Making a difference...together

Report #EWW 10-98

**REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE /
ENVIRONMENTAL SUSTAINABILITY COMMITTEE
MEETING OF WEDNESDAY 10 NOVEMBER 2010**

SUBJECT **SLUDGE PROCESSING FOR THE CORE AREA WASTEWATER TREATMENT PROGRAM**

ISSUE

Some committee members have questioned the decision to process sludge using anaerobic digestion suggesting that a thermal destruction process should be reexamined.

BACKGROUND

Early on in the planning stage for the CAWTP, the Core Area Liquid Waste Management Committee (CALWMC) adopted the triple bottom line (TBL) assessment to assist with decision making. The CALWMC received input from the public to weigh the social, environment and economic criteria equally. It was on this basis that the TBL assessment in the *Biosolids Management Plan (BMP), November 2009, Stantec and Brown & Caldwell* showed anaerobic digestion options as scoring the highest and thermal destruction options scoring the lowest (see Table 11.2 in Appendix A).

The Capital Regional District (CRD) technical team of advisors (Associated/CH2MHill) identified anaerobic digestion as the preferred sludge treatment process in March 2007, because it provided the most likely means to recover energy, reduce solids mass and create a product that can be used in a beneficial reuse program. The Peer Review Team reviewed the sludge processing option of anaerobic digestion and considered it “an appropriate choice”.

This sludge treatment process has been identified as the preferred process in all of the public consultation material over the last two years and this public consultation, along with the November 2009 BMP, culminated in the CALWMC approving anaerobic digestion for the Liquid Waste Management Plan Amendment No. 7 in a special meeting of the CALWMC on November 18, 2009.

In the following sections, merits of each of the disposal options are discussed:

1. Comparison of a municipal solid waste – waste to energy (MSW – WTE) facility and an anaerobic digestion facility

   There are a number of significant factors still being assessed before the implementation of a MSW – WTE facility can proceed:

   - The CRD has determined that a facility with a capacity of around 300,000 tonnes per year represents the optimum size to achieve the benefits associated with economies of scale. Currently, the CRD generates approximately 100,000 tonnes per year of residual MSW (not including recyclables and source separated organics (SSO)) and there are discussions underway with the Cowichan Valley and Nanaimo Regional District’s to explore opportunities in developing a tri-regional MSW – WTE. The MSW from these three regional districts is approximately 200,000 tonnes per year (not including recyclables and SSO) and is about two-thirds the optimum amount for a MSW – WTE. Despite this, it would be prudent for the CRD to explore a future MSW – WTE facility that could be used for the south island.

- The capital cost to implement a MSW – WTE for 200,000 tonnes per year, including sludge, is $437 million for mass burn and $539 million for gasification.

- The capital cost for a mass burn MSW – WTE facility plus a separate anaerobic digestion facility is $467 million.

- The WTE capital cost component of these three options ranges between $206 million and $315 million. This capital cost component would be shared between the three regional districts if a tri-regional facility were to be developed. CRD's share would be approximately 50%.

- A 200,000 tonnes per year MSW – WTE facility, including sludge, would generate additional revenues from energy recovery of $12 million for mass burn and $15 million for gasification. The annual operating costs would be approximately $22 million and $23.4 million respectively.

There is also the potential that the proposed WTE facility in Gold River could be considered as an option for the disposal of CRD's MSW. CRD staff recommend that these options be fully explored before making any decisions on a CRD stand-alone MSW – WTE facility.

It is not likely that CRD share of the additional $206 – $315 million in capital costs would be shareable by senior levels of government. It is also not very likely that this facility would be completed by December 2016, as the issue of permitting and public acceptance of thermal destruction of MSW and sludge would also need to be addressed. It is essential that when the wastewater treatment plant becomes operational, the method for sludge management is also in place.

2. <u>Comparison of a stand-alone thermal destruction process for sludge processing and thermophilic anaerobic digestion</u>

Anaerobic digestion is used as the sludge processing technology for approximately 80% of all wastewater treatment facilities across North America and Europe. Many of these jurisdictions are reaffirming their commitment to this process by continuing to explore options to optimize and increase the energy generation from these facilities.

In the TBL assessment of sludge processing options, anaerobic digestion options scored highest and thermal destruction options scored the lowest. This is largely due to:

- the higher social acceptance of anaerobic digestion compared to thermal destruction

- the higher carbon offset of 9,000 tonnes CO_2e per year for anaerobic digestion versus 1,470 and 90 tonnes CO_2e per year increase for fluidized bed and gasification thermal destruction, respectively

- capital cost of anaerobic digestion is $268.5 million; annual operating cost is $6.1 million with potential revenues of $3.1 million

- capital cost of fluidized bed thermal destruction for raw sewage is $284.9 million; annual operating cost is $6.9 million with potential revenues of $0.5 million

- capital cost of gasification thermal destruction for raw sludge is $307.3 million; annual operating cost is $8.3 million with potential revenues of $0.8 million.

It is important to note that all three of these options require the same processes that include dewatering and drying. The amount of dewatering and drying varies with each option.

In addition to the social, environmental and economic benefits of anaerobic digestion outlined above, there are operational issues that must be considered. Raw sludge to thermal destruction poses significant health risks during handling and this is made worse when the thermal destruction facility is not available to receive the sludge. The sludge will be generated 24 hours per day 7 days a week and there is a need to store this material if a disposal method is not available. Raw sludge is very odourous and putrescible. The Peer Review Team indicated that "feeding raw wastewater sludge as a fuel supplement must be done with great care to the design, equipment selection and operation to ensure that pathogenic organisms are not released to the environment and prove a risk to worker and public health and safety."

On the other hand, the biosolids produced from anaerobic digestion are a pasteurized product with the organics stabilized. This product is typically stored on site in an open area protected from rain. It has much less odour potential and it is a very safe product that poses no health risks, during storage and transport. The anaerobic digestion facility will have four digesters with one as a backup to be used during maintenance.

The gasification technology for sludge to thermal destruction received a "fail" under the criteria that the technology must be a proven. It is a promising technology but has a capital cost that is 50% higher than the fluidized bed technology. The gasification technology is complex and operation costs are higher. There is no full scale application for raw sludge in North America. Most of these technologies are operating at a demonstration scale. Existing gasification installations in British Columbia are using only wood waste as a source of fuel.

Sweden has for several decades been making use of MSW – WTE facilities. Of the facilities visited by a delegation from the CRD, none were using incineration as a means of disposing of biosolids. There were a number of examples where the biosolids were applied to willow coppice fields. The harvest from these fields is used as a fuel source in the WTE facilities. Biosolids were also land applied in large scale landscaping and mine reclamation operations, as Swedish farmers do not want wastewater treatment biosolids to be land applied for their food and forage crops. Source separated organics after processing are used as a soil supplement.

3. <u>Comparing electricity production from sludge processing and biogas recovery to displace natural gas</u>

The recovery of biogas and dried biosolids provide a carbon offset when it is used to displace a fossil fuel like natural gas and coal. Whereas, recovered electricity provides very little carbon offsets since BC's hydro generated electricity has a very low carbon footprint. From the perspective to meet the CRD goal of being sustainable and achieving carbon neutrality, anaerobic digestion offers the best result.

FINANCIAL IMPLICATIONS

As noted above.

CONCLUSION

The analysis to date has shown that the preferred sludge processing option is thermophilic anaerobic digestion. This processing option provides the greatest opportunities for resource recovery, enhances volatile solids reduction, gas production and integration with the MSW stream through co-digestion of fats, oils and greases. Anaerobic digestion also stabilizes the biosolids to a Class A level and dried biosolids product maximizes future program flexibility and diversity that could include diverting the dried biosolids to a future MSW – WTE to provide additional energy production.

Over the past three years, the CRD has engaged well recognized consulting firms to assess the sludge processing alternatives for the CAWTP. The assessment completed by these firms indicated anaerobic digestion as the preferred sludge processing alternative. Unless the CALWMC chooses to change the assessment criteria, anaerobic digestion will remain the preferred sludge processing alternative for the CAWTP.

CRD is in the process of exploring the opportunities to participate in a tri-regional MSW – WTE. However, this process is in its early stages.

RECOMMENDATION

That the Core Area Liquid Waste Management Committee and Environmental Sustainability Committee receive this report for information.

Tony Brcic, PEng
Project Manager, Core Area Wastewater Treatment

J.A. (Jack) Hull, MBA, PEng
General Manager, Integrated Water Services
Concurrence

Larisa Hutcheson, PEng
General Manager, Environmental Sustainability
Concurrence

TB:hjr
Attachment: 1

Table 11.2 - Summary Table of TBL Analysis Results (from BMP November 2009)
Stantec/Brown and Caldwell

