Storage Tanks Containment & Spills

A diverse range of case histories and new developments is reviewed in **ES&E's** semi-annual look at tanks, containment systems and spill management.

Continued development of tank testing protocols benefits new green bin composting facility

By Darrin Hopper

In 2002, the City of Toronto started its Green Bin Program for Source Separation of Organics (SSO). It is a critical component of "Target 70", the City's goal of achieving a 70% diversion rate from landfill.

Toronto currently collects more than 110,000 tonnes of residential and commercial SSO annually, from green bins at more than 500,000 single family dwellings. To meet a collection target of around 180,000 tonnes of SSO per year, the City is now embarking on the next phase of its strategy. This involves providing green bins to multi-family dwellings, including schools, apartments and high rise condo buildings.

To-date, the majority of the SSO collected has been processed by aerobic composting. However, this process does not harness its energy potential. To meet current and future processing capacity and to capture the renewable energy potential of the collected SSO, Toronto has expanded its existing Dufferin Organics Processing Facility (DOPF), which utilises an anaerobic digestion (AD) process.

It has also added a second AD facility on Disco Road, located just east of Lester B. Pearson Airport. The City contracted an AECOM-led team to deliver a full design-build-operate service for the new Disco Road facility. Once both projects are completed, the City will have two facilities with a combined processing capacity of up to 130,000 tonnes annually. (55,000 tonnes per year from the Dufferin plant and 75,000 tonnes per year from the Disco Road plant).

In 2011, H2Flow Tanks & Systems Inc. erected a Permastore glass-fused-to-steel bolted tank at the original DOPF.

The BTA Process[R] is the technology selected for the new Disco Road facility. It is the same process that has been in operation since 2002 as a technology demonstration project at the DOPF. Key features of the two AD facilities include the BTA Hydropulper and BTA Grit Removal (hydrocyclone) preprocessing technology. This pre-treatment stage pulps and cleans the SSO material, prior to digestion, separating both the light (mostly plastic) and heavy (glass, stone, metal, etc.) contaminants.

Removing contaminants, prior to digestion, ensures trouble-free digester operation and that the digested organics

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are suitable for producing Category A compost at external composting sites. Under the new draft Ontario Compost Guidelines, this compost can be marketed for unrestricted use as a beneficial fertiliser and soil conditioner.

The anaerobic digestion stage of the process converts volatile organics of the SSO into biogas, with a methane content of around 60%. Biogas at the DOPF is currently flared. Plans are underway to review options for energy utilization for both facilities by upgrading the biogas. This includes biomethane for injection into the natural gas pipeline network and fuelling City-owned vehicles.

In 2011, H2Flow Tanks & Systems Inc. erected a Permastore glass-fused-to-steel bolted steel tank at the original DOPF. The first tank, installed in 2001, required shut down for maintenance and cleaning. Erection of the new tank allowed for future expansion and growth to meet the City's green bin demands. H2Flow worked closely with BTA on this project, which helped with the design of the much larger Disco Road facility.

The project involved eight tanks.

H2Flow and AECOM worked together to get the design, layout and structural requirements of eight bolted steel tanks coordinated and shipped to site for erection within a tight timeline. H2Flow also provided the sequencing batch reactor (SBR) treatment system and associated tanks for the liquid waste from the facility.

One very interesting aspect of this project was the regulations around pressure testing and sign off of the access requirements. These are governed by the Technical Standards & Safety Authority (TSSA) - Fuels Safety Engineering Program. They are the body in charge of upholding the CAN/CGA B105-M93 and the newly released code CSA-B149.6-11. Clause 8.3.1 of CAN/CGA-B105-M93 specifies that "in the roof of a digester with an internal diameter larger than 15m, there shall not be less than three manholes, at least one of which shall not be less than 1.05m internal diameter, and of sufficient area to allow a man equipped with an air pack, easy access into the digester using a portable ladder."

The other manholes are for venting and are typically distributed evenly around the roof.

This code was written around typical municipal concrete pancake digesters that are not designed for mixing efficiency or maximization of biogas production. Access to these digesters was typically designed through a large opening in the roof structure as they had no sidewall access. Because steel tank structures have grade level access there is not a requirement for such a large opening in the roof structure. The structural beamed roof design actually precludes design of an access manhole this large.

TSSA simply provided a letter of variance and the work done in the discovery and letter of variance on the DOPF site helped facilitate work on the Disco Road site.

The newly released code CSA-B149.6-11, soon to be adopted in Ontario, does not qualify the tank by a percentage of pressure drop. It has formulas to calculate the loss of volume extrapolated over a 24 hour period. It is understood that during the re-writing process for this test the committee members agreed not to state a maximum percent loss per volume. This is because there is no historical value to set a reasonable standard. Instead, it was agreed for committee members to collect data to be used to establish loss criteria for the next edition of the code.

It is common knowledge that field testing has certain environmental conditions which cannot be accounted for, such as wind conditions and the exact placement of a signal thermal couple inside the tank. It is also common knowledge that steel tanks are affected more by these conditions than concrete tanks.

Based on Permastore's experience in other markets, the only definitive measure of determining that there are no gas leaks in a bolted steel tank is with a soap test. This is typically done at 1.5 times maximum operating pressure, over the period of time it takes to soap the gaseous zone of the tank.

The experience gained from tank testing at the Dufferin Organics Processing Facility site was invaluable. This included an attempt to eliminate the temperature variance by getting the tank up to pressure for three hours at night in order to eliminate temperature variance from the sun and the wind. The difficulty with this was the window of time it took to build pressure as the temperature was dropping. Tank testing at the Disco Road site was a much simpler process as it followed the European time tested method of bringing the pressure up to the 1.5 times max operating level (as per the CSA code) and soap testing the gaseous zone of the tank. The new CSA code was applied and some of the first historical data was collected for the calculation of allowable pressure loss formula.

The Disco Road project is almost fully completed and is entering the commissioning stage. The majority of the tanks are now covered with insulation and cladding, in order to maintain the required operating temperatures for the anaerobic digestion process.

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