Who are we?

• Proven, award-winning provider of solutions for the conversion of biosolids and other organics into a CFIA registered (Class A EQ) fertilizer product.

• Solutions from the Waste Water Treatment Plant - through to beneficial end use.

• Founded in 2000 at the University of Waterloo, headquartered in Cambridge, Ontario
  - Proprietary technology - protected by numerous US and CDN patents.

• Experienced management team – expertise in microbiology, wastewater engineering, regulatory affairs, agrology, business development & marketing/communications

• Converting materials into valuable products with a range of uses including;
  - Agriculture, sod farming, horticulture, golf courses, marginal soil revitalization
  - Other uses/benefits in WWTP optimization (digesters, BNR systems, etc.)
Who are we?

• Owned by management team & RW Tomlinson Ltd, Ottawa, Ontario (billion dollar, privately held corp. >1000 employees) Strong financial backing & guarantees

• Patented protected technology – series of existing & pending patents

• Low temperature thermal hydrolysis technology - after digestion & dewatering

• Produces a hydrolyzed, multi-use, end product:
  • Fertilizer, CFIA registered (Canada) & Class A EQ (U.S. EPA)
  • Digester enhancement, improves biogas yields, reduces overall volumes
  • BNR – alternative carbon source (replacement for methanol/glycerol)
Why were we founded?

• Disposal of biosolids & other organics in landfills is not considered sustainable – is being disallowed by regulators in some regions/geographic areas

• Escalating management challenges & costs - forcing communities to re-think approaches

• Program diversity/risk mitigation is strongly desired:
  - Generators are looking for safe, proven solutions
  - Fiscally & environmentally responsible – short & longer term
  - Public understanding & acceptance is key
Peak Phosphorus study – 2010;

• “The supply of phosphorus from mined phosphate rock could ‘peak’ as soon as 2033, after which this non-renewable resource will become increasingly scarce & expensive.”

• “We are completely unprepared to deal with the shortages in phosphorus inputs, the drop in production and the hike in food prices that will follow.”

• “In the longer term on a global scale, the majority of human excreta will need to be returned to a large proportion of agricultural soils to close the phosphorus loop.”

• “We need to start thinking of human excreta as a resource, not a waste.”

U.K. Soil Association – 2010
Growth Challenges = Broken Cycle

- Increasing social, environmental & economic pressures
- Decrease in productive farmland
- Increase in use of chemical fertilizers
- Increasing demand on food production
- Increasing use of finite resources
- Increasing disposal costs
- Increase in organic waste

Lytek
Nothing wasted. Everything to gain.
Management options?

- Landfilling
- Historical “Class B” land application
- Incineration
- Enhanced treatment/advanced beneficial use

- Technology has advanced - allows materials to be viewed as “raw materials” - a resource that can be transformed & beneficially utilized – sustainably

- Municipalities & generators have a role to play in ensuring this happens!
What are we hearing?

“Concerns, especially about pathogens, odours, etc. are contributing to a distinct shift away from Class B and toward Class A treatment options.”

WEF/WERF Workshop – “Pathogens for the 21st Century” (October, 2013)
How our solutions help

• Meets &/or exceeds guidelines & regulations for beneficial use - CFIA registered in Canada & recognized as Class A EQ - USA EPA

• Produce high quality, biofertilizer product in high demand – agriculture, sod farming, horticulture, golf courses, revitalization of marginal lands, reclamation & more

• Develop revenue generating/sharing models that help to offset infrastructure investments & ongoing, operational costs for municipalities & other generators

• WWTP optimization solutions that help to increase biogas recovery & conversion of materials into “green energy” while reducing GHG’s & overall volumes of biosolids

• Provide viable solutions for sustainable, long term, beneficial use programs
Solutions - overview

- Biosolids & Organics Processing
- Fertilizer Production & Marketing
- Digester Enhancement
- BNR Alternative Carbon Source
- Plant Optimization

