

# LYSTEK TECHNOLOGY

Lystek International Inc.

October 23, 2014



PRESENTED BY:  
Ward Janssens

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- **Anaerobic Digester & BNR enhancement**
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# **The Company, Experience & Technology**



# Lystek - The Company

- Biosolids and organics processing through on- and off-site solutions:
  - Producing Class A EQ / CFIA product with enhanced fertilizer value
  - Improving WWTP processes utilizing Lystek's hydrolyzed product
- Developed at University of Waterloo, Canada in year 2000
- Ownership: Management & RW Tomlinson, Ottawa (>1000 employees, billion dollar (+) corp. = financial strength & backing)



## Who Uses Lystek Now?

| Location        | Guelph               | St. Marys           | Southgate                | Iroquois             | Elora                | North Battleford                    |
|-----------------|----------------------|---------------------|--------------------------|----------------------|----------------------|-------------------------------------|
| Status          | 2008                 | 2010                | 2012                     | 2012                 | 2014                 | 2014 Fall                           |
| Capacity (WT/Y) | 18,000               | 3,500               | 150,000                  | 20,000               | 3,500                | 3,500                               |
| Location        | On site              | On site             | Off site                 | Off site             | On site              | On site                             |
| Ownership       | Guelph               | St Marys            | Lystek                   | DES/Third High Farms | Centre Wellington    | North Battleford                    |
| Solution        | Design Build License | Design Tech License | Design Build Own Operate | Design Build License | Design Build License | Design Build License Product Market |



Serving Cities of Toronto, Ottawa, Peterborough, Oakville, Burlington, and Regions of Waterloo and Halton...and several other communities.



# Lystek Technology – Overview

- Low Temperature Physical Chemical Hydrolysis Technology
  - Installed after dewatering
- Produces a multi-purpose, hydrolyzed product for:
  - Anaerobic Digester Enhancement (mesophilic digesters)
    - Improve biogas yields by >30%
    - Reduce biosolids volumes by >20%
  - BNR System Enhancement – a cost effective, alternative carbon source
  - Liquid fertilizer
    - Class A EQ (USA)
    - CFIA registered (Canada)

