## Waterloo Biosolids Story – History, Research & Technology

Given the recent interest and discussions in our Region on biosolids, this submission summarizes more than a decade of Waterloo-based research on biosolids processing. The vision was to develop processes to make locally based, University of Waterloo spin-off, Lystek International Inc., into a global, industry leader in biosolids management. Achieving this goal required collaborative research between the University of Waterloo and other top Canadian researchers and Universities. Additional support was provided by the Government of Canada, the Federation of Canadian Municipalities and various private industry partners. Our objectives were to make meaningful contributions to environmental sustainability with comprehensive biosolids processing solutions and be recognized for setting new standards for health and safety amongst all industry stakeholders including regulators, scientists, practitioners and the community at large. The result is the emergence of a whole, new, green manufacturing approach and the delivery of quality assured products and services.

It is globally accepted that the long-term security of our food supply demands that biosolids and other organic ``left overs`` from food production and consumption be recycled into safe biofertilizers for sustainable use in agriculture. This is especially urgent because our world food supply needs to double by 2050 to feed our global population, estimated to be 10 billion by 2050 and the resources required to make chemical fertilizers are rapidly depleting. Plus, landfilling and incineration are being phased out and are no longer considered acceptable options for disposal.

The Waterloo team reviewed global trends as well as all strategic management options for biosolids, including landfilling, incineration, gasification, various forms of biosolids drying, production of liquid concentrates, recycling methodologies to produce bio-energy as well as various combinations of these options. As part of this process, biosolids handling facilities were visited on three continents and best practices related to health, safety and economics in the chemical and biological processing of both liquid and solid products were observed and considered.

Some of the common parameters evaluated in the risk analysis process were pathogen and odour reduction, heavy metals and product stability. Research found that, with dry biosolids, the US EPA and Occupational Safety and Health (OSHA) warn of fire and explosion risks as well as negative health impacts on lung function related to dust and particle inhalation from dry biosolids. In short, dried biosolids are combustible and known to cause work-related asthma and other health and safety risks during production, storage, transportation and field application.

The first, common industry response to these risks is to try to re-engineer enhanced safety measures into plant and storage facilities. However, the major dust-related risks intrinsic to dried biosolids cannot be resolved by re-engineering the drying process. The second response is to try to implement enhanced safety measures in the product. This approach requires the addition of more components resulting in significant, additional capital costs to reduce risks. The added costs then cancel out the principal advantage of drying, which is the reduction of volumes to handle.

The Waterloo team concluded it made no sense to incur significant additional costs to mitigate the risk and liabilities especially given that inherent risk associated with the end product remains after it has left the plant anyway. So, what was the team's response to the risks associated with dried biosolids? Simple - eliminate the risk and go with a liquid product. First, develop an innovative technology that produces a safe, stable biofertilizer while avoiding the health and fire risks. Second, focus on a solution that not only reduces the volume of output requiring off-site disposal but that also increases gas production for conversion to green bio-energy. This process

addresses the principal advantage of dried biosolids, namely the reduced volume for off-site disposal, while also preserving the opportunity to produce and utilize green energy.

This technology has already been proven at the City of Guelph and St Marys and will be central to the new wastewater treatment plant under development in Elora. Plus, the Lystek system will be utilized at two regional processing centres to responsibly manage biosolids from a number of other Ontario communities including Ottawa, Orangeville, Peterborough, Toronto and more. The technology has won the NRC-Regional Innovation Award and two Exemplary Biosolids Management Awards from the Water Environment Association of Ontario. It was also nominated by the University of Waterloo for the Premier of Ontario Award for Water Innovation. Key Canadian and U.S. patents have also been granted to Lystek for the protection of its intellectual property and its agricultural products are registered and recognized as true fertilizer by the Canadian Food Inspection Agency.

In my follow up submission, I will discuss how our Waterloo technology stacks up against heat drying technology.

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