



THERMAL
PROCESS
SYSTEMS

TPS
THERMAER™
PROCESS

***Your Class A Solution
for Biosolids Management***

TPS THERMAER™ PROCESS

Advanced thermophilic biosolids treatment

BiofiltAer™ at the Morehead, KY facility. Organic material along with a constant 90°F temperature and moisture help reduce any residual ammonia from the biomass.

**A revolutionary process that
delivers the results you want —
without the side effects**

Thermal Process Systems' proprietary ThermAer biosolids reduction system is the second generation in Autothermal Thermophilic Aerobic Digestion (ATAD) technology. It gives you the best of all worlds — a high quality pathogen-free product — plus controlled foam, the elimination of foul odors through more complete oxidation with Oxidation/Reduction Potential (ORP) control and superior reduction of volatile solids. On the following pages you will see how ThermAer can make all the difference in your process.

Retrofit of anaerobic digesters - Morehead, KY



Your best solution for biosolids management

Now, for the first time you have a reliable, realistic solution to the increasingly difficult problem of biosolids processing, reuse and disposal. With the ThermAer Process you achieve:

Superior volatile solids reduction

Today, biosolids disposal is more complex than ever. Many states have imposed restrictive legislation on land application, composting and land fills. Volume reduction and odor control are key elements in successful biosolids management. Now, thanks to ThermAer, you have a solution.

- ThermAer destroys 60-70% of volatile solids and increases dewatering cakesolids as much as 25-30%. This process generates a high quality product reducing solids volume by up to 70%, while saving on your transportation and disposal costs.
- The nutrient and moisture content in ThermAer biosolids are ideal for direct land application as well as composting applications — often completely eliminating disposal costs.

Assured “Class A” quality at a “Class B” price

A quality product is needed to compete for access to today’s limited land application and reuse markets. With ThermAer, you’re assured of Class A solids classification under USEPA Part 503 regulations, giving you unrestricted use of your biosolids.

Environmentally Green

Without the production of methane, a gas with 22 times the potential atmospheric destruction of carbon dioxide, the ThermAer is kinder to Mother Earth. In addition, the excess autothermal heat produced in the reactor can be used to heat buildings or as supplement heat used in other processes. The reuse of this energy lowers the overall carbon footprint; a consideration for our environment.

Reduces capital and operating costs

Your savings in operating and capital expense can often more than justify your decision to specify ThermAer. It’s the ideal solution to upgrade your current system or as the heart of your new installation.

Process Flexibility

Now you can meet required volatile solids destruction and pathogen kill rates with greater process flexibility. You can achieve the desired results in either a single reactor or multiple reactors operated in parallel systems.

Downstream efficiency and synergy

The ThermAer process reduces volatile solids and improves dewaterability, resulting in reduced mass and volume. This significantly decreases the size, operational costs and capital investment of unit processes required for “further treatment” downstream (such as dewatering, drying, etc.), while increasing their efficiency.

