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RESOURCE RECOVERY

Advanced Manure Management for Dairy Farms

COMPANY SUMMARY

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About Us

Trident provides resource recovery technologies for agricultural, industrial and municipal applications. We help our customers successfully recover the valuable resources in their waste streams and make them available for efficient reuse.

Agricultural applications:

Trident provides livestock producers a range of systems and standalone equipment to help with their waste treatment processes. The bedding and nutrient recovery technologies focus on efficient capture of the valuable components in manure: fiber, nutrients and water. Standalone equipment like rotary screen separator, screw press or pumps and agitators are excellent options to improve manure handling and separation on the farm.

Trident's Nutrient Recovery System has been recognized as one of the Top 10 technologies at the 2016 EPA Nutrient Recycling Challenge.

Major Projects (Ag)

2017: Nutrient Recovery for 5,500 cow dairy (raw manure) at Wolf Creek Dairy, Fort Collins, CO.

2017: Nutrient Recovery for 3,500 cow dairy (raw manure) at Prairies Edge Dairy, Fair Oaks, IN.

2016: Fiber Recovery for 7,000 cow dairy with digester at Windy Ridge Farms, Fair Oaks, IN.

2015: Nutrient Recovery for 14,000 cow dairy with digester at Fair Oaks Farms, Fair Oaks, IN.

2015: Nutrient Recovery for 300 cow dairy with digester at Seabreeze Farm, Delta, BC.

2014: Nutrient Recovery Cold Process Pilot (raw manure) at 3,100 cow dairy in Cleveland, WI.

2014: Fiber Recovery for 5,000 cow dairy in Dong-Jun Nei Meng Gu Co., Ltd in Linhe City, Shandong, China.

Industrial and municipal applications:

Wastewater treatment plant operators are looking for alternative ways to better manage their sludge dewatering processes. Trident's innovative sludge dewatering technology combines excellent dewatering results, small footprint and high capacity, consistently outperforming other technologies such as centrifuges or belt presses in efficiency. Replacement programs for key spare parts ensure easy re&re procedures and make maintenance predictable.

Who are we

With decades of leadership in liquid waste processes and solid-liquid separation, Trident continues to help its valued customers with efficient and reliable solutions, resulting in economic benefits and improved sustainability.

Trident has assembled an experienced team including farm equipment specialists, wastewater treatment experts, as well as specialists in the process engineering field, project management and manufacturing. Founder, Kerry Doyle, was the developer of the original Rotary Screen Separator, now sold around the world and has been a leader in the development of livestock waste handling and processing systems for over 20 years.

What we do

- Nutrient Recovery Solutions
- Bedding Recovery Solutions
- Wastewater Treatment Solutions
- Sludge Thickening and Dewatering Equipment

Bedding Recovery Process

Manufactured Bedding For Every Farm Size

The Trident Bedding Recovery Technology converts manure into a valuable resource. The system captures and separates large fiber from animal manure and makes it available for reuse as premium bedding material. The process includes feedstock conditioning, coarse fiber separation and dewatering, resulting in dry manufactured bedding that is ready for immediate reuse or as a revenue generator for off-farm markets.

The technology is designed for flush or scrape manure handling and can be implemented as a stand-alone system or completely integrated in the Trident Nutrient Recovery process. The system is fully scalable and integrates well with or without Anaerobic Digesters.

"The Trident Bedding System is unique because it extracts the manure's large fiber eliminating the unwanted fine particles.

Conditioning and separation of the coarse fiber is key.

Self manufactured bedding reduces operational cost and helps control the supply.

Strategic Alliances

Trident has built strategic relationships with industry resources that have the expertise to contribute to the design, development and marketing of Trident technologies.

Accelerated Renewable Energy (ARE) Consortium - A University of Wisconsin R&D project in partnership with Soil Net and Maple Leaf Dairy.

AQUA Engineering Inc. - A civil engineering firm specializing in water and wastewater resources, and environmental services.

Earthwise Inc. - A consultancy that develops and implements practical strategies for state and federal environmental laws and regulations serving the dairy industry.

Export Development Canada - A Gov't agency that provides a variety of support to Canadian exporters.

Global Dairy Farmers - A global network of inspirational and ambitious dairy farmers and industry experts.

Midwestern BioAG - An agricultural based consulting and manufacturing company specializing in biologically-based agricultural fertilizers.

National Research Council of Canada - A Gov't agency that consults with and supports the development of innovative Canadian businesses.

