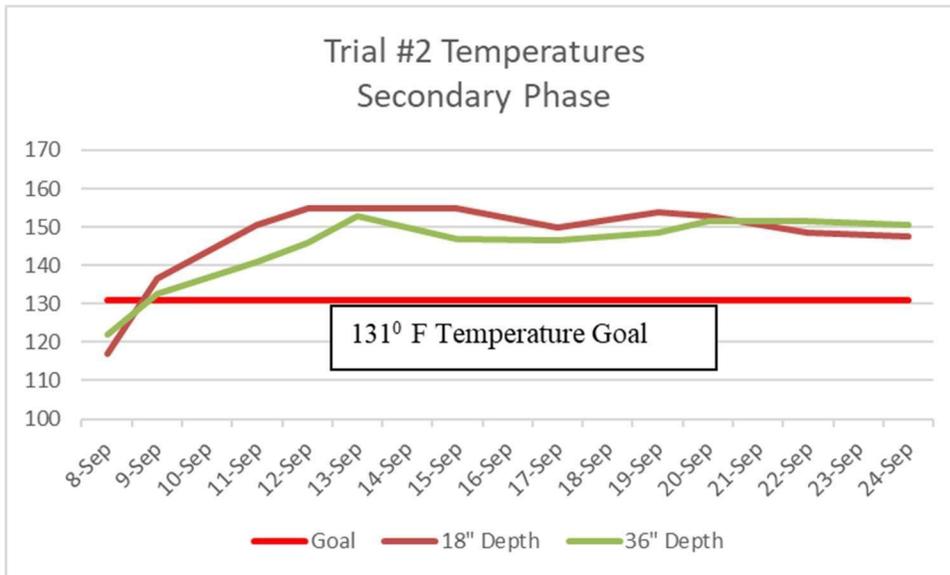


Figure #5: Trial #1 Compost Mixture Placed in Bin Prior to Capping



Figure #6: Trial #1 Compost Mixture Placed in Bin after Capping and with Temperature Locations Flagged



Table #1: Trial #1 Primary Composting Nitrogen Analysis

	Organic N	Ammonium N	Nitrate N	Total N	C:N
	% Dry Basis	% Dry Basis	% Dry Basis	% Dry Basis	
8/14/2025	3.75	0.177	0.004	3.93	11.0
8/20/2025	1.67	0.049	0.001	1.72	13.7
8/22/2025	1.88	0.035	0.001	1.92	20.8
8/25/2025	2.05	0.080	0.001	2.13	19.8
8/28/2025	1.81	0.026	0.001	1.84	20.0

Table #2: Trial #1 Secondary Composting Nitrogen Analysis

	Organic N	Ammonium N	Nitrate N	Total N	C:N
	% Dry Basis	% Dry Basis	% Dry Basis	% Dry Basis	
9/1/2025	1.48	0.106	0.001	1.59	28.0
9/9/2025	1.79	0.077	0.001	1.87	21.1
9/15/2025	1.87	0.050	0.001	1.92	20.8

Table #3: Trial #2 Primary Composting Nitrogen Analysis

	Organic N	Ammonium N	Nitrate N	Total N	C:N
	% Dry Basis	% Dry Basis	% Dry Basis	% Dry Basis	
8/21/2025	1.91	0.035	0.001	1.95	21.0
8/25/2025	1.41	0.049	0.001	1.46	28.6
9/1/2025	1.41	0.064	0.001	1.47	25.5
9/5/2025	1.67	0.105	0.001	1.77	24.4
9/8/2025	1.49	0.043	0.001	1.53	26.3

Table #4: Trial #2 Secondary Composting Nitrogen Analysis

	Organic N	Ammonium N	Nitrate N	Total N	C:N
	% Dry Basis	% Dry Basis	% Dry Basis	% Dry Basis	
9/19/2025	1.84	0.036	0.001	1.88	21.20
9/24/2025	1.03	0.047	0.001	1.08	37.68

Table #5: Trial #1 Primary Composting Other Analysis

	Phosphate	Potash	Moisture	pH
	% Dry Basis	% Dry Basis	%	
8/14/2025	1.66	0.75	48.86	7.3
8/20/2025	1.12	0.69	43.17	7.0
8/22/2025	1.09	0.89	44.63	6.3
8/25/2025	1.16	0.79	46.01	6.1
8/28/2025	1.72	0.68	47.86	6.0

Table # 6: Trial #1 Secondary Composting Other Analysis

	Phosphate	Potash	Moisture	pH
	% Dry Basis	% Dry Basis	%	
9/1/2025	0.75	0.67	39.97	7.4
9/9/2025	0.87	0.67	32.27	7.4
9/15/2025	1.10	0.64	42.46	7.3

Table #7: Trial #2 Primary Composting Other Analysis

	Phosphate	Potash	Moisture	pH
	% Dry Basis	% Dry Basis	%	
8/21/2025	1.00	1.57	49.66	7.6
8/25/2025	0.71	0.74	47.46	7.0
9/1/2025	0.64	0.69	44.03	6.1
9/5/2025	1.22	0.71	47.05	6.2
9/8/2025	0.76	0.76	47.08	6.0

Table # 8: Trial #2 Secondary Composting Other Analysis

	Phosphate	Potash	Moisture	pH
	% Dry Basis	% Dry Basis	%	
9/19/2025	0.68	0.62	29.39	7.6
9/24/2025	0.81	0.68	34.21	7.6