Lystek
How it works

• Processing time: semi-continuous batch – approximately 45 minutes

• Processes 3%-30% biosolids & utilizes a combination of:
  - Heat - low pressure steam (7-8 psi), low temp. 70° c
  - CFIA registered & Class A EQ (time-temp conditions as per US EPA 503 reg)
  - High speed shearing/mixing (cell lysis)
  - pH adjustment (9.5-10) using alkali

• Produces a high solid (14-17%) homogeneous, liquid biofertilizer product that remains stable & pathogen “free” over time
Lystek System

Dispersers & Process Reactors = Small Footprint
What are the benefits?

**BETTER ENVIRONMENTAL PERFORMANCE**

- No more landfilling – improves diversion rates, safe & sustainable
- Pathogen “free”, no regrowth during long term storage - tested up to three years
- Process & system practically eliminates odors, reduces GHG’s & operational costs
- Applied at same rate as commercial fertilizers – with organic benefits & far less cost
- End product meets or exceeds stringent, regulatory guidelines of MOE’s, DEP’s & all other regulatory agencies in U.S. & Canada – CFIA & US EPA
## LysteGro fertilizer – pathogen kill

<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><em>Escherichia coli</em> (MPN/g dry wt)</td>
<td>1.8</td>
<td>-</td>
<td>&gt; 1,600</td>
<td>&lt; 1.8</td>
</tr>
<tr>
<td><em>Salmonella</em> (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><em>Ascaris</em> eggs (per 4g)*</td>
<td>1</td>
<td>&lt; 1</td>
<td>131</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>
LysteGro fertilizer – “Liquid Gold”
LYSTEK PRODUCT LABEL
Registration Number 2013059D Fertilizers Act

BRAND: LYSTEK
FERTILIZER NAME: NUTKRGROWELL
GRADE: 3-3-3
MANUFACTURER: Elora Wastewater Treatment Plant
Centre Wellington, County of Wellington
49 Guelph Road, Elora, ON N0B 2S0

NET WEIGHT
LOT NUMBER

GUARANTEED MINIMUM ANALYSIS:
Total Nitrogen (N) ...................................................... 3%
Available Phosphoric Acid (P₂O₅) .................................. 3%
Soluble Potash (K₂O) .................................................. 3%
Organic Matter ........................................................... 5%

DIRECTIONS FOR USE:
Maximum application rates for Lystek product should not exceed 8.0 dry tonnes per hectare. Reference should be made to local Agricultural Guidelines regarding crop nutrient requirements prior to using Lystek Product. The product should be used based on soil and/or tissue analysis.

MATERIAL SAFETY DATA

PHYSICAL PROPERTIES
FORM: Semi-solid
SOLUBILITY: Partially soluble in water
pH VALUE: 7 - 10

FIRE AND EXPLOSION DATA
EXTINGUISHING MEDIA: CO₂, Dry powder, foam, water

PRECAUTIONS IN USE
EYE PROTECTION: Safety Glasses
HAND PROTECTION: Rubber Gloves
PROTECTIVE CLOTHING: Overalls
RESPIRATORY PROTECTION: N/A
VENTILATION: N/A
OTHER PRECAUTIONS: Do not eat, drink or smoke while handling material

STORAGE: Liquid storage tanks or lagoon
SPILLAGE: Prevent from entering drain
WASTE DISPOSAL: In accordance with local regulations
PRODUCT CLASSIFICATION
CONVEYANCE: Protect from leakages
HAZARDS
SKIN: May cause irritation. Wash with water and soap
EYES: May cause irritation. Flush with water thoroughly. Seek medical advice if irritation persists
LUNGS: May cause irritation. Remove patient to fresh air. Seek medical advice if irritation persists
INGESTION: May cause illness or upset stomach. Seek medical advice

KEEP AWAY FROM CHILDREN
February 27, 2014

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

Ward Januza,
Lystek International Inc.
1525 Bishop St. # C Unit 36
Cambridge, Ontario, N1R 6G0

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

Dear Mr. Januza,

Thank you for your e-mail and attached paper from Dr. George Nobile 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 most effective at reducing the volatile solids, with levels 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 250 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 regulations.