Criteria Group	No.	Criteria Categories	Measure Description	Weight	Anaerobic Digestion Alternative Results							WTE Alternative Results			
					Dried Fertilizer	Top Soil Blend	Mine Reclamation	Land Application	Biomass Production	Compost Product	Cement Kiln Fuel	WTE - A	WTE - B	WTE - C	WTE - D
Economic	EC-01	Capital Costs	construction cost and markup for soft costs adjusted to midpoint of construction	8	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.8	2.6	3.0	2.8
	EC-02	Capital Costs Eligible for Grants	Not available at this time	-	-	-	-	-	-	-	-	-	-	-	-
	EC-03	Tax Revenue Implications	cost of private property lost and lost revenue from reduced property values	1	3	3	3	3	3	3	3	3	3	3	3
	EC-04	Present Worth of O&M costs	O&M costs	8	3.2	3.0	3.1	3.1	2.9	2.8	3.2	3	3	3	3
	EC-05	Flexibility for Future Treatment Process Optimization	cost of additional tankage needed for process optimization	1	3	3	3	3	3	3	3	1	3	1	3
	EC-06	Expandability for Population Increases	additional space needed versus available to meet 2065 loading	1	3	3	2	2	2	3	3	4	3	5	3
	EC-07	Flexibility to Accommodate Future Regulations	additional space needed versus available to meet potential regulations	1	3	3	4	4	4	3	4	2	4	2	4
			Economic Subtotal (100 pts max)[1]:		**61**	**59**	**60**	**60**	**58**	**58**	**62**	**55**	**57**	**57**	**59**
Environmental	EN-01	Carbon Footprint	tons of eCO2 created	1.82	4	4	5	4	4	4	4	2	3	2	3
	EN-02	Heat Recovery Potential	Heat energy replacing natural gas	1.82	4	4	4	4	4	4	4	5	4	5	4
	EN-03	Water Reuse Potential	not applicable to this analysis	-	-	-	-	-	-	-	-	-	-	-	-
	EN-04	Biomethane Resource Recovery	Recovery of biomethane resources	1.82	5	5	5	5	5	5	5	1	5	1	5
	EN-05	Power (energy) usage or generation	kilowatt hours per year consumed	1.82	2	2	2	2	2	2	2	4	3	4	3
	EN-06	Transmission Reliability	risk cost of transmission failure	1.82	5	5	2	4	2	5	5	5	5	4	5
	EN-07	Site Remediation	risk cost of site remediation	1.82	3	3	3	3	3	3	3	3	3	3	3
	EN-08	Pollution Discharge	air emissions discharged	1.82	3	3	3	3	3	3	3	3	3	3	3
	EN-09	Non-renewable Resource Use	Gallons of diesel consumed per year	1.82	3	3	1	2	1	3	3	3	3	2	3
	EN-10	Non-renewable Resource Generated	Biosolids production	1.82	4	5	3	3	3	5	4	1	3	1	3
	EN-11	Flexibility for Future Resource Recovery	Additional space needed to add 100% additional resource recovery	1.82	3	3	3	3	3	3	3	4	3	5	3
	EN-12	Terrestrial and Inter-tidal Effect	Habitat areas potentially disturbed	1.82	5	5	5	5	5	5	5	5	5	5	5
			Environmental Subtotal (100 pts max):		**75**	**76**	**66**	**69**	**64**	**76**	**75**	**66**	**73**	**64**	**73**
Social	SO-01	Impact on Property Values	Lost value to present community	1.82	5	5	5	5	5	5	5	5	5	4	4
	SO-02	Operations Traffic in Sensitive Areas	Cost of traffic inconvenience during operations	1.82	4	4	4	4	4	4	4	5	5	2	4
	SO-03	Operations Noise in Sensitive Areas	Cost of noise inconvenience	1.82	5	5	5	5	5	5	5	5	5	4	4
	SO-04	Odour Potential	Cost of odour issues	1.82	3	3	3	3	3	3	3	3	3	2	2
	SO-05	Visual Impacts	Perceived value of lost view	1.82	5	5	5	5	5	5	5	5	5	4	4
	SO-06	Construction Disruption	Cost of traffic inconvenience due to construction	1.82	3	3	3	3	3	3	3	3	3	3	3
	SO-07	Public and Stakeholder Acceptability	Lost time due to public disapproval	1.82	3	3	4	2	2	3	4	2	2	2	2
	SO-08	Impacts on Future Development	Loss of value of developable land adjacent to facility	1.82	3	3	3	3	3	3	3	3	3	1	1
	SO-09	Loss of Beneficial Site Uses	Loss of park land due to facility	1.82	3	3	3	3	3	3	3	3	3	3	3
	SO-10	Compatibility with Designated Land Use	Delay due to zoning changes	1.82	3	3	3	3	3	3	3	3	3	3	3
	SO-11	Cultural Resource Impacts	Risk cost of a cultural site find	1.82	3	3	3	3	3	3	3	3	3	3	3
			Social Subtotal (100 pts max):		**73**	**73**	**75**	**71**	**71**	**73**	**75**	**73**	**73**	**56**	**60**
			TOTAL SCORE (300 pts max):		**209**	**208**	**200**	**200**	**193**	**207**	**212**	**193**	**203**	**178**	**192**

1 - Economic weighting is proportional to NPV results

Option WTE - A: Raw Sludge at WWTP Site
Option WTE - B: Digested Sludge at WWTP Site
Option WTE - C: Raw Sludge with MSW at Hartland
Option WTE - D: Digested Sludge with MSW at Hartland