NRCS NC Approval for Advanced Composting Technology's Enhanced Forced Aeration Composting System

The enhanced systems will consist of:

1. Mixer/grinder (specifically designed to process animal mortality) used on the front-end to mix and process the mortality, carbon material (bulking agent), and compost (hot) material, on a weight-based mixture of 3:2:1. The mixer and unloading area will be under a roof.
2. Composter bin mortality loading rate of 12,000 pounds. (traditional system = 10,000 pounds)
3. Reduce composting treatment cycle time:
 - a. Sow operations - 17 days primary & 16 days secondary (traditional system - 40 days P & 40 days S)
 - b. Swine finishing - 14 days primary & 14 days secondary (traditional system - 35 days P & 35 days S)
 - c. Swine nursery - 11 days primary & 10 days secondary (traditional system - 30 days P & 15 days S)
 - d. Broiler - 11 days primary & 11 days secondary (traditional system - 30 days P & 20 days S)
 - e. Tom Turkey - 17 days primary & 16 days secondary (traditional system - 45 days P & 20 days S)
 - f. Hen Turkey - 14 days primary & 14 days secondary (traditional system - 40 days P & 15 days S)
4. Elimination of the mechanical leachate collection system. (traditional system - required)
5. Using static bin rather than forced air in the secondary treatment phase. (Will offer secondary bin force air as an option for large swine operations) (traditional system - forced air in all bins)
6. Extend treatment bin from 12' to 15' but keep same storage volume (684cf) and installation of a gate rather than heavy bin doors.
7. Concrete bin walls.
(Will offer wood walls as an option for swine nursery and broiler operations)

8. An 18” filter (bedding) is to be used in the primary treatment bins. (traditional system - 12” bedding)
9. Maintaining 60 days storage area.
(Considered also tertiary treatment area for larger animals)
10. O&M Plan will be revised to reflect these changes and have specific instructions, by animal type, for type of litter, amount of sawdust, loading rate, mixing time, and bin preparation.

Compost Feedstock Analysis



Account No. : 4861

Compost (TMECC) Analysis Report

**STOERMANN, MARK
NEWTRIENT LLC
10255 W HIGGINS ROAD
SUITE 900
ROSEMONT**

IL 60018

Invoice No. : 1160021
Date Received : 08/21/2025
Date Analyzed: 08/22/2025

Lab No. : 3399

Results For : WIN HOLSTEINS
Sample ID : 08 14 25 PRIM6 RUP
TIMBERVILLE

	Lbs / Ton				
	Analysis Dry Basis	Analysis As Is Basis	Dry Basis	As Is Basis	Available First Year
Organic N, % N	3.75	1.92	75.0	38.4	9.6
Ammonium, % N	0.177	0.0910	3.5	1.8	1.7
Nitrate, % N	0.004	0.0020	0.1	0.0	0.0
Total N, % N	3.93	2.01	78.7	40.2	11.4
Phosphorus, % P ₂ O ₅	1.66	0.85	33.1	16.9	11.9
Potassium, % K ₂ O	0.75	0.38	14.9	7.6	6.9
Sulfur, % S	0.29	0.15	5.8	2.9	1.2
Calcium, % Ca	3.45	1.76	69.1	35.3	24.7
Magnesium, % Mg	0.37	0.19	7.4	3.8	2.6
Sodium, % Na	0.31	0.16	6.1	3.1	3.1
Sodium Adsorption Ratio (SAR)	4.16				
Zinc, ppm Zn	79.6	40.7	0.2	0.1	0.1
Iron, ppm Fe	3768.9	1927.4	7.5	3.9	2.7
Manganese, ppm Mn	120.0	61.4	0.2	0.1	0.1
Copper, ppm Cu	17.0	8.7	0.0	0.0	0.0
Aluminum, ppm Al	1371.7	701.5	2.7	1.4	1.0
Boron, ppm B	6.7	3.4	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		7.22			
pH		7.3			
Moisture, %	48.86				
Dry Matter (TS), %	51.14				
Ash, %	25.22	12.90			
Organic Matter LOI 550C, %	74.78	38.24			
Organic Carbon, %	43.37	22.18			
Organic C:N Ratio	11.0				
Bulk Density, lbs / cubic foot		21			

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8/22/2025

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Harrington, DE 19952



Account No. : 4861

Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160021
 Date Received : 08/21/2025
 Date Analyzed : 08/22/2025

Lab No. : 3400

Results For : WIN HOLSTEINS
 Sample ID : 08 20 25 PRIM6 RUP
 TIMBERVILLE

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.67	0.95	33.4	19.0	4.7
Ammonium, % N	0.049	0.0280	1.0	0.6	0.5
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.72	0.98	34.4	19.6	5.3
Phosphorus, % P ₂ O ₅	1.12	0.64	22.4	12.7	8.9
Potassium, % K ₂ O	0.69	0.39	13.9	7.9	7.1
Sulfur, % S	0.28	0.16	5.6	3.2	1.3
Calcium, % Ca	4.05	2.30	81.0	46.0	32.2
Magnesium, % Mg	0.32	0.18	6.3	3.6	2.5
Sodium, % Na	0.27	0.15	5.5	3.1	3.1
Sodium Adsorption Ratio (SAR)	3.52				
Zinc, ppm Zn	84.4	48.0	0.2	0.1	0.1
Iron, ppm Fe	5827.3	3311.7	11.7	6.6	4.6
Manganese, ppm Mn	142.2	80.8	0.3	0.2	0.1
Copper, ppm Cu	17.0	9.7	0.0	0.0	0.0
Aluminum, ppm Al	1686.7	958.6	3.4	1.9	1.3
Boron, ppm B	6.2	3.5	0.0	0.0	0.0
Soluble Salts, (EC 1.5) dS/m		7.51			
pH		7.0			
Moisture, %	43.17				
Dry Matter (TS), %	56.83				
Ash, %	59.50	33.81			
Organic Matter LOI 550C, %	40.50	23.02			
Organic Carbon, %	23.49	13.35			
Organic C:N Ratio	13.7				
Bulk Density, lbs / cubic foot		20			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160098
 Date Received : 08/26/2025
 Date Analyzed: 08/27/2025