Roeslein Alternative Energy - An operator and developer of renewable energy production facilities that converts wastes to renewable natural gas and sustainable co-products.

Soil Net LLC - Owner Dr. Aicardo Roa, PhD, Scientific R&D Scholar, an Adjunct Professor at the University of Wisconsin's Biological Systems Engineering Dept. is an expert in liquid-solid separation technologies.

Trident's CEO Kerry Doyle (center) with customers at a new installation in Delta, BC.

Farmers Who Manufacture Their Own Bedding Save More

One of the unique features of the Trident Nutrient Recovery System is the inclusion of Trident's Bedding Recovery System, a process that recycles the large fiber from manure the farmer can use as barn stall bedding. This free and abundant recycled fiber is an ideal substitute for organic material farmers purchase from outside suppliers. What makes the Trident Bedding System unique is its' ability to breakdown manure's viscous mucoid structure and remove fine particles prior to large fiber extraction enabling the harvest of truly premium bedding, and not just dried manure.

Bedding Cost Recovery

Recycling fiber as bedding represents a significant cost savings for farmers and a significant contributor to the ROI of the nutrient recovery system. The past few years, cost of premium bedding has risen steadily, causing many farmers to either re-bed less often or look for cheaper material alternatives. This can have detrimental affects on cow health and comfort reducing milk production. Manufacturing bedding from manure provides ample bedding material to allow farmers to bed deep and bed often, a key component to keeping cows healthy, comfortable and productive.

A Note On Pathogens In Recycled Bedding

Studies by Cornell University regarding pathogens related to use of non-pasteurized green bedding have indicated that cow health is not adversely affected. In fact, in some cases, depending on farm bedding practices, there were health improvements after green bedding was implemented. There were also cases of increased milk production, which was attributed to the volume of bedding giving the farmer opportunity to bed deeply and more often.

Nutrient Recovery Process

Effective Treatment Turns A Liability Into Assets

The Trident Nutrient Recovery Process consists of several mechanical and chemical treatment steps. The system receives its feedstock from the farm's reception pit. In the first stage the manure is conditioned and large particles are captured and removed. The remaining effluent undergoes further treatment in the Dissolved Air Flotation (DAF) tank to effectively isolate and capture the nutrients. The DAF sludge containing the NPK nutrients is then dewatered to a nutrient rich cake.

"Farmers recognize the operational and economic benefits. Reduced transportation costs, improved lagoon management, clean water for reuse as flush or for sand recovery are just some examples.

The system recovers three main components from manure: The clarified effluent water is pumped to a lagoon or remains in a closed-loop and is directly reused as flush water in the barns. The recovered fiber becomes available as bedding or as feedstock for other applications. The concentrated nutrients become available for land application or can be further processed to plant nutrients, creating new revenue opportunities for the farm.

The range of benefits for the dairy is broad: i.e. Significant volume reduction helps reduce transportation costs; only a fraction of the solids is sent to the lagoon requiring fewer lagoon cleanouts; clarified water can be land applied through efficient low-pressure irrigation systems; farmers can increase their herd size without having to expand their land base.

Two 400 sqft DAF tanks at a 14,000 cow site with anaerobic digester.

Advanced Nutrient Recovery Technology for Ag Wastes

"We are very impressed with Trident. They came and did what they said they would do, at the price they had quoted, and they did it within the promised timeline.

Dr. Michael McCloskey
CEO, Fair Oaks Farms
Fair Oaks, Indiana

DES Configuration Enhances the Anaerobic Digestions Process

DES refers to a Digester Enhancement System, a specific configuration of the Trident equipment prior to the Anaerobic Digester. In particular on flush dairies the conditioning of the AD feedstock, including the water extraction, allows to meet higher TS% requirements resulting in a more effective break down of the organic matter. Another significant advantage is the reuse of the captured water for flushing cycles in the barn or for sand recovery.

The Use Of Molecular Chemistry

The effectiveness of mechanical separation for very small particles is limited. The fact that about 45% of the solids in dairy cow manure are smaller than 25 microns in size makes clear that an additional step is required.

Prior to the Dissolved Air Flotation treatment a custom polymer is introduced to the system. The flocculation, which creates long chains of low density particles, allows the flotation and capture of the nutrient rich solids. The conversion of the phosphate in manure, into free ions means that large minerals will end up in the solid fraction. In addition, flocculation, and the relative low concentration of cations will affect crystallization of compounds such as struvite.