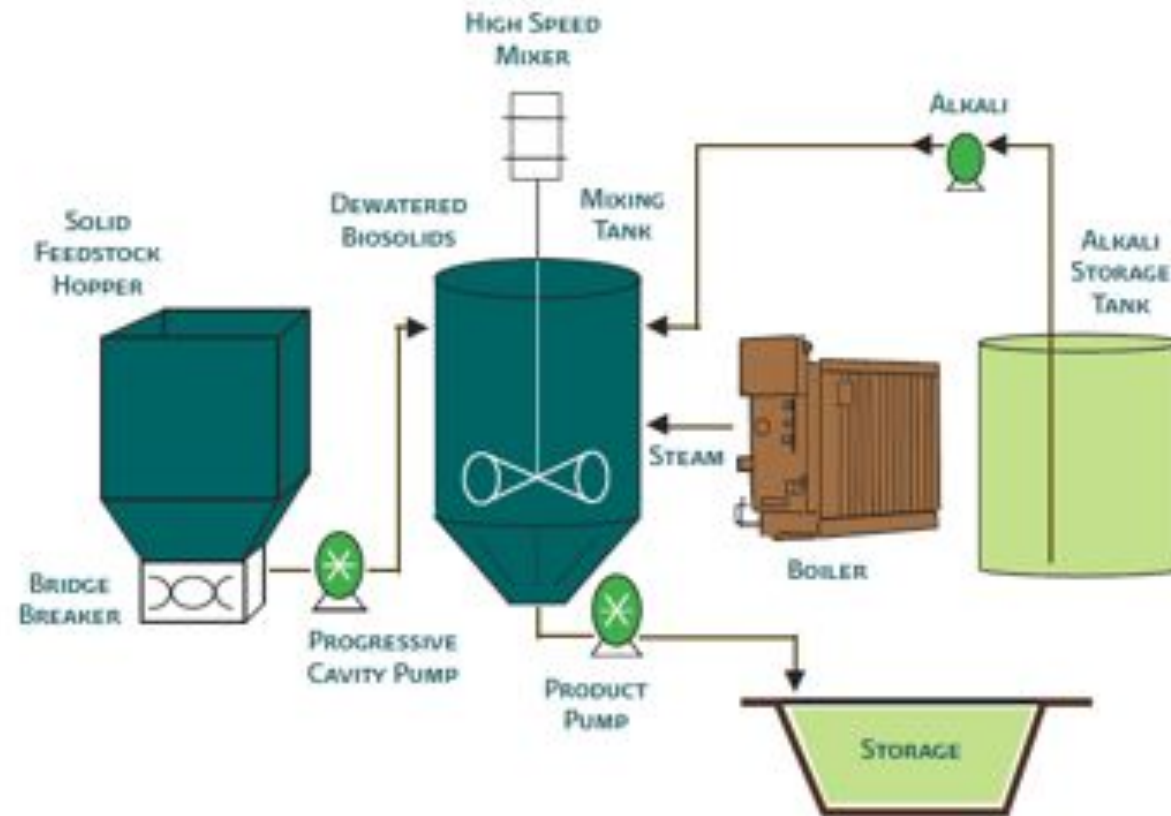


## Technical/Scientific Basis

- Cell disintegration & hydrolysis of complex organic molecules into simpler compounds
- Process makes the residual recalcitrant volatile solids in digested biosolids more amenable to further biodegradation when re-fed to anaerobic digester
- Hydrolyzed product provides readily available organics for AD and BNR system + nutrients for soil/plants
- Product contains >40% of the TCOD as SCOD
- Product contains 10-fold higher VFA as compared to standard, biosolids cake



# Lystek Process - Simple PFD



## Regional site – Dundalk, ON



# LysteGro™ Product



- Homogeneous liquid/ high solid (15-19%) product
- Viscosity <5,000 cP
- Fully pumpable using conventional liquid equipment
- Enhanced treatment = pathogen-free/Class A EQ
- Nutrient rich (NPK 4:3:2)
- Long-term storage stability
- No pathogen regrowth
- Huge demand from the agricultural sector