Lab No. : 3422

Results For : WINDCREST HOLSTEINS
 Sample ID : 08 21 25 PRIM BIN 5 12 RAC

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.91	0.96	38.2	19.2	4.8
Ammonium, % N	0.035	0.0180	0.7	0.4	0.3
Nitrate, % N	< 0.001	0.0000	0.0	0.0	0.0
Total N, % N	1.95	0.98	38.9	19.6	5.1
Phosphorus, % P ₂ O ₅	1.00	0.50	20.0	10.1	7.0
Potassium, % K ₂ O	1.57	0.79	31.5	15.8	14.3
Sulfur, % S	0.74	0.37	14.7	7.4	3.0
Calcium, % Ca	2.77	1.39	55.5	27.9	19.5
Magnesium, % Mg	0.56	0.28	11.2	5.6	3.9
Sodium, % Na	0.28	0.14	5.5	2.8	2.8
Sodium Adsorption Ratio (SAR)	3.93				
Zinc, ppm Zn	114.5	57.6	0.2	0.1	0.1
Iron, ppm Fe	3990.4	2008.8	8.0	4.0	2.8
Manganese, ppm Mn	264.2	133.0	0.5	0.3	0.2
Copper, ppm Cu	80.1	40.3	0.2	0.1	0.1
Aluminum, ppm Al	1695.7	853.6	3.4	1.7	1.2
Boron, ppm B	16.7	8.4	0.0	0.0	0.0
Soluble Salts (EC 1.5) dS/m		5.98			
pH		7.6			
Moisture, %	49.66				
Dry Matter (TS), %	50.34				
Ash, %	29.44	14.82			
Organic Matter LOI 550C, %	70.56	35.52			
Organic Carbon, %	40.93	20.60			
Organic C:N Ratio	21.0				
Bulk Density lbs / cubic foot		21			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT

IL 60018

Invoice No. : 1160098
 Date Received : 08/26/2025
 Date Analyzed: 08/27/2025

Lab No. : 3423

Results For : WINDCREST HOLSTEINS
 Sample ID : 08 22 25 PRIM BIN 4 12 RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.88	1.04	37.6	20.8	5.2
Ammonium, % N	0.035	0.0190	0.7	0.4	0.4
Nitrate, % N	< 0.001	0.0000	0.0	0.0	0.0
Total N, % N	1.92	1.06	38.4	21.2	5.6
Phosphorus, % P ₂ O ₅	1.09	0.60	21.8	12.1	8.4
Potassium, % K ₂ O	0.89	0.49	17.9	9.9	8.9
Sulfur, % S	0.41	0.23	8.2	4.6	1.8
Calcium, % Ca	3.57	1.98	71.4	39.6	27.7
Magnesium, % Mg	0.44	0.24	8.8	4.9	3.4
Sodium, % Na	0.28	0.16	5.6	3.1	3.1
Sodium Adsorption Ratio (SAR)	3.74				
Zinc, ppm Zn	99.5	55.1	0.2	0.1	0.1
Iron, ppm Fe	4144.4	2294.8	8.3	4.6	3.2
Manganese, ppm Mn	175.6	97.2	0.4	0.2	0.1
Copper, ppm Cu	38.5	21.3	0.1	0.0	0.0
Aluminum, ppm Al	1912.8	1059.1	3.8	2.1	1.5
Boron, ppm B	9.6	5.3	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		9.13			
pH		6.3			
Moisture, %	44.63				
Dry Matter (TS), %	55.37				
Ash, %	31.33	17.35			
Organic Matter LOI 550C, %	68.67	38.02			
Organic Carbon, %	39.83	22.05			
Organic C:N Ratio	20.8				
Bulk Density, lbs / cubic foot		23			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT

IL 60018

Invoice No. : 1160157
 Date Received : 08/28/2025
 Date Analyzed: 08/29/2025

Lab No. : 3430

Results For : WINDCREST HOLSTEINS
 Sample ID : 08 25 25 PRIM BIN 5 12 RWP

	Analysis		Lbs / Ton		Available First Year
	Dry Basis	As Is Basis	Dry Basis	As Is Basis	
Organic N, % N	1.41	0.74	28.2	14.8	3.7
Ammonium, % N	0.049	0.0260	1.0	0.5	0.5
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.46	0.77	29.2	15.3	4.2
Phosphorus, % P ₂ O ₅	0.71	0.37	14.2	7.4	5.2
Potassium, % K ₂ O	0.74	0.39	14.8	7.8	7.0
Sulfur, % S	0.26	0.14	5.3	2.8	1.1
Calcium, % Ca	3.62	1.90	72.3	38.0	26.6
Magnesium, % Mg	0.49	0.26	9.8	5.1	3.6
Sodium, % Na	0.22	0.12	4.3	2.3	2.3
Sodium Adsorption Ratio (SAR)	2.83				
Zinc, ppm Zn	78.3	41.1	0.2	0.1	0.1
Iron, ppm Fe	6349.4	3336.0	12.7	6.7	4.7
Manganese, ppm Mn	163.5	85.9	0.3	0.2	0.1
Copper, ppm Cu	21.3	11.2	0.0	0.0	0.0
Aluminum, ppm Al	2189.4	1150.3	4.4	2.3	1.6
Boron, ppm B	4.3	2.3	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		4.05			
pH		7.0			
Moisture, %	47.46				
Dry Matter (TS), %	52.54				
Ash, %	28.21	14.82			
Organic Matter LOI 550C, %	71.79	37.72			
Organic Carbon, %	41.64	21.88			
Organic C:N Ratio	28.6				
Bulk Density, lbs / cubic foot		20			

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8/29/2025

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 Harrington, DE 19952



Account No. : 4861

Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160157
 Date Received : 08/28/2025
 Date Analyzed: 08/29/2025

Lab No. : 3431

Results For : WINDCREST HOLSTEINS
 Sample ID : 08 25 25 PRIM BIN 4 12 RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	2.05	1.11	41.0	22.2	5.5
Ammonium, % N	0.080	0.0430	1.6	0.9	0.8
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	2.13	1.15	42.7	23.0	6.4
Phosphorus, % P ₂ O ₅	1.16	0.63	23.3	12.6	8.8
Potassium, % K ₂ O	0.79	0.43	15.9	8.6	7.7
Sulfur, % S	0.28	0.15	5.6	3.0	1.2
Calcium, % Ca	2.74	1.48	54.8	29.6	20.7
Magnesium, % Mg	0.27	0.15	5.4	2.9	2.0
Sodium, % Na	0.29	0.16	5.8	3.1	3.1
Sodium Adsorption Ratio (SAR)	4.47				
Zinc, ppm Zn	93.8	50.6	0.2	0.1	0.1
Iron, ppm Fe	5166.3	2789.3	10.3	5.6	3.9
Manganese, ppm Mn	153.4	82.8	0.3	0.2	0.1
Copper, ppm Cu	21.1	11.4	0.0	0.0	0.0
Aluminum, ppm Al	1810.6	977.5	3.6	2.0	1.4
Boron, ppm B	7.8	4.2	0.0	0.0	0.0
Soluble Salts (EC 1.5) dS/m		5.95			
pH		6.1			
Moisture, %	46.01				
Dry Matter (TS), %	53.99				
Ash, %	27.27	14.72			
Organic Matter LOI 550C, %	72.73	39.27			
Organic Carbon, %	42.18	22.77			
Organic C:N Ratio	19.8				
Bulk Density lbs / cubic foot		20			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160166
 Date Received : 08/29/2025
 Date Analyzed: 09/02/2025

Lab No. : 3455

Results For : WINDCREST HOLSTEIN
 Sample ID : 08 28 25 TNRN BW4 12INCH RWP

	Analysis		Lbs / Ton		Available First Year
	Dry Basis	As Is Basis	Dry Basis	As Is Basis	
Organic N, % N	1.81	0.94	36.3	18.9	4.7
Ammonium, % N	0.026	0.0140	0.5	0.3	0.3
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.84	0.96	36.8	19.2	5.0
Phosphorus, % P ₂ O ₅	1.72	0.90	34.4	18.0	12.6
Potassium, % K ₂ O	0.68	0.35	13.5	7.1	6.4
Sulfur, % S	0.29	0.15	5.9	3.1	1.2
Calcium, % Ca	3.99	2.08	79.7	41.6	29.1
Magnesium, % Mg	0.34	0.18	6.7	3.5	2.4
Sodium, % Na	0.22	0.11	4.4	2.3	2.3
Sodium Adsorption Ratio (SAR)	2.85				
Zinc, ppm Zn	99.5	51.9	0.2	0.1	0.1
Iron, ppm Fe	11305.6	5894.7	22.6	11.8	8.3
Manganese, ppm Mn	238.9	124.6	0.5	0.2	0.2
Copper, ppm Cu	24.4	12.7	0.0	0.0	0.0
Aluminum, ppm Al	4556.2	2375.6	9.1	4.8	3.3
Boron, ppm B	0.0	0.0	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		10.99			
pH		6.0			
Moisture, %	47.86				
Dry Matter (TS), %	52.14				
Ash, %	36.51	19.04			
Organic Matter LOI 550C, %	63.49	33.10			
Organic Carbon, %	36.82	19.20			
Organic C:N Ratio	20.0				
Bulk Density, lbs / cubic foot		23			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160222
 Date Received : 09/04/2025
 Date Analyzed: 09/05/2025