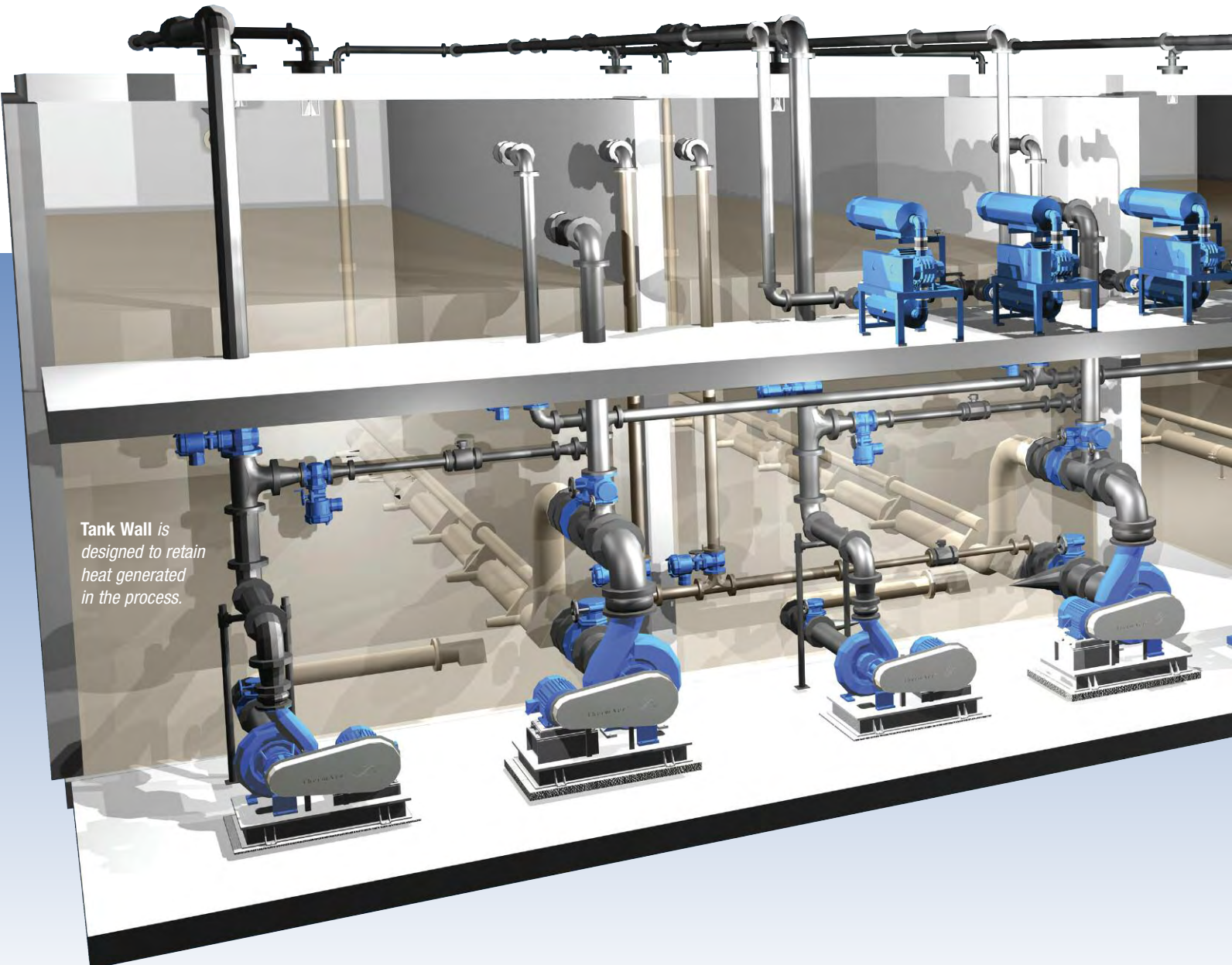


& green



TPS THERMAER™ PROCESS

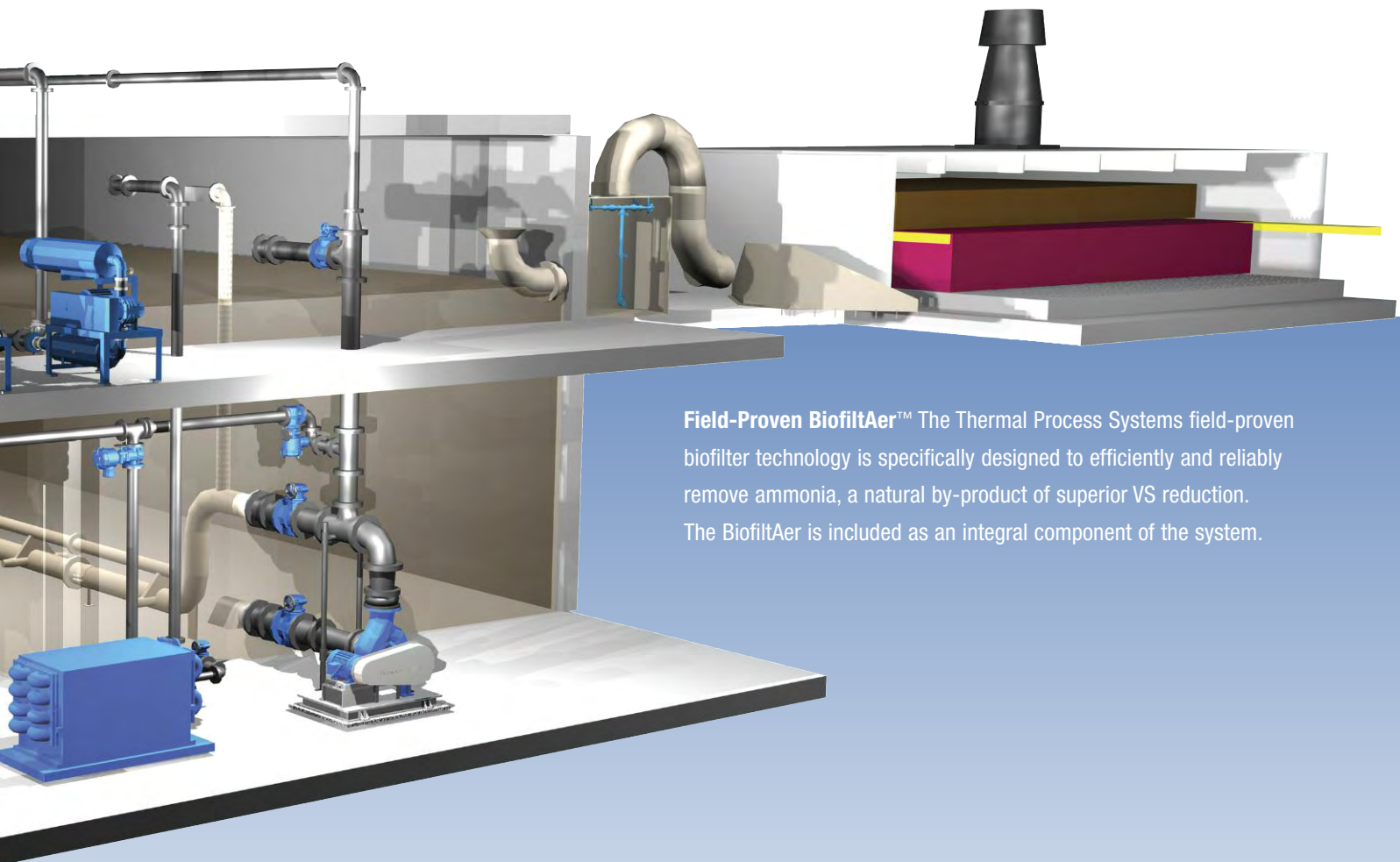
Your system will be custom-engineered to fit your requirements exactly, whether you would like to retrofit your existing basins — or integrate ThermAer into your new system. In typical installations, such as the one illustrated here, you will have the flexibility to batch or continuously feed the process daily, after thickening the feed material.



Tank Wall is designed to retain heat generated in the process.

Assured product quality – with no compromises

With the patented ThermAer Process, you can achieve the results you want without compromising your quality or cost objectives. The system delivers superior volatile solids and pathogen reduction combined with extremely low odor in any reactor configuration – with assured EPA Class A and/or exceptional quality certification.



Field-Proven BiofiltAer™ The Thermal Process Systems field-proven biofilter technology is specifically designed to efficiently and reliably remove ammonia, a natural by-product of superior VS reduction. The BiofiltAer is included as an integral component of the system.



Pump Gallery — Yorkville, IL
Conventional Out-of-Basin Pumps are already familiar to operating and maintenance staff.



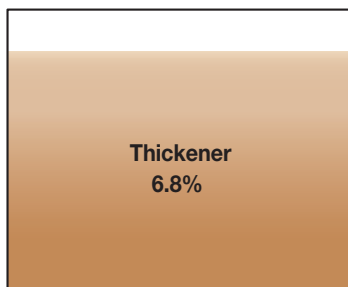
Control Panel — Delphos, OH
An Integrated Control Package provides the flexibility to operate the processes by a simple touch on the screen.



Positive Displacement Blowers — Delphos, OH
Positive displacement blowers allow for the flexibility of varying the liquid depth in the reactors as well as air flow delivery.

