

Bio-Logic Environmental Systems

Responsible Waste & Resource Management
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Technical Memo

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Subject: Waste Stabilization Facility (WSF) Evaluation and Comment on Stantec Inc. & SNC-Lavalin Inc. Reports

At the request of Dillon Consulting Limited, on behalf of their client MIRROR Nova Scotia (MIRROR), an evaluation of the Otter Lake WSF was completed to determine its performance in terms of stabilizing the organic constituents in Halifax Regional Municipality's residual waste stream. In addition, two recent reports on the municipality's waste management system by Stantec Inc. and SNC-Lavalin Inc. were reviewed regarding their reference to the WSF. The focus of this memo is process-oriented and does not integrate economics into the evaluation, nor does it assess the Front End Processing (FEP) with the exception of its contribution to the size reduction stage for waste destined for the WSF.

The evaluation of the WSF demonstrates the facility is capable of significantly stabilizing the organic content in the residual waste stream delivered to the WSF, reducing the respiration rate (or in other words, the reactivity or appetite for oxygen) by approximately 67% over the three-week treatment process. This reduction in the rate of oxygen consumption diminishes the subsequent decomposition that