Lab No. : 3475

Results For : WINDCREST HOLSTEINS
 Sample ID : 09 01 25 SEC BIN 4 12 RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.48	0.89	29.7	17.8	4.5
Ammonium, % N	0.106	0.0640	2.1	1.3	1.2
Nitrate, % N	< 0.001	0.0000	0.0	0.0	0.0
Total N, % N	1.59	0.95	31.8	19.1	5.7
Phosphorus, % P ₂ O ₅	0.75	0.45	15.0	9.0	6.3
Potassium, % K ₂ O	0.67	0.40	13.5	8.1	7.3
Sulfur, % S	0.31	0.19	6.1	3.7	1.5
Calcium, % Ca	2.62	1.57	52.3	31.4	22.0
Magnesium, % Mg	0.26	0.16	5.2	3.1	2.2
Sodium, % Na	0.24	0.14	4.8	2.9	2.9
Sodium Adsorption Ratio (SAR)	3.78				
Zinc, ppm Zn	378.2	227.0	0.8	0.5	0.3
Iron, ppm Fe	7462.4	4479.7	14.9	9.0	6.3
Manganese, ppm Mn	159.6	95.8	0.3	0.2	0.1
Copper, ppm Cu	18.4	11.0	0.0	0.0	0.0
Aluminum, ppm Al	2220.4	1332.9	4.4	2.7	1.9
Boron, ppm B	1.9	1.1	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		9.11			
pH		7.4			
Moisture, %	39.97				
Dry Matter (TS), %	60.03				
Ash, %	23.21	13.93			
Organic Matter LOI 550C, %	76.79	46.10			
Organic Carbon, %	44.54	26.74			
Organic C:N Ratio	28.0				
Bulk Density, lbs / cubic foot		21			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160222
 Date Received : 09/04/2025
 Date Analyzed: 09/05/2025

Lab No. : 3476

Results For : WINDCREST HOLSTEINS
 Sample ID : 09 01 25 PRIM BIN 5 12 RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.41	0.79	28.2	15.8	3.9
Ammonium, % N	0.064	0.0360	1.3	0.7	0.7
Nitrate, % N	< 0.001	0.0000	0.0	0.0	0.0
Total N, % N	1.47	0.82	29.5	16.5	4.6
Phosphorus, % P ₂ O ₅	0.64	0.36	12.7	7.1	5.0
Potassium, % K ₂ O	0.69	0.39	13.9	7.8	7.0
Sulfur, % S	0.32	0.18	6.4	3.6	1.4
Calcium, % Ca	4.23	2.37	84.7	47.4	33.2
Magnesium, % Mg	0.38	0.21	7.5	4.2	3.0
Sodium, % Na	0.21	0.12	4.3	2.4	2.4
Sodium Adsorption Ratio (SAR)	2.68				
Zinc, ppm Zn	891.5	499.0	1.8	1.0	0.7
Iron, ppm Fe	6713.8	3757.7	13.4	7.5	5.3
Manganese, ppm Mn	169.0	94.6	0.3	0.2	0.1
Copper, ppm Cu	17.4	9.7	0.0	0.0	0.0
Aluminum, ppm Al	2213.4	1238.8	4.4	2.5	1.7
Boron, ppm B	1.7	1.0	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		8.18			
pH		6.1			
Moisture, %	44.03				
Dry Matter (TS), %	55.97				
Ash, %	35.11	19.65			
Organic Matter LOI 550C, %	64.89	36.32			
Organic Carbon, %	37.64	21.07			
Organic C:N Ratio	25.5				
Bulk Density, lbs / cubic foot		23			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
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 SUITE 900
 ROSEMONT

IL

60018

Invoice No. : 1160273
 Date Received : 09/08/2025
 Date Analyzed : 09/09/2025

Lab No. : 3508

Results For : WINDREST HOLSTEINS
 Sample ID : 09 05 25 SPRIMBIN512RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.67	0.88	33.3	17.6	4.4
Ammonium, % N	0.105	0.0560	2.1	1.1	1.1
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.77	0.94	35.4	18.8	5.5
Phosphorus, % P ₂ O ₅	1.22	0.65	24.3	12.9	9.0
Potassium, % K ₂ O	0.71	0.38	14.2	7.5	6.8
Sulfur, % S	0.35	0.19	7.1	3.7	1.5
Calcium, % Ca	3.92	2.08	78.4	41.5	29.1
Magnesium, % Mg	0.37	0.20	7.4	3.9	2.8
Sodium, % Na	0.24	0.13	4.7	2.5	2.5
Sodium Adsorption Ratio (SAR)	3.06				
Zinc, ppm Zn	236.7	125.3	0.5	0.3	0.2
Iron, ppm Fe	7397.4	3916.9	14.8	7.8	5.5
Manganese, ppm Mn	284.7	150.7	0.6	0.3	0.2
Copper, ppm Cu	30.4	16.1	0.1	0.0	0.0
Aluminum, ppm Al	3226.4	1708.4	6.5	3.4	2.4
Boron, ppm B	7.2	3.8	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		6.99			
pH		6.2			
Moisture, %	47.05				
Dry Matter (TS), %	52.95				
Ash, %	25.33	13.41			
Organic Matter LOI 550C, %	74.67	39.54			
Organic Carbon, %	43.31	22.93			
Organic C:N Ratio	24.4				
Bulk Density, lbs / cubic foot		22			

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Compost (TMECC) Analysis Report

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 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160296
 Date Received : 09/09/2025
 Date Analyzed: 09/10/2025

Lab No. : 3510

Results For : WINDOREST HOLSTEIN
 Sample ID : 09 08 25 TURN BIW 5 12 INCH RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.49	0.79	29.7	15.7	3.9
Ammonium, % N	0.043	0.0230	0.9	0.5	0.4
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.53	0.81	30.6	16.2	4.4
Phosphorus, % P ₂ O ₅	0.76	0.40	15.3	8.1	5.7
Potassium, % K ₂ O	0.76	0.40	15.2	8.1	7.3
Sulfur, % S	0.24	0.13	4.8	2.5	1.0
Calcium, % Ca	3.79	2.01	75.8	40.1	28.1
Magnesium, % Mg	0.31	0.16	6.2	3.3	2.3
Sodium, % Na	0.23	0.12	4.6	2.4	2.4
Sodium Adsorption Ratio (SAR)	3.03				
Zinc, ppm Zn	105.2	55.7	0.2	0.1	0.1
Iron, ppm Fe	6476.7	3427.5	13.0	6.9	4.8
Manganese, ppm Mn	160.5	84.9	0.3	0.2	0.1
Copper, ppm Cu	30.4	16.1	0.1	0.0	0.0
Aluminum, ppm Al	1703.8	901.7	3.4	1.8	1.3
Boron, ppm B	4.4	2.3	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		8.20			
pH		6.0			
Moisture, %	47.08				
Dry Matter (TS), %	52.92				
Ash, %	30.66	16.23			
Organic Matter LOI 550C, %	69.34	36.69			
Organic Carbon, %	40.22	21.28			
Organic C:N Ratio	26.3				
Bulk Density, lbs / cubic foot		22			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
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 SUITE 900
 ROSEMONT

IL 60018

Invoice No. : 1160359
 Date Received : 09/11/2025
 Date Analyzed: 09/12/2025

Lab No. : 3540

Results For : WINDCREST HOLSTEIN
 Sample ID : 09 09 25 SECBIN 4 12 RWP

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.79	1.21	35.8	24.3	6.1
Ammonium, % N	0.077	0.0520	1.5	1.0	1.0
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.87	1.27	37.4	25.3	7.1
Phosphorus, % P ₂ O ₅	0.87	0.59	17.3	11.7	8.2
Potassium, % K ₂ O	0.67	0.45	13.5	9.1	8.2
Sulfur, % S	0.24	0.16	4.8	3.2	1.3
Calcium, % Ca	3.12	2.11	62.5	42.3	29.6
Magnesium, % Mg	0.32	0.22	6.4	4.4	3.1
Sodium, % Na	0.18	0.12	3.6	2.4	2.4
Sodium Adsorption Ratio (SAR)	2.59				
Zinc, ppm Zn	95.1	64.4	0.2	0.1	0.1
Iron, ppm Fe	5273.4	3571.7	10.5	7.1	5.0
Manganese, ppm Mn	205.8	139.4	0.4	0.3	0.2
Copper, ppm Cu	19.4	13.1	0.0	0.0	0.0
Aluminum, ppm Al	2358.5	1597.4	4.7	3.2	2.2
Boron, ppm B	5.5	3.7	0.0	0.0	0.0
Soluble Salts, (EC 1.5) dS/m		7.13			
pH		7.4			
Moisture, %	32.27				
Dry Matter (TS), %	67.73				
Ash, %	32.05	21.71			
Organic Matter LOI 550C, %	67.95	46.02			
Organic Carbon, %	39.41	26.69			
Organic C:N Ratio	21.1				
Bulk Density, lbs / cubic foot		18			

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Compost (TMECC) Analysis Report

**STOERMANN, MARK
NEWTRIENT LLC
10255 W HIGGINS ROAD
SUITE 900
ROSEMONT IL 60018**

Invoice No. : 1160466
Date Received : 09/17/2025
Date Analyzed: 09/18/2025

Lab No. : 3578

Results For : WINDEREST HOLSTEINS
Sample ID : 091525 FINAL BIN4 12 RWP

	Lbs / Ton				
	Analysis Dry Basis	Analysis As Is Basis	Dry Basis	As Is Basis	Available First Year
Organic N, % N	0.14	0.08	2.8	1.6	0.4
Ammonium, % N	0.050	0.0290	1.0	0.6	0.5
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	0.19	0.11	3.8	2.2	1.0
Phosphorus, % P ₂ O ₅	1.10	0.63	22.0	12.6	8.9
Potassium, % K ₂ O	0.64	0.37	12.8	7.4	6.6
Sulfur, % S	0.27	0.16	5.5	3.1	1.3
Calcium, % Ca	3.61	2.08	72.2	41.5	29.1
Magnesium, % Mg	0.28	0.16	5.6	3.2	2.2
Sodium, % Na	0.21	0.12	4.2	2.4	2.4
Sodium Adsorption Ratio (SAR)	2.87				
Zinc, ppm Zn	95.5	55.0	0.2	0.1	0.1
Iron, ppm Fe	6023.2	3465.7	12.0	6.9	4.9
Manganese, ppm Mn	156.0	89.8	0.3	0.2	0.1
Copper, ppm Cu	17.5	10.1	0.0	0.0	0.0
Aluminum, ppm Al	3016.5	1735.7	6.0	3.5	2.4
Boron, ppm B	4.0	2.0	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		9.17			
pH		7.3			
Moisture, %	42.46				
Dry Matter (TS), %	57.54				
Ash, %	31.04	17.86			
Organic Matter LOI 550C, %	68.96	39.68			
Organic Carbon, %	40.00	23.02			
Organic C:N Ratio	208.4				
Bulk Density, lbs / cubic foot		21			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160587
 Date Received : 09/24/2025
 Date Analyzed: 09/25/2025