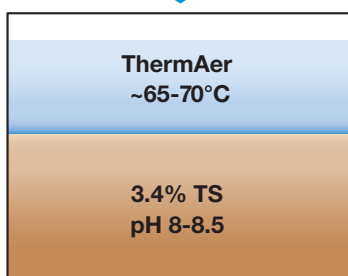
TPS ThermAer Process Overall Flow Schematic*

- Jet Aeration
- High oxygen transfer efficiency
- Independent mixing and oxygen delivery control
- Hydraulic foam control
- Fully automated
- Varying liquid depths



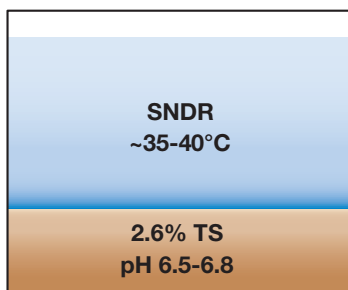
- Primary and/or secondary thickened before feeding to ThermAer Reactor(s)

10,000 Lbs



- High temperature and intense mixing ruptures the cell walls of incoming waste stream
- Foam production, an indication of degradation of proteins, controlled by hydraulic foam control cones
- Very low yield, and high volatile solids reduction

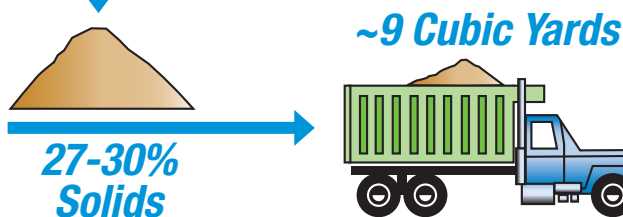
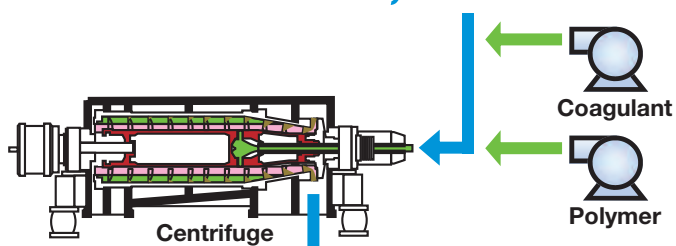
5,000 Lbs



- Single reactor system for nitrification and denitrification
- Integrated control strategy for pH, temperature and ORP
- Headspace utilized as a natural scrubber

- Greatly reduces the overall dewatering costs
- Mesophilic conditioning and optimum pH provide suitable conditions for nitrification and denitrification
- No external alkalinity required
- Conditioning in SNDR decreases ammonia and soluble COD while reducing overall chemical and polymer consumption

3,800 Lbs



* Destruction data based upon the representative observed values at Yorkville Bristol Sanitary District

Granulated dewatered biosolids at Yorkville Bristol Sanitary District, IL. Volume reduction greatly increases the storage capacity while reducing, and in some cases completely eliminating transportation and disposal costs.



CAUTION
WEAR EYE
PROTECTION

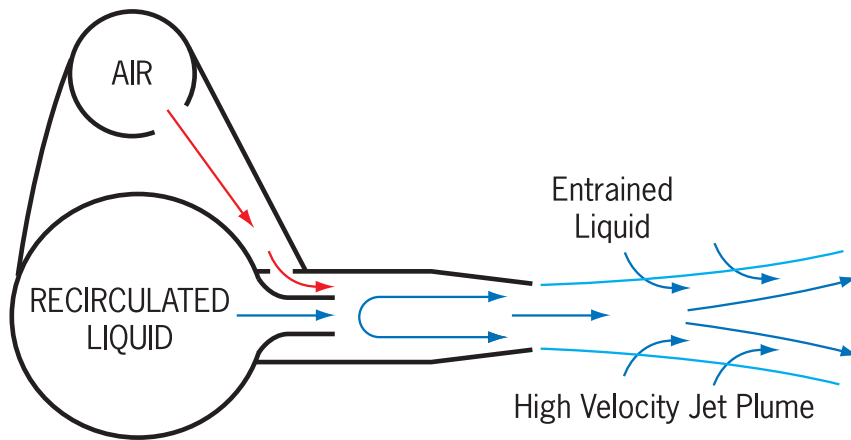
ThermAer Jet Aeration System

Matching oxygen supply to process demands

ThermAer uses naturally occurring thermophilic microorganisms, through an aerobic process, to consume organic material. The exact amount of oxygen they need for optimum performance is not constant. Oxygen demand varies widely depending upon the stage of the process.

