

Integrated Biosolids Management

Plant Modification Provided Opportunity to Implement Leading Edge Solution

Lystek 
Nothing wasted.
Everything to gain.



St. Marys wanted to be at the forefront of wastewater treatment technology.

ABOUT

Known as the “Stone Town” due to the abundance of limestone in the surrounding area, St. Marys is a picture-perfect southern Ontario town that is home to approximately 6,800 residents. www.townofstmarys.com

CHALLENGES

- Control rising wastewater treatment costs
- Improve environmental performance of existing plant facilities
- Meet new Ministry of Environment and Climate Change (MOECC) guidelines for biosolids storage

SOLUTION

- Modification of existing activated biosolid treatment process to an anoxic/oxic (A/O) biological nutrient removal system with an integrated management system based on Lystek technology

RESULTS

- Significantly reduced biosolids yield
- Nitrogen and phosphorous removal
- Increased plant treatment capacity
- Generation of Class ‘A’ biosolids with reduced odor, pathogens, and vector attraction
- Controlled cost of capital improvements

THE TOWN WORTH LIVING IN

With its unique limestone architecture, gentle rolling hills, many festivals and events throughout the year, St. Marys more than lives up to its motto “the town worth living in”. St. Marys has become a magnet for thousands of visitors in all seasons and services a ‘commuter shed’ of more than 1.6 million people. With popularity comes growth that invariably puts pressure on municipal services and the wastewater treatment plant in particular.

STORAGE CHALLENGES

A central concern and municipal challenge involved storage. In 1990, the St. Marys wastewater treatment plant (WWTP) began operating with primary and secondary, conventional activated treatment followed by anaerobic digestion of biosolids. Digested material was applied as a soil amendment to surrounding agricultural land from April to November. This Class B material was stored during seasons when it could not be applied in an environmentally responsible manner.

The St. Marys WWTP had a total on-site storage capacity of 1,270 m³ which provided about 90 days of biosolids storage when the plant reached its maximum influent processing capacity of 5,560 m³ per day. However, the Ministry of the Environment and Climate Change (MOECC) amended the Nutrient Management Act in 2007 and recommended 240 days of biosolids storage by 2009. These new guidelines were

a safety precaution designed to ensure sufficient storage capacity within the plant in case Class B land application or landfill disposal was not possible.

Escalating volumes of effluent from the WWTP coupled with a desire to comply with MOECC guidelines motivated the town to explore more advanced management systems. The Town's engineering firm GHD (formerly Conestoga Rovers & Associates) was retained by St. Marys to perform a comprehensive evaluation of the current biosolids management and make recommendation to meet the town's growing requirements and MOECC guidelines.

MANAGEMENT OPTIONS EVALUATED

Technical and economic analysis of alternatives included:

- **Constructing additional off-site storage**
- **Thickening prior to digestion**
- **Applying the Lystek technology**
- **Integrating the Lystek technology and biological nutrient removal (BNR)**

Following a careful assessment, GHD recommended the town implement a management strategy that integrated BNR and Lystek technologies. "We believed this combination would provide the town with the most cost effective solution when both capital investment and life cycle costs are considered," confirmed Andrew Lugowski, P. Eng. Associate at GHD.

"The combined Lystek/BNR strategy increased biosolids storage capacity from 90 to 300 days without expanding the plant's existing storage facility," says Lugowski

Moreover, the combined Lystek/BNR approach provided St. Marys with a rare opportunity to:

- Reduce the capital costs of the project while meeting all performance objectives
- Control the overall life cycle cost of wastewater treatment
- Meet all MOECC regulations
- Improve the energy efficiency and reduce greenhouse gas emissions in a cost effective manner

AWARD-WINNING SOLUTION

Lystek's unique, thermal hydrolysis process is patented, award-winning and commercially proven.

High speed shearing, alkali and low pressure steam are simultaneously applied in an enclosed reactor to transform raw sludge or digested biosolids into a unique, multi-purpose product. The result is a stable, high solid, low viscosity, dust-free product that meets or exceeds U.S. Class 'A' EQ (Exceptional Quality) standards and that is registered by the Canadian Food Inspection Agency (CFIA) in Canada.

The end product, branded and trademarked as LysteGro®, has many, diverse uses such as agriculture, sod farming, horticulture and more. As it is recognized as a true, commercial fertilizer product, it can be stored virtually anywhere, including on the farm or at a third party facility. The process incorporates strict quality control standards and there have never been any health or environmental issues related to use of the LysteGro® biofertilizer product – and the solution can be easily integrated into existing plant infrastructure.