Lab No. : 3619

Results For : WINDCREST HOLSTEIN
 Sample ID : 091925 SEC BINS

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.84	1.30	36.9	26.1	6.5
Ammonium, % N	0.036	0.0250	0.7	0.5	0.5
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.88	1.33	37.6	26.6	7.0
Phosphorus, % P ₂ O ₅	0.68	0.48	13.7	9.7	6.8
Potassium, % K ₂ O	0.62	0.44	12.3	8.7	7.8
Sulfur, % S	0.23	0.16	4.7	3.3	1.3
Calcium, % Ca	2.93	2.07	58.6	41.4	29.0
Magnesium, % Mg	0.28	0.20	5.7	4.0	2.8
Sodium, % Na	0.17	0.12	3.4	2.4	2.4
Sodium Adsorption Ratio (SAR)	2.54				
Zinc, ppm Zn	71.2	50.3	0.1	0.1	0.1
Iron, ppm Fe	5466.6	3860.0	10.9	7.7	5.4
Manganese, ppm Mn	174.2	123.0	0.3	0.2	0.2
Copper, ppm Cu	29.7	21.0	0.1	0.0	0.0
Aluminum, ppm Al	2071.1	1462.4	4.1	2.9	2.0
Boron, ppm B	3.1	2.2	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		4.14			
pH		7.6			
Moisture, %	29.39				
Dry Matter (TS), %	70.61				
Ash, %	31.14	21.99			
Organic Matter LOI 550C, %	68.86	48.62			
Organic Carbon, %	39.94	28.20			
Organic C:N Ratio	21.2				
Bulk Density, lbs / cubic foot		17			

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Compost (TMECC) Analysis Report

STOERMANN, MARK
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 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160598
 Date Received : 09/25/2025
 Date Analyzed: 09/26/2025

Lab No. : 3623

Results For : WINDCREST HOLSTEIN
 Sample ID : 09 24 25 FINAL

	Analysis Dry Basis	Analysis As Is Basis	Lbs / Ton		Available First Year
			Dry Basis	As Is Basis	
Organic N, % N	1.03	0.68	20.6	13.6	3.4
Ammonium, % N	0.047	0.0310	0.9	0.6	0.6
Nitrate, % N	0.001	0.0010	0.0	0.0	0.0
Total N, % N	1.08	0.71	21.6	14.2	4.0
Phosphorus, % P ₂ O ₅	0.81	0.53	16.1	10.6	7.4
Potassium, % K ₂ O	0.68	0.45	13.5	8.9	8.0
Sulfur, % S	0.25	0.16	5.0	3.3	1.3
Calcium, % Ca	3.29	2.16	65.7	43.2	30.3
Magnesium, % Mg	0.29	0.19	5.8	3.8	2.7
Sodium, % Na	0.21	0.14	4.2	2.7	2.7
Sodium Adsorption Ratio (SAR)	2.96				
Zinc, ppm Zn	115.6	76.1	0.2	0.2	0.1
Iron, ppm Fe	7065.7	4648.5	14.1	9.3	6.5
Manganese, ppm Mn	197.4	129.9	0.4	0.3	0.2
Copper, ppm Cu	32.5	21.4	0.1	0.0	0.0
Aluminum, ppm Al	2135.5	1404.9	4.3	2.8	2.0
Boron, ppm B	8.0	5.3	0.0	0.0	0.0
Soluble Salts, (EC 1:5) dS/m		6.41			
pH		7.6			
Moisture, %	34.21				
Dry Matter (TS), %	65.79				
Ash, %	29.65	19.51			
Organic Matter LOI 550C, %	70.35	46.28			
Organic Carbon, %	40.80	26.84			
Organic C:N Ratio	37.8				
Bulk Density, lbs / cubic foot		17			

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Compost Environmental Sample Analysis



Account No. : 4861

Environmental Sample Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT

IL 60018

Invoice No. : 1159891
 Date Received : 08/14/2025
 Date Analyzed : 08/15/2025

Lab No. : 3440

Results For : WINDEREST
 Sample ID : 08 12 25 PRIM6RNP
 Description :

	Analysis Solid: Dry Wgt Liquid: As Rcvd	EPA Method Number	Lab. Tech.	Detection Limit
Microbiological Screening				
	Count	Method		Detection Limit
Coliform Bacteria, MPN of CFU/g	200.00	Colilert		1 CFU/g
E Coli Bacteria, MPN of CFU/g	0.00	Colilert		1 CFU/g
Fecal Bacteria, MPN of CFU/1g dry basis	74	TMEC 07.01-B		1 MPN/g dry wgt
Salmonella MPN of CFU/4g	Not Detected	L. Flow ATEC 13076		Pos/Neg/4g dry wgt

Reviewed By : L.D. Severson - AgroLab/Matrix Sciences Inc

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Account No. : 4861

Environmental Sample Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT

IL 60018

Invoice No. : 1159998
 Date Received : 08/20/2025
 Date Analyzed: 08/21/2025

Lab No. : 3466

Results For : NEWTRIENT LLC
 Sample ID : 08 18 25 2 PR M
 Description : WINDOREST HORSTEIN

	Analysis Solid: Dry Wgt Liquid: As Rcvd	EPA Method Number	Lab. Tech.	Detection Limit
Microbiological Screening				
	Count	Method		Detection Limit
Coliform Bacteria, MPN of CFU/g	0.00	Colilert		1 CFU/g
E Coli Bacteria, MPN of CFU/g	0.00	Colilert		1 CFU/g
Fecal Bacteria, MPN of CFU/1g dry basis	NONE	TMEC 07.01-B		1 MPN/g dry wgt
Salmonella MPN of CFU/4g	Not Detected	L. Flow ATEC 13076		Pos/Neg/4g dry wgt

Reviewed By : L.D. Severson - AgroLab/Matrix Sciences Inc

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Account No. : 4861

Environmental Sample Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT IL 60018