Please contact me at 415 972-3514 or Pauline.Jackson@epa.gov with any questions regarding this.

Thank you,

Lauren Prescott
Biosolids Coordinator, WTR-5
...and what else?

EASY TO OPERATE, BETTER PERFORMANCE, LOWER COSTS

• Simple, proven equipment, easy to operate & inexpensive to maintain
• Small footprint – easy to retrofit to existing facility infrastructure
• Digester enhancement approach can be leveraged to enhance the performance of Anaerobic Digesters, BNR, or as a possible alternative to Anaerobic Digestion:
  – Reduces biosolids generation by 25% (or more)
  – Increases biogas yields by 25% (or more)
  – Reduces storage requirements
Digester optimization – example

ENHANCED ANAEROBIC DIGESTION & BNR SYSTEMS

Optimization of biogas (methane) production for “green” energy

Reduced polymer use, reduces volumes, requirements for storage & transport
...and what else?

- First company (in our space) to be accepted by the Canadian Fertilizer Institute
- Federally registered, nutrient-rich fertilizer
- High in organic matter & micronutrients = excellent for soil
- Liquid nature allows for sub-surface injection, maximum benefits of nutrients, timely & precise placement, strong odour mitigation
- Substantially reduces costs compared to commercial/chemical fertilizers
- Third-party field trials have already shown remarkable results in yields
How are growers reacting?

• Acutely aware of input costs, soil conditions – importance of restoring (not only) micronutrients - but also critical moisture, organic matter – back to the soil

• Looking for ways to reduce input costs – lessen dependency on commercial fertilizers

• Interested in affordable, nutrient-rich, organically-based fertilizer products, particularly if they are recognized/certified by regulators

...AND THEY ARE WILLING TO INVEST IN THESE SOLUTIONS!
Land application – standard equipment
Western Canada Case Study
City of North Battleford, Sask.
City of North Battleford

Project Background

• Wastewater Plant (built in 2006) services 14,000 residents

• Existing staff of four plant operators, an IT person, a mechanic & one foreman

• 2200 tonnes of biosolids produced annually

• Historical biosolids disposal option was at the local landfill
City of North Battleford

Project Drivers

• City was experiencing challenges with odours & other issues due to landfilling & was provided with the following mandate by the Provincial Water Security Agency;

“..the City must have the facility constructed and operated in accordance with any applicable Water Security Agency standards, permits to construct & good engineering practices. The process shall be in operation by no later than November 1, 2015.”

• Wanted a beneficial use option with Class A product that could be sold – generate revenue

• Solution had to fit within a limited capital & operating budget

• Solution needed to minimize the hiring of additional staff
Options? Five Year Search...

- Landfilling – not allowed
- Composting
- Incineration
- Enhanced treatment/advanced beneficial use
RFP Issued in Dec., 2013

Request For Proposal (RFP) to design and construct a facility to convert biosolids into a fertilizer was issued. Key points asked in the RFP were:

1. Proposed biosolid treatment process will convert the wastewater treatment plant (WWTP) biosolids to a Class A (or equivalent) fertilizer.
2. That the process be acceptable to the Saskatchewan Water Security Agency (WSA).
3. Proposals will estimate the capital and operating costs for their treatment process, including any costs to modify the existing WWTP.
4. Will include in their capital costs, commissioning and training services, as well as ongoing, operational support for a 5-year period after commissioning.
5. That the awarded firm would enter into a revenue share agreement with the City to market the Class A (or equivalent) end biofertilizer product.
RFP – responses

...were received in the following, three categories;

• Composting

• Lime Stabilization

• Lystek (low pressure/low heat) Thermal Hydrolysis

A review committee was formed to analyze, discuss all options/submissions & provide a recommendation to Council.
RFP - findings

1. Composting:

• Could convert the biosolids into a soil amendment product.