ThermAer Jet Aeration System

Exclusive system monitors and controls air flow and liquid pumping.



At the heart of the ThermAer process: our exclusive jet aeration system efficiently provides the right amount of oxygen needed to keep the biomass fed and healthy, without excessive foam or reduced sulfur compounds.

Today the rules have changed...

For the first time you can precisely match oxygen delivery to oxygen demand, thanks to the revolutionary ThermAer process featuring a patented flexible-flow Jet Aeration System. Benefits included, yet not limited to:

- High shear aeration provides excellent mixing and viscosity reduction with thickened biosolids.
- Extremely high oxygen transfer efficiencies at low air/liquid ratio.
- High heat production with minimal evaporation heat loss.
- Independent control of oxygen supply and mixing.
- Variable liquid and air delivery provides ORP control while conserving heat for proper temperature control.
- "Retrofitability" to virtually any basin/tank geometry.

Horsepower When You Need It. Energy Savings When You Don't.

The ThermAer system monitors and controls your process throughout the cycle. Using proprietary technology, available only with ThermAer, aerobic conditions are maintained in the reactor. The benefits of this revolutionary concept have been proven through several years of full-scale operating experience:

- Optimized energy input.
- More efficient mixing from the bottom up — providing the most effective mixing intensity for 3-4% solids mixed liquor.
- Managed and controlled foam production.
- Minimizing the production of reduced sulfur compounds which may cause offensive odors.

The scrubber unit (right foreground) can remove up to 60% of the ammonia emitted by the ThermAer system before the remaining gases are treated by the BiofiltAer at this Marshall, MN installation.



The Splash Cone™ (left) hydraulically controls foam to a preset elevation. This allows for maximum aeration during critical phases of the digestion process.



Pump galleries may be configured in a variety of layouts, including straight line, semi-circular or in a "clover-leaf" configuration as shown here.



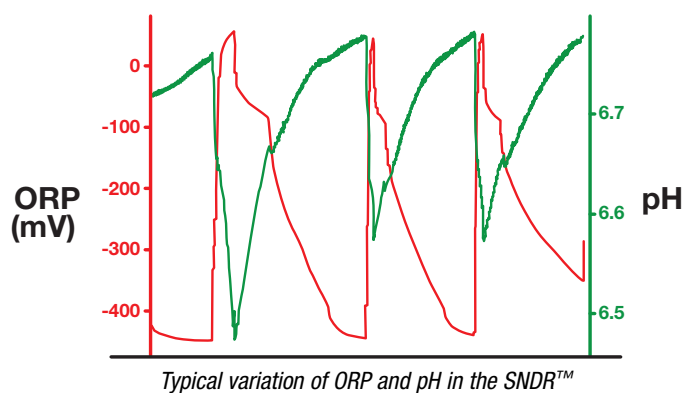
Storage Nitrification Denitrification Reactor^{*}

(SNDR[™])

The importance of producing a high-quality cake and reducing recycle constituents cannot be overstated. With the advent of Storage Nitrification Denitrification Reactor (SNDR), thermophilic sludges can be dewatered more economically, producing a very high-quality end product. Mesophilic conditioning - as provided in the SNDR, prior to dewatering reduces the soluble COD fraction in the digested biosolids. The SNDR provides optimum temperature, pH, alkalinity and aeration conditions for nitrification and denitrification of digested biosolids. The SNDR improves dewaterability, cake quality and reduces recycle concentrations.

Nitrification and denitrification are controlled in the SNDR by monitoring the pH, temperature, and ORP. Since nitrification is inhibited at temperatures above ~100° F, this reactor is operated just under this temperature, in order to fully optimize the growth rate of these specialized microorganisms. pH set points can be used to control the nitrification and denitrification process by creating an aerobic or anoxic condition as warranted. Because a reduction of total alkalinity accompanies nitrification, the pH of the system provides an ideal method of control.