Invoice No. : 1160261
 Date Received : 09/05/2025
 Date Analyzed: 09/08/2025

Lab No. : 3528

Results For : WINDCREST HOLSTEIN
 Sample ID : 09 03 25 PATH 6 RUP
 Description :

	Analysis Solid: Dry Wgt Liquid: As Rcvd	EPA Method Number	Lab. Tech.	Detection Limit
Microbiological Screening	Count	Method		Detection Limit
Coliform Bacteria, MPN of CFU/g	0.00	Colilert		1 CFU/g
E Coli Bacteria, MPN of CFU/g	0.00	Colilert		1 CFU/g
Fecal Bacteria, MPN of CFU/1g dry basis	NONE	TMEC 07.01-B		1 MPN/g dry wgt
Salmonella MPN of CFU/4g	Not Detected	L. Flow ATEC 13076		Pos/Neg/4g dry wgt

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Account No. : 4861

Environmental Sample Analysis Report

STOERMANN, MARK
 NEWTRIENT LLC
 10255 W HIGGINS ROAD
 SUITE 900
 ROSEMONT

IL 60018

Invoice No. : 1160604
 Date Received : 09/25/2025
 Date Analyzed: 09/26/2025

Lab No. : 3669

Results For : WINDCREST HOLSTEIN

Sample ID : 092425 FINAL

Description :

Description :	Analysis		EPA Method Number	Lab. Tech.	Detection Limit
	Solid: Dry Wgt	Liquid: As Revd			
Microbiological Screening	Count		Method		Detection Limit
Coliform Bacteria, MPN of CFU/g	4600.00		Colilert		1 CFU/g
E Coli Bacteria, MPN of CFU/g	0.00		Colilert		1 CFU/g
Fecal Bacteria, MPN of CFU/1g dry basis	150		TMEC 07.01-B		1 MPN/g dry wgt
Salmonella MPN of CFU/4g	Not Detected		L. Flow ATEC 13076		Pos/Neg/4g dry wgt

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Advanced Composting Technology Equipment Operating and Maintenance Protocol

Preprocessing of the mortality:

- Open the door of the Compost Special Mixer to do a visual inspection to make sure the unit is free of any debris. Close back before filling.
- Turn on mixer by pressing the start button on the control panel; be sure the two green lights are shining.
- Turn on and zero out the scales when you first start a batch. Do not re-zero while reaching maximum weight of 3,000 lbs. or full batch. Turn scales on and off daily as needed to monitor loading weight.
- Load 1,000 lbs. of sawdust into the mixer (scales/display).
- Then load 1,500 lbs. of mortality in the mixer; all at one time or over an extended time period depending on mortality and animal type.
- Top off or load with 500 lbs. of first stage compost. Total batch weight of 3,000 lbs.
- Run the mixer approximately one to three minutes daily as you are reaching the 1,500 lbs. of mortality and/or 25-30 minutes after the unit is full and before unloading.
- Visually inspect to see that the mixture is blended to a homogenous consistency before unloading.
- Do not mix too long (more than 30 minutes) or you will start seeing a balling effect and perhaps too wet. If you see this add one more bucket of the bulking agent or sawdust and mix for three to five minutes.
- Turn on conveyor.
- Open the door of the unit and empty into the catch bin. Open the door about 10-12" not to overload conveyor.
- Once the material is dumped into the catch bin prepare the aerated bins to receive this ground/mixed material.

General operating procedures for aerated bins:

- Be sure aeration pipes are connected and there are no air leaks at the pipe connections before filling of the bin.
- Be sure small holes in pipes are turned up and are thoroughly clean. The holes are 1/16th”.
- Check bins operating pressure to ensure it is between 5-20 before filling.
- If pressures are higher than 20, poke holes with 1/16” tool. If the pressure remains high take the pipes apart and clean with a pressure washer or water hose; recheck pressure to be sure it is in the 5-20 psi range.
- If the pressures are 0 then check for broken or loose pipes. Fix or reconnect pipes.

Filling bin with mortality mix:

- Turn on compressor.
- Place 18” sawdust filter on floor of bin that will be receiving mortality.
- Load the bin placing compost mixture in the rear of the bin moving to the front. Fill to the height of the bin walls. Crown in the middle.
- When approaching the front stay back 3’ from front of bin if you do not have doors. Place sawdust or bulking agent along the front to absorb any seepage.
- There should be approximately eight mixer batches/loads (24,000 total lbs.) in each bin. During mortality spikes 10 loads or 30,000 total lbs. can be achieved if necessary.
- Wet the bin during filling to maintain 35-50% moisture and wet as needed before you place a clean 1-2” sawdust cap on the bin to reduce flies when you have finished filling the bin. A fly control program is a must. Use granular or liquid fly bait/spay on an as needed basis to control flies during fly season.
- Monitor and record temperatures at least 3 times weekly after the bin is filled and capped to be sure temperatures are above 135 degrees. Our goal is to have temperatures above 150 degrees for the whole time. Call ACT personnel if temperatures are not reached.
- Leave mortality in the combined 1st and 2nd stage forced air bin for a minimum of 21-40 days depending on the type of the mortality. See Chart #1.
- During high mortality spikes you can reduce cycle time to maximize aerated bin use. Temperature requirements must be met.
- Empty the bin after cycle times have been met or as needed. Place composted material in the storage area for a minimum of 60 days.

- Land-apply the stored compost according to your nutrient management plans.

