About Lystek

- Biosolids management specialists providing services:
  - Biosolids processing
  - Fertilizer production
  - WWTP optimization

- Proprietary technology & intellectual property that is protected by several US and CDN patents

- Founded in 2000 in Canada

- Experienced management team

- Ownership: management and RW Tomlinson Ltd., Ottawa

- Tomlinson - a 60 year old company with 2,000 employees and prominent player in construction and environment services

- Financial and performance guarantees backed by Tomlinson
Biosolids – Resource not Waste

- Wastewater / biosolids are now considered a means of resource recovery not a waste
- Currently about half of the biosolids volume produced in North America is land applied as a fertilizer or soil conditioner
- The trend is moving towards cost-effectively producing Class A Exceptional Quality biosolids or registered fertilizers
- Biosolids reduction, biogas recovery and utilization for heat and electricity generation
- Nutrient (N, P, K, Mg & S) recovery potential from wastewater

Nothing wasted. Everything to gain.
Biosolids Management Options

- Landfilling
- Land application of Class B biosolids
- Incineration
- Composting
- Alkali stabilization
- Thermal hydrolysis
- Thermal drying
- Thermo-alkaline hydrolysis (Lystek)

- Technology has advanced - allows materials to be viewed as “raw materials” - a resource that can be transformed & beneficially utilized - in sustainable ways
- Municipalities & generators have a role to play in ensuring this happens!
How can the Industry Help?

SOLUTIONS/BENEFITS

• Keep advancing & refining biosolids & organics management programs to meet and /or exceed guidelines for beneficial use

• Produce safe & healthy fertilizer products that can be sold to reduce ongoing costs for generators – (i.e. farming, greenhouses, sod farms, etc.)

• Develop revenue generating models that assist in short & longer term cost recovery

• Provide solutions that help to increase biogas recovery & conversion of materials into “green energy” while reducing costs & overall volumes
Land Application

- More sustainable and beneficial than landfill etc.
- Globally – is dominant practice that takes place in many countries
- Has been in place for over 30 years and it is growing
- Biosolids contain important nutrients that are beneficial for crop growth
- Biosolids contain organic matter that enhance the soil structure
- Farmers can save by reducing the use of chemical fertilizer
Lystek’s Sustainable Solution

- Safe, sustainable, 100% beneficial reuse
- Decreases management & disposal costs
- Meets demand of local farmers for organic, nutrient-rich fertilizers
- Decreases use of chemical fertilizers
- Helps reduce social, environmental, agricultural & economic pressures
LYSTEK

- Biosolids / Source separated organics (SSO) processing
- Fertilizer production/ Land application
- WWTP optimization/ Enhanced digestion
- Lagoon biosolids cleanup/ Application
How does Lystek do it?

THE TECHNOLOGY

• A patented process that uses a combination of heat (158-167°F/70-75°C), pH 9.5-10.0 using KOH/NaOH and high shear mixing for up to 45 min

• End product – pathogen free, high-solid (14-17%), liquid fertilizer product (<5,000 cP) with high nutrient (NPK) values

• Registered fertilizer with Canadian Food Inspection Agency (CFIA)

• Meets US EPA Class A EQ criteria

• Recycling the product to anaerobic digester improves biogas yield (>30%) and reduces biosolid volume (>20%)
Strict Odor Control

OUR PROCESS

• Waste receiving, processing: enclosed facilities, enclosed reactors, odour abatement train

• Transport: enclosed liquid tanker

• Storage: enclosed storage tanks, covered lagoons

• The product: stable, reduced odor, no pathogen regrowth

• Application: subsurface injection
The Product - LysteGro
# LysteGro - Nutrients

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Lystek Biofertilizer (% dry wt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Solids</td>
<td>15 - 17</td>
</tr>
<tr>
<td>Volatile Solids (% of TS)</td>
<td>50 - 55</td>
</tr>
<tr>
<td>Total NH₄-N</td>
<td>1.0 – 2.0</td>
</tr>
<tr>
<td>Total NO₃/NO₂-N</td>
<td>0.003 – 0.005</td>
</tr>
<tr>
<td>Total Kjeldahl N</td>
<td>4.0 – 5.0</td>
</tr>
<tr>
<td>Total P</td>
<td>3.0 – 3.5</td>
</tr>
<tr>
<td>Total K</td>
<td>2.0 – 4.0</td>
</tr>
<tr>
<td>Total Ca</td>
<td>2.8 – 3.2</td>
</tr>
<tr>
<td>Total Mg</td>
<td>0.4 – 0.5</td>
</tr>
</tbody>
</table>
# LysteGro – Pathogens non-detectable