The polymer works with both anaerobically digested and raw manure. The separation efficiency however is effected by the dairy manure composition. Anaerobic digestion (AD) technology produces a more uniform effluent while stabilizing organic solids, requiring lower polymer application rates.

Lab testing polymer formulations.

Automation Improves Efficiency And System Control

The Trident Automation System is a customized controls solution designed to manage the process variables of advanced manure management. Based on specific input parameters provided by sensors and customized event action circuits, the controls ensure optimal performance of the system, even under changing conditions.

The automation system includes Programmable Logic Controller (PLC) and Variable Frequency Drive (VFD) motor controls as required, as well as sensors and signaling devices, air valve actuators, HMI operator touch-panels, UL listed enclosed industrial control panel, and a secure internet router. Standard features include: individual component monitoring, embedded input data configuration, Ethernet IP communication, text notification, remote access function, total runtime monitoring and I/O. The automation system is specifically developed for each installation

The automation system gives operators access to real-time data.

Project Specifications

Details to be confirmed

As we progress with the project there will be more data that needs to be confirmed to allow a comprehensive project layout. Below is a list of example questions:

What existing infrastructure is in place? e.g. lagoons, reception pits, buildings, storage bays etc.

What are the details with regards to the flush management? flush cycles and volumes, slope and velocity, solids content, pumps etc.

Are there special conditions or limitations with regards to manure handling or access to or use of water, bedding, cow comfort, transportation or land application etc.?

What automation or integration of components is required?

Project phases

Effective project management requires good planning and clear timelines for the different project phases. Below is an example for a large scale Nutrient Recovery project with estimated timelines. Actual dates may vary based on project requirements:

- Consultation Stage
- Project Proposal
- Design & Engineering
- Contract incl. Performance Guarantee
- Manufacturing
- Installation
- Commissioning

Trident's project management starts with a detailed analysis of the customer's operation. Flowrates, integration of existing equipment, automation requirements, site layout and other details are assessed. A comprehensive questionnaire can be used to help the customer confirm specific details. We then proceed with capacity calculation and equipment sizing and configuration. These items are part of Trident's project management deliverables:

- Mass Flow Balance Calculation
- Nutrient Captures Rates per Treatment Stage
- Process & Instrumentation Diagram (P&ID)
- 3D Layout Drawings

Kerry Doyle (right), founder and CEO of Trident Processes LLC, and R.C. Ludke (left), President, inspecting a site after the installation of a Trident nutrient recovery system.

Next Step

We look forward to discussing the next steps with you. We will continue to work with you to provide consultation and will also arrange for a site visit.

Please do not hesitate to contact me if you have further questions or concerns.

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Case Study

Nutrient Recovery System at Indiana Dairy Farm

"Because Trident's system is fully automated our manure is now much easier to handle. It separates the beneficial parts from manure and converts it all into usable by products.

Carl Ramsey Operations Manager, Prairie's Edge Farm, Fair Oaks, IN

Trident nutrient recovery installation at Prairie's Edge's site II dairy farm.

One of North America's largest dairy farms has turned a liability into assets.

For the past years the farm had been investigating the potential to segregate and capture the valuable nutrients contained in the manure from their anaerobic digesters; with the goal to create a nutrient rich cake for fertilizer and a "tea water" effluent for unrestricted land application. The keys would be to reduce the handling and transportation costs, allow for time sensitive applications of the carbon based fertilizer and improve effluent water quality. After extensive investigation the decision to choose the Trident system was made. With a proven processing method to extract and concentrate the NPK from the digestate, the vision was realized. Various options are now available including the opportunity to manufacture fertilizer granules for on and off farm use. The clarified effluent that remains, referred to as "tea water", can be irrigated through cost-efficient center pivot systems. Thus enabling Prairie's Edge Farms to fulfill their economic objectives and achieve the ultimate in sustainability.

After the first Trident system on their 14,000 cow site had been in operation successfully for 2 years, the farm implemented a second Trident system to process the manure at their 3,500 cow site.

Project specifications

- Challenge: Customer was looking to optimize manure management and reduce operational costs on farm
- Action: Sample testing to determine system configuration and design of specific process automation based on farms operation
- Solution: Implementation of Trident Nutrient Recovery System to produce high-concentrated NPK cake, separated organic fiber, and clarified water ready for land application through efficient irrigation systems