• Would require 7-additional WWTP staff to operate the treatment facility.

• Would require approximately 10 acres of land – not included in the capital costs.

• Would require biosolids from other communities to reduce operational costs.

• Estimate of approximately 3 months to construct the facility upon WSA approval.

COSTS

Construction Capital = $2,371,950 (land not incl.)
Estimated Yearly Operating = $2,647,186
Operating Cost (per tonne) = $1,102.99/tonne
RFP - findings

2. Lime Stabilization:

• Takes approximately 12 hours to convert the biosolids into a “dry” soil amendment product.

• Would require no further City staff, but would require an outside employee, storage silo, truck and a front end loader to transport and handle the treated material from the WWTP.

• Storage silo cost were included, however, no costs for truck and front end loader

• Estimated design and construction time of approximately 16 months to be in operation

COSTS

Capital Construction = $5,059,950 (truck & loader not incl.)
Estimated Yearly Operating = $236,250
Operating Cost (per tonne) = $118.13/tonne
RFP - findings

3. Lystek (Low heat/pressure Thermal Hydrolysis):

• End product is liquid, CFIA registered (Class A) fertilizer – proven in market.

• 45 mins. – 1 hour (max) processing time per semi-continuous batch to fertilizer product.

• Lined & covered storage lagoon or tanks required to store the finished product – costs for lagoon were included in the proposed contract.

• Retrofit into existing biosolids facility – estimated construction time of approximately 1 year.

• No additional staff required – included revenue share + five year sales & marketing support.

COSTS

Capital Construction = $3,197,250 (all inclusive)
Estimated Yearly Operating = $71,400
Operating Cost (per tonne) = $21/tonne
Recommendation & next steps

- North Battleford staff recommended to Council that the City approve & proceed with the plan as proposed by Lystek

- Lystek was awarded the contract to modify the biosolids handling system & install the solution in the existing building - total, capital cost = $3,197,250 (plus tax)

- Project commenced in January of 2014.
Biosolids building—before install

Truck loading bay/Processing area
Before install/retrofit

Polymer Area / Boiler Room
After install/retrofit

Polymer Area / Boiler Room
Lystek system – installed
Results – post deployment

• Project was completed on budget & approximately one full year ahead WSA mandated deadline

• Training and commissioning commenced in December 2014 + ongoing support

• Product marketing - fertilizer customers committed for 2015 application season

• Savings on dewatering polymer already realized (>40%)

• No additional operational staff required – minimal plant disruption
Resource Recovery = Responsible Re-Use

RECOVER ORGANICS & ENRICH SOILS
- Decrease organic "waste"
- Decrease management costs

AREA GROWERS
- Meet demand for food production
- Increase use of organically based fertilizers & nutrients

RESPONSIBLE RE-USE
- Alleviate social, environmental & economic pressures

DECREASE RELIANCE ON FINITE RESOURCES

DECREASE USE OF CHEMICAL FERTILIZERS

Lystek
Nothing wasted. Everything to gain.
A great “green” story...

Fertilizing the Prairies

Application of municipal biosolids on farmland has traditionally presented some nuisance problems. But a new treatment process often an array of nutrients for farm use without the risk

A better way to land-apply biosolids

that municipal biosolids have value for farm fields, but cause some harassment. “There were some technical issues, there were some issues with application or prime handling.” The introduction of standardized non-agricultural stormwater rules and regulations, which came into effect in 2001, saw a steep decline, he says, even with those measures in place, he provides the use of biosolids like the ones

Better Farming

A promising future for treated biosolids on the farm

Thank You

Nothing wasted.
Everything to gain.

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e: info@lystek.com
w: www.lystek.com
s: