REVIEW OF PRESENTATIONS
AT WESTSIDE SOLUTIONS' INNOVATION DAYS

The following are my comments following the review of the presentations made on Westside Solutions' Innovation Days on April 28, 29 & 30, 2015.

ECOfluids Systems Inc. provided the initial presentation. Their presentation indicates that ECOfluids Systems was purchased by NORAM Engineering and Constructors Ltd. in 2012. ECOfluids patented technology is the USBF® (upflow sludge blanket filtration) technology, which is one of the many activated sludge process modifications. The USBF reactor has an integral clarifier which limits the control of biomass recirculation and has a significant, negative impact on effluent quality. ECOfluids Systems Inc. identified the Town of Strathmore's 4 ML/d plant as one of their case studies. Because of operational problems at the plant approximately 12 years ago, I was involved in a process evaluation and an attempt to establish consistent plant performance. The plant was being contract operated and with the plant continually out of compliance, the contract operator paid approximately $2 million for the conversion of the USBF to an SBR (sequencing batch reactor). About 5 years ago the Town issued a performance based design-build RFP and the SBR was converted to a BNR (biological nutrient removal) activated sludge plant at a cost of $21.1 million; the plant has a 16 ML/d design capacity for a 50,000 population equivalent design.

The second presentation was by NORAM Engineering and Constructors Ltd of Vancouver. NORAM's technology is the VERTREAT™ which is the latest version of the Deep Shaft technology introduced to North America by CIL about 25 or 30 years ago. I was involved in pilot plant projects at Agropur in Quebec and at the Dominion Textiles plant in Brantford, ON, as well as full-scale plants at Molson's brewery in Barrie, ON and municipal plants in Virden and Portage la Prairie, MB. None of these original systems were mentioned and I doubt that any of them are operational. The system can be made to function well but the systems cannot exceed organic and hydraulic design capacity and thus, require flow equalization as they have very limited capacity to handle flow variation. Dissolved air flotation for biosolids removal functions well as entrained air from the bioreactor is released and floats the biosolids to the surface. As presented, these plants can easily be located within a built up area but they will be expensive. Construction issues are a concern as in the Molson's brewery plant the contractor left a 48" diamond drill cutting head in the hole at about 420 feet; the contractor paid the extra cost to relocate the shaft in a new location on the project site. The plant performed as per design specifications until the brewery was shut down a number of years ago.

I just reviewed the Econo Services (India) Private Limited presentation again and I really don't know whether they have anything that would be of interest to CRD. They said that they have a unique activated carbon catalyst and use chemoautotrophic bacteria in a fluidized bed reactor. Chemoautotrophic bacteria are required to convert ammonia to nitrites and nitrates but do not remove organic carbon. They also state that the sludge is fully digested and that there is no sludge for disposal. The concept of fully digested sludges within the operating reactors means the bacteria (heterotrophs and autotrophs) consume the active biomass or cannibalize mature cells. While at Environment Canada's Wastewater Technology Centre we were contacted by an

innovator that insisted that he had a fixed film fluidized bed system requiring no sludge wasting. We ran a pilot scale system for more than a year with very low sludge production (not no sludge production as claimed by the proponent); however hydraulic and solids retention times were high which represents an increased capital cost and increased energy/O&M costs. If there is any interest in considering this option, I would contact the Singapore Land Transport Authority to determine what they achieved in the 1000 m^3/day pilot plant study. You would need to see some independent third party data and find out whether the Authority has proceeded to full scale and if not, why not. In summary, this was a very poor presentation with minimal data to convince a client why they should consider their technology in a municipal resource recovery application.

The Mequipco presentation by Rob Hacking was of the quality expected. I've always been a strong supporter of the Salsnes technology developed by the Research Institute in Norway. For the smaller systems (<10 ML/d) this should certainly be considered for the primary solids removal. The presentation on the Zenon/GE Water membrane system was excellent; however we have to consider that they are not the only supplier of membranes for the MBR systems. A few years ago Kubota's flat sheet membranes were installed in more than 5000 plants while Zenon had 1500 plants. Zenon had all the large plants so treated much more wastewater than Kubota; however for the smaller sizes Kubota and others need to be considered. Premier Tech Aqua a Canadian company based in Quebec with a significant western Canada presence and an extensive international presence, markets a flat sheet membrane manufactured in Germany. FibraCast located in Ancaster, ON, is a serious competitor to GE Water as they have reduced both capital and operating costs. FibraCast's first full-scale installation replaced a Kubota membrane system at a plant in Italy. If water reuse or groundwater recharge is to be considered then membranes are the best option.
The Monsal anaerobic system marketed by Mequipco could be investigated further; however, I believe that in the green field situation which exists in CRD there are better solutions for biosolids and organic/kitchen solid wastes.

The World Water Works presentation represents another secondary treatment option. The MBBR /Ideal DAF technology represents an ideal system for industrial wastewater pre-treatment with discharge to a municipal sewer. The technology could be considered for the larger systems; i.e., the 50ML/d units, but because of it operations complexity, I wouldn't be considering it for a network of smaller distributed plants. Their technology has apparently been selected for Lady Smith on Vancouver Island and thus, their choice of technology should be assessed. Ideal DAF incorporating microbubbles for flotation was likely the reason why the technology was selected as there was a very small parcel of land available for plant construction. World Water Works application of micro bubbles in their DAF reactors improves the solids removal capability; however it is still not as reliable as any of the membrane systems used in the membrane bioreactor technology. Solids excursions will occur from DAF systems which really can't be tolerated in water reuse applications and thus, I would always recommend a membrane system over a DAF clarifier technology.

The Veolia presentation by Chris Howarth was an excellent presentation and the inclusion of the Sechelt plant as an example gave it a local presence. I spent a considerable amount of time investigating the European installations of the Organica' technology being used at Sechelt and the jury is still out on its merits. We will have to see how well Sechelt's system functions. It is a

relatively expensive option however with the X-flow membranes they will definitely achieve a high quality effluent. The MBBR - DAF system with the Kaldness media has been a work horse for Veolia but it does not produce a tertiary quality effluent. The MBBR - DAF at the Canmore, AB, wastewater treatment plant which was failing, used proprietary clay media which could only be purchased from John Meunier, the supplier of the plant. The media kept washing out of the system and John Meunier would only sell them more of the expensive media and would not fix the problem. My report to Mayor Casey stated that they should scrap the plant and install a system that worked. This was obviously unacceptable to the mayor as the Town still owed about $10 million for the plant so EPCOR (the operator) and the town went back to John Meunier and they were able to force them to make modifications to bring operations and performance to acceptable standards.

I don't know much about the BAF system with the Biostyr media. I know that the consultant for the Kingston project, created a situation in the bid process that resulted in a plant capital cost that was significantly more than it needed to be. Veolia obviously considered this to be a favourable procurement option as their technology had been selected and the plant capital cost had not been identified. I would not accept this procurement strategy as the purchaser is locked into a solution with no upside on the costs. This approach generates very significant profits for the project consultants and the equipment supplier.

I don't know enough about Veolia's wet air oxidation technology to comment on its merits or deficiencies.

Veolia mentioned their Hydrotech primary filtration system but did not provide details. This is the type of technology that needs to be considered to reduce the footprint for plants constructed in built up areas. There are other significant benefits such as odour control, minimizing heat loss and better control over primary solids removal. The Salsnes technology provides these benefits.

Another option is the SRS (Sewage Recycling System) technology which has been introduced from Israel and the Netherlands by Bioform Sewage Mining a division of Canadian Sewage Mining Corporation of Alberta. The process replaces the primary clarifier by suspended solids extraction (I don't know how), followed by dewatering, drying and pelletizing. The effluent goes to the MBR and the pelletized primary solids could be fed directly to the gasifier. There is a full scale demonstration project underway at the wastewater treatment plant in Devon, AB; however I have not had a chance to do a site inspection/process evaluation. The closed system reactor is modular and thus we need to determine the maximum throughput per module. Their website indicates that their largest module can treat >50 ML/d and thus a bank of units would cover all of CRD's potential applications. I have asked whether the unit could process a 1.5% mixed liquor from an MBR and they indicated that they had not considered this application. The SRS process is definitely a technology which needs to be considered for the CRD plants.

Lakeside is obviously a leader in the supply of quality pre-treatment / primary technology. The introduction of Salsnes technology as a replacement for primary clarifiers obviously cuts into their market share. The oxidation ditch or closed loop activated sludge systems have been a work horse in the industry for at least 60 years and they have been modified to address today's nutrient removal requirements. Since the closed loop system is an open tank reactor with considerable space requirements they do not fit into the scenario being considered for the Westside or for CRD.

I listened to the Pivotal IRM presentation again and have the following comments. The presentation by Graeme Bethell and Chris Corps is much more focused and provides good technical and economic information essential to address CRD's issues related to sustainable environmental resource management. I am not familiar with the performance data from the Biowater CFIC system however the use of a MBBR with a plastic support media followed by a ceramic membrane will definitely produce a tertiary quality effluent 100% of the time. I've not seen data from a ceramic membrane in this application and I would want to see long term performance data from a unit in this specific application before I could give it a green light. The ceramic membranes are used extensively in the oil and gas industry as it is easy to use thermal processes to extract/remove the oil from the core and surface of the ceramic membrane. Their larger flow diagram identified ultra-filtration or micro-filtration as options and these have a proven track record so could replace a ceramic membrane if there were issues.

The gasifier technology to process the WWTP sludges and the kitchen waste plus some of the MSW needs to be included in the overall process sequence. The cost savings from the displacement of hauled sludge and anaerobic digestion costs, plus the reduction in the MSW haulage and landfill tipping costs, and the carbon credits gained must be factored into the overall financial calculations. They estimate that each module processing 11 tonnes of dry solids per day will generate approximately 4 million kWh of electricity annually plus a very significant quantity of heat. We need to obtain installed capital costs, operating costs and realistic revenue projections in order to develop a life cycle cost analyses. If results are favourable, a full scale demonstration plant needs to be constructed and placed in operation to verify the benefits of the technology at a commercial scale.

Chris Corps said that it was not necessary to use a P3 procurement approach; however it is my opinion that you need a performance based procurement strategy with a performance guarantee and penalties if the integrated system does not perform to contract specifications. Significant financial penalties for non-performance can be included in operations contracts during start–up and long term operation if the private sector is contract operating the plant. A design-build-finance-operate project based on a P3 model will provide these technical and financial guarantees. If you can specify the location, the quantities, the time frame and the required performance from the wastewater treatment and residuals management system, then a P3 procurement will provide a long term solution which is technical viable and most cost effective for the communities.

Review prepared by: Bruce Jank, Ph.D., P. Eng. (ON,AB)
Submitted: September 30, 2015