BIOLOGICAL NUTRIENT REMOVAL (BNR)

BNR is a next-generation process where nitrification and denitrification are achieved through an internal recirculation whereby nitrates generated in the aeration tank are reduced to atmospheric nitrogen and removed from the system in the anoxic tank. The BNR process provides many advantages over conventional treatment, including

expanded treatment capacity and nitrification/denitrification, enhanced phosphorus removal, improved process stability, and significantly reduced biosolids yield.

"We expected the integrated Lystek/BNR approach to reduce the 'carbon footprint' of the plant by decreasing GHG's from roughly 6.3 tons CO² per ton of wasted activated sludge, says Lugowski.



SUMMARY OF BENEFITS

- Recycling to the BNR and digester reduces biosolids for disposal and increases methane gas
- Compared to a conventional treatment plant, BNR can reduce biosolids production by up to 30 percent
- Conversion of Class B biosolids to a pathogen-free, nutrient rich, Class A biofertilizer product

- Smaller footprint and flexible approach to biosolids management with adequate storage ensured cost effective, year-round processing of biosolids
- Potential increase in the existing biosolids storage capacity from 90 to 300 days
- End product is a safe, low viscosity liquid material that can be easily handled, loaded, transported and applied as a cost effective, commercial grade fertilizer product

PILOT STUDY

Given the impressive benefits that were expected, the town of St. Marys agreed to implement a Pilot Plant Study at the existing WWTP. To ensure the most rigorous analysis and objectivity, the study was initiated jointly by GHD, the University of Western Ontario and Lystek - with Dr. George Nakhla's lab at the University of Western Ontario providing most of the analytical work and lab studies. The goal was to demonstrate the effectiveness of integrated Lystek/BNR and

anaerobic digestion systems and the ability to measurably reduce overall volumes of biosolids that needed to be handled.

With the proposed integrated biosolids management strategy, first waste activated sludge (WAS) from the BNR system is treated with Lystek technology. A portion of the Lystek-treated material is recycled to the BNR system and the primary digester with the remaining volume being pumped to storage or land application.

PILOT EXCEEDS EXPECTATIONS

The pilot study exceeded the expectations of technical staff. “The combined Lystek/BNR strategy increased the Plant’s storage capacity from 90 to 300 days without expanding the existing storage facility requirements,” stated Lugowski. The study also confirmed that the integrated approach had the potential to:

- Reduce biological yield of **up to 30 percent** (with total nitrogen and total phosphorous removal efficiencies of **up to 60 to 80 percent** and **80 to 90 percent** respectively)
- Potentially reduce the net, dewatered biosolids volumes by **as much 75 percent**
- Achieve **four to five-fold volumetric reduction** in volume produced by the plant
- **Further volume reduction** enabled by recycled Lystek-processed biosolids to the BNR process and primary digester
- Help to control expanding capital & operating costs

In addition, the study also confirmed that recycling Lystek-processed biosolids to the anaerobic digesters can potentially increase methane by greater than 50 percent, and that LysteMized® material is an excellent source of readily biodegradable carbon for increased methane production.

Following confirmation of these desired benefits through the Pilot Study, St. Marys implemented this advanced approach to biosolids management at its WWTP.

FIRST OF ITS KIND

“Incorporating BNR and Lystek technology provided the most cost-effective management alternative to meet the MOECC’s storage requirements, while providing the greatest benefit to overall operations at the St. Mary’s WWTP,” confirms Lugowski.

The solution has increased the plant’s treatment efficiency, process stability, and nutrient removal capacity in addition to producing a nutrient-rich fertilizer product that meets U.S. EPA standards for EQ biosolids. In doing so, the combined BNR/Lystek plant modifications reduced biosolids production and spared St. Marys the cost of expanding its existing biosolids storage facility.

Moreover, St. Marys was the first plant of its kind to make use of beneficial recycling of LysteMized® biosolids in an integrated approach to enhance the performance of BNR and anaerobic digester systems – making the town a leader in biosolids management.



About Lystek International

Lystek is a leading provider of Thermal Hydrolysis solutions for the sustainable management of biosolids and organics. The multi-use, award-winning Lystek system reduces costs, volumes and GHG’s by converting municipal and industrial wastewater treatment facilities into resource recovery centers. This is achieved by transforming organic waste streams into value-added products and services, such as the patented LysteMize® process for optimizing digester performance, reducing volumes and increasing biogas production; LysteGro®, a high-value, nutrient-rich biofertilizer and LysteCarb®, an alternative source of carbon for BNR systems.