# Product Storage



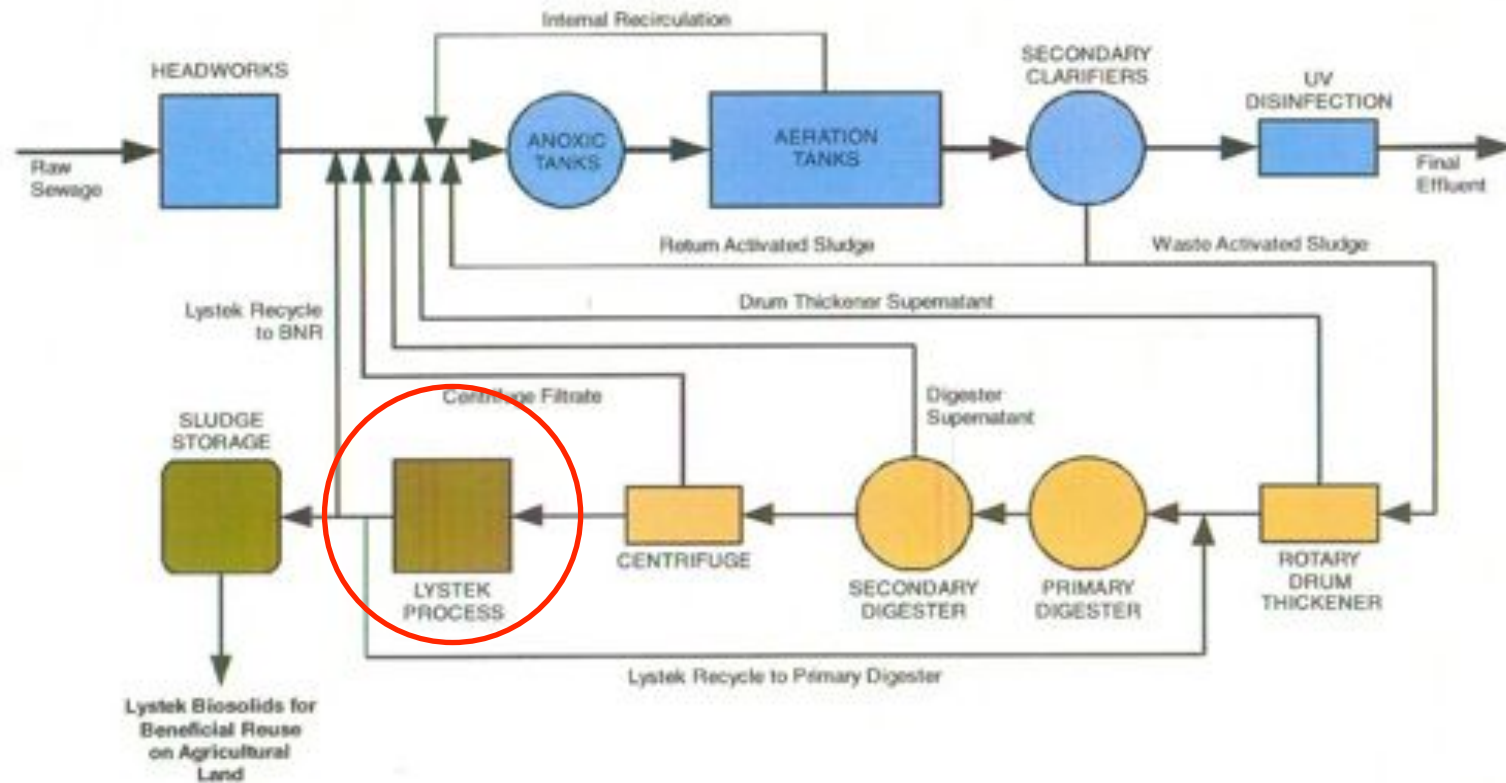
Lined & Covered Storage Lagoons



# **Anaerobic Digester & BNR Enhancement**



# Digester & BNR Optimization



# Digester Enhancement

- City of Guelph, Ontario – Full-scale pilot study:
  - >40% extra biogas and >25% solids reduction by re-feeding the Lystek product into the test digester
  - Biodegradability of Lystek product was 65-70%

| Parameters (average of different feed rates over 6 months study) | Control Digester without Lystek biosolids | Test Digester with Lystek biosolids |
|------------------------------------------------------------------|-------------------------------------------|-------------------------------------|
| Influent VSS primary sludge (kg/d)                               | 2307                                      | 2278                                |
| Lystek VSS (kg/d)                                                | 0                                         | 921                                 |
| Combined Influent VSS (kg/d)                                     | 2307                                      | 3199                                |
| Effluent VSS (kg/d)                                              | 1118                                      | 1222                                |
| VSS Destroyed (%)                                                | 51                                        | 62                                  |
| Biogas production (m <sup>3</sup> /d)                            | 1189                                      | 1977                                |



# Digester Performance Enhancement

- **Los Angeles County, California: 2012**
  - Independent lab study at Western University, Ontario
  - Lystek biosolids ~65% biodegradable; compared to raw sludge 30-50% more biogas potential with Lystek product
  - Further lab & pilot studies at LA County site planned for 2014-2015
- **New York City: 2014**
  - Independent lab study at Manhattan College, New York
  - Lystek biosolids >50% biodegradable; higher biogas production compared to TWAS
  - Additional studies being executed in 2014-2015



## Lab Testing - Potential C Source for BNR

- **Manhattan College, New York: 2014**

- Independent study on potential of Lystek biosolids as a carbon source in BNR systems - using a variety of sources
- Lystek shows significantly higher specific denitrification rates (SDNR)
- Additional, detailed studies underway

|                  | Early Rates - First 30 minutes |           |           |          |
|------------------|--------------------------------|-----------|-----------|----------|
| Carbon Source    | Stamford                       | 26th Ward | Battery E | Hunts Pt |
| Endogenous       | -0.0208                        |           |           | -0.0597  |
| Primary Effluent | -0.0284                        | -0.0309   | -0.0495   | -0.1384  |
| Methanol         | -0.0443                        |           | -0.0462   |          |
| Glycerol         |                                | -0.0493   | -0.0277   | -0.0586  |
| Lystek           | -0.0491                        | -0.1832   | -0.0656   | -0.0920  |