**Patent Pending*



SNDR Advantages

- **Lower Conditioning Costs**

Reduction in soluble COD and ammonium in the SNDR significantly reduces dewatering costs.

- **Lower Nutrient Recycle**

Nitrification and denitrification in the SNDR greatly reduce the ammonium concentration in the recycle streams.

- **Single Reactor System**

Nitrification and denitrification is carried out in a single tank.

- **No External Alkalinity Required**

CO₂ released during ThermAer digestion generates carbonate and bi-carbonate alkalinity. When transferred to the SNDR, this alkalinity is utilized for nitrification; therefore, eliminating the requirement for an external alkalinity source.

- **Simple Control Strategy**

A control strategy based on pH, temperature and ORP controls the overall process in SNDR.

- **Lower Disposal Costs**

SNDR provides an additional 10-15% VS reduction in addition to already high VS destruction in ThermAer. The SNDR further reduces the volume of biosolids to be hauled from the facility.

- **Full Automation**

Automation includes automatic waste, feed, aeration, nitrification and denitrification. The system can be operated with minimal assistance.

The SNDR:

- Reduces ammonium and soluble COD fraction in recycle stream.
- Provides optimum conditions for nitrification and denitrification in a single reactor system.
- Provides additional aeration to reduce the oxidative demand and lower odor potential.
- Provides additional 10-15% VSR, thus reducing the biosolids to be hauled from the facility.
- Utilizes a heat exchanger and/or air cooling to lower the temperature of the liquid contents.
- Lower temperature and pH provide the optimum conditions for the scrubbing action in the headspace of the tank.
- Provides nitrifiers and denitrifiers in the centrate to continuously re-seed the activated sludge basin system.

Quality Biosolids

Cake Nutrient Data*

Total Nitrogen	~30	pounds/ton
Organic Nitrogen	~25	pounds/ton
Phosphorus (P)	~20	pounds/ton
Potassium (K)	~30	pounds/ton

Centrate Data*

TSS	~150	mg/L
NH ₃ as N	~300	mg/L
COD	~2000	mg/L
Phosphorus	~30	mg/L
BOD	~200	mg/L

* Based on the representative sample analyzed from Yorkville Bristol Sanitary District

BiofiltAer odor control unit in Bowling Green, OH. BiofiltAer ensures that no odors are present on site.



BiofiltAer components:

- Odor control fan
- Primary humidification chamber
- Secondary humidification chamber
- Air redistributors
- Biofiltration chamber

BiofiltAer has:

- The ability to remove high ammonia concentrations during upset conditions
- No additional requirements for nutrients
- Low operating cost
- Minimal head losses
- Minimal electrical requirements
- Low re-acclimation time
- Inorganic layer for longer media life
- Root wood media for biological culture to attach and thrive



BiofiltAer in Marshall, MN. The BiofiltAer is available in prefabricated modular units for quick and easy startup, field-constructed units for larger projects and can often be retrofitted to existing equipment. The constant temperature and moisture levels ensure ammonia is removed through constant action by natural microorganisms in the organic filter media bed.

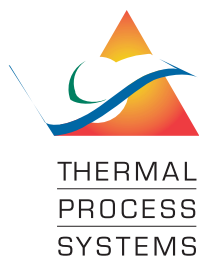
The **experience** to know what works.
The **innovation** to make it work better.

TPS ThermAer offers:

- Superior volatile solids reduction independent of outside temperature
- Assured "Class A / Quality" biosolids
- Reduced capital and operation costs
- Process flexibility
- Minimal odors
- Complete process control
- Potential use of existing tankage
- Increased solids after dewatering

Thermal Process Systems was founded by experienced wastewater treatment professionals who understand the complex issues of biosolids processing and re-use. Hindered by the compromises that were necessary with existing systems — and the inability of these processes to meet industry demand — they formed their own company focused exclusively on biosolids management. The result is the proprietary ThermAer process. ThermAer has been subjected to rigorous field testing in full-scale operating systems, and pilot testing at various sites since 1995. It has exceeded every customer expectation.

Contact us today for a no obligation analysis of your biosolids management needs (219) 663-1034



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