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>MDL</th>
<th>Class A Criteria</th>
<th>Untreated dewatered biosolids</th>
<th>Lystek treated biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal coliforms (MPN/g dry wt)</td>
<td>1.8</td>
<td>&lt; 1,000</td>
<td>&gt; 1,600</td>
<td>&lt; 1.8</td>
</tr>
<tr>
<td>Escherichia coli (MPN/g dry wt)</td>
<td>1.8</td>
<td>-</td>
<td>&gt; 1,600</td>
<td>&lt; 1.8</td>
</tr>
<tr>
<td>Salmonella (P-A / 25 g)</td>
<td>1</td>
<td>&lt; 3 MPN/4g</td>
<td>POS</td>
<td>NEG</td>
</tr>
<tr>
<td>Polio virus (pfu / 4g)*</td>
<td>1</td>
<td>&lt; 1</td>
<td>776</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Ascaris eggs (per 4g)*</td>
<td>1</td>
<td>&lt; 1</td>
<td>131</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>
Ease of Land Application

Stable liquid product

- High-solids low viscosity (<5,000 cP) liquid product is easier to manage – store, transport and land apply using conventional equipment
- Nutrient value: (15% TS) >$430/acre @ 3000 gal/acre application

Listek
Nothing wasted.
Everything to gain.
Corn Trial at University of Guelph

No Fertilizer | Lystek Fertilizer | Chemical Fertilizer

Lystek
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# Greenhouse Gas Reduction Potential – BEAM model 1.1

<table>
<thead>
<tr>
<th>Biosolids management scenarios</th>
<th>GHG Estimate (Mg CO2 eq. / 100 DT AD biosolids eq.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill</td>
<td>297 - 335</td>
</tr>
<tr>
<td>Incineration</td>
<td>- 23 to 224</td>
</tr>
<tr>
<td>Heat drying</td>
<td>51 - 71</td>
</tr>
<tr>
<td>Compost</td>
<td>6 - 34</td>
</tr>
<tr>
<td>Land application (Class B cake)</td>
<td>- 40</td>
</tr>
<tr>
<td>Lystek AD biosolids to land</td>
<td>- 49</td>
</tr>
<tr>
<td>Lystek, 30% recycle to AD, electricity production, rest to land</td>
<td>- 47</td>
</tr>
<tr>
<td>Lystek, 30% recycle to AD, heat production, rest to land</td>
<td>- 63</td>
</tr>
<tr>
<td>Site</td>
<td>Guelph</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Status</td>
<td>operating</td>
</tr>
<tr>
<td>Biosolids</td>
<td>18,000 t / 22-24%</td>
</tr>
<tr>
<td>Capacity per hour</td>
<td>10 m³ (2600 gal)</td>
</tr>
<tr>
<td>Ownership</td>
<td>Guelph</td>
</tr>
<tr>
<td>Solution</td>
<td>On site</td>
</tr>
</tbody>
</table>

Serving multiple municipalities: Toronto, Ottawa, Orangeville, Peterborough, Regions of Halton & Waterloo etc.
WWTP Process Optimization

- Lystek process makes biosolids more amenable to further degradation of residual volatile solids when fed back to the anaerobic digesters.
- SCOD is ~35% of TCOD in the Lystek product.
- Lab and pilot tests have shown >30% improvement in biogas production and corresponding solids reduction.
- Lystek’s hydrolyzed product provides a readily available nutrient source for the anaerobic microorganism.
- Provides a cost effective source of readily available carbon for denitrification process in BNR system.
WWTP Process Optimization

ENHANCED ANAEROBIC DIGESTION & BNR SYSTEMS
On site solution (at WWTP): small footprint, typically 8 m * 15 m

City of Guelph

Town of St. Marys
Off-site Regional Lystek Facility

Dundalk, Ontario, 150,000 tons/year

Lystek

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Everything to gain.
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Dundalk OMRC
Summary of Benefits

• Scalable and Affordable
  - Simple, affordable, proven – can be made available to all sizes of communities – not just for “big” cities and municipalities

• Environmentally Safe & Responsible
  - Safe, healthy & sustainable, lowers overall carbon footprint (GHG)
  - Metals and Pathogens - meets or exceeds all health and safety guidelines as set out and regulated by MOE, OMAFRA & CFIA
  - Recycling to anaerobic digester improves biogas yield and reduces volumes

• Agricultural Benefits
  - Cost effectiveness and high nutrient value of the product has been recognized by farmers
Thank You - Q & A’s

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