Average SDNR Values (mg NO<sub>x</sub>-N/mg VSS)



# **Performance, Product Value & Investment**



# Cost and Benefits

## **Investment:**

- 25,000 tons/year Design, Build, Transfer
- 150,000 tons/year Design, Build, Own, Operate

## **Operating:**

- Energy input (Electricity, natural gas or CHP heat)
- Alkali use
- Control system
- Labour

## **Added benefits**

- Improved biogas / reduced solids
- Fertilizer value



## On-Site Facility (Post Dewatering)



## Regional Facility (Off-Site)



Southgate, Ontario - 150,000 WT/year  
Design, Build, Own, Operate investment: \$11 M US



## Performance Indicators

- (Un)digested biosolids & source separated organics - 1% to 35% biosolids @ 15-19% solids level in the reactor
- **Power input** (pumps/mixer): 52-58 KWH per dry ton
- **High speed shear**: Tip speed >3000 ft./min
- **KOH/NaOH input** (45-50% sol): 175-195 lbs/dry ton to pH 9.5-10.0
- **Natural gas** (low pressure boiler) input: 13-15m<sup>3</sup> per dry ton to 70-75°C / 158-167°F / 30 min / Class A regime
- **Labour**: <2 man hours per day; Fully automated SCADA – minimum operator attention
- Small footprint: 1000 sq. ft - 25,000 WT / 2500 sq. ft. - 100,000 WT
- Side streams: none



# Performance Indicators

- **Re-feeding into BNR**
  - Up to 30% of the product can be re-fed into BNR
  - Replaces Methanol and Glycerol
- **Re-feeding into anaerobic digesters**
  - 30 - 50% of the product can be re-fed into digesters
  - 30 - 50% more biogas yield potential
  - 20 - 30% additional VS breakdown after re-feeding



## Value of the LysteGro™ Fertilizer

- Balanced nutrient source, fertilizer value >\$80/1000 gal
- N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O = 30-27-31 lbs/1000 gal, in the year of application
- S 10 lbs/1000 gal, Ca 40 lbs/1000 gal and other micronutrients such as Cu, Zn, B, Mg etc.
- Application rates = 3000 – 4000 gal/acre
- Organic matter = ~5%



# Ease of Land Application



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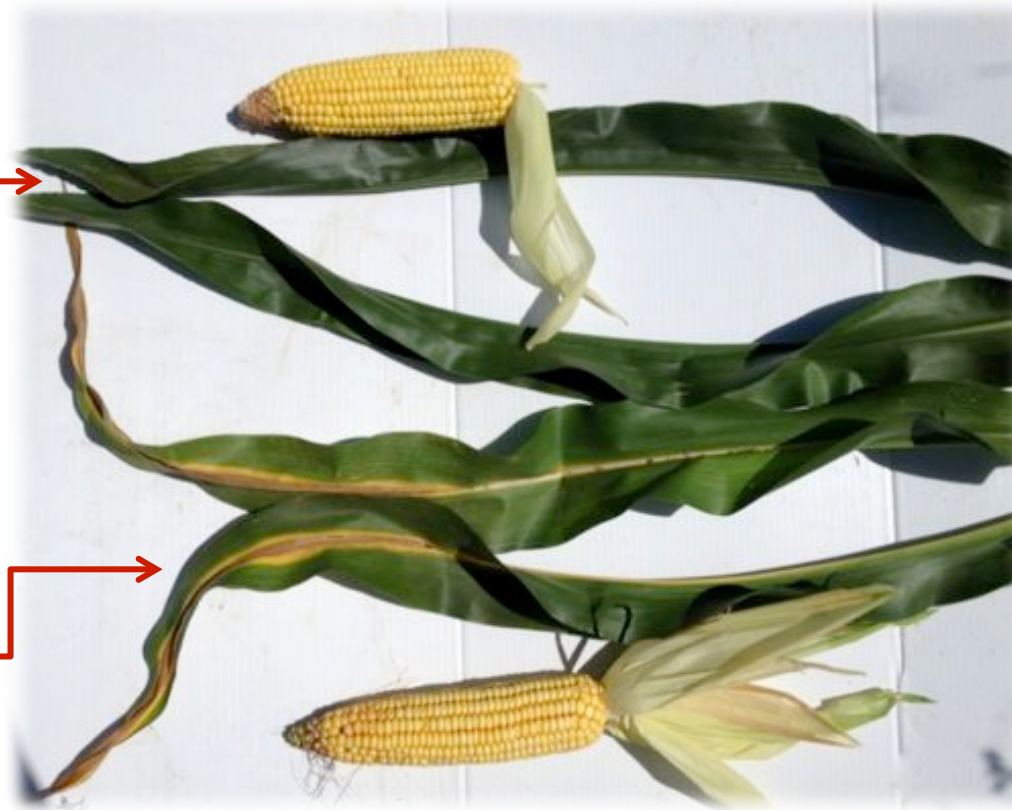


## LysteGro vs. Chemical Fertilizer Trial

With LysteGro -  
ear leaf strong  
color



With Chemical  
Fertilizer -  
ear leaf firing



## LysteGro vs. Chemical Fertilizer Trial



Tassel stage - strong leaf color  
- critical stage of development



Tassel stage - leaves yellowing  
due to lack of available N & K



# Class A EQ Letter – U.S. EPA



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX  
75 Hawthorne Street  
San Francisco, CA 94105

February 27, 2014

Ward Janssens  
Lystek International Inc.  
1425 Bishop St. N. Unit 16  
Cambridge, Ontario, N1R 6J9

Re: Demonstration of Vector Attraction Reduction using Option 2 for Lystek Thermo-Alkaline Treatment

Dear Mr. Janssens,

Thank you for your e-mail and attached paper from Dr. George Nahkla of February 3, 2014 with results of volatile solids reduction tests on anaerobically digested biosolids treated with the Lystek Thermo-Alkaline treatment process.

The results showed that for the sampling periods in question, VAR Option 2 was met, as the volatile solids were reduced by less than 17% during additional digestion. This option may be used in the future to demonstrate vector attraction reduction.

The frequency at which the test must be run is specified in 40 CFR 503.16, ranging from once per year for facilities producing less than 290 dry metric tons of biosolids per year, to once per month for facilities producing over 15,000 dry metric tons per year.

Demonstration of VAR using this method, in conjunction with demonstration of Class A pathogen reduction and pollutant concentrations meeting 40 CFR 503.13 Tables 1 and 3 limits, demonstrates "exceptional quality" biosolids that may be distributed without further restrictions.

Please contact me at 415 972-3514 or [Fondahl.lauren@epa.gov](mailto:Fondahl.lauren@epa.gov) with any questions regarding this.

Thank you,  
  
Lauren Fondahl  
Biosolids Coordinator, WTR-5



# **Summary of Beneficial Applications**

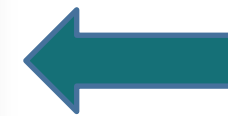


# One System = Multiple Benefits

Produce a  
Class A EQ  
Fertilizer  
Product



Optimize  
Digesters &  
BNR systems



# Advanced Technology & Benefits

- **Lystek System**

- Low capital cost - Small foot print - modular system – easy to expand
- Minimum operator attention – Fully automated / SCADA
- Simple to operate, easy to maintain – standard equipment, low pressure steam, no heat exchangers
- No side centrate or waste stream for further treatment
- Flexible, back-end solution (after dewatering) - no interferences
- Can be paired with (other), existing, pre-treatment processes
- Multi-use end product

- **Strong R&D program**

- Academic and industrial collaborations for continuous process and product improvement



# Advanced Technology & Benefits

- **Strict Odor Control**
  - Totally enclosed facility – feedstock material receiving and processing area, enclosed reactors, air handling and odor abatement train
  - Storage: enclosed storage tanks, covered lagoons
  - The product: stable, homogeneous, reduced odor, no pathogen regrowth, limited exposure to air
  - Transport: enclosed tanker vehicles
  - Land application: sub-surface injection



# Thank You



**Nothing wasted.  
Everything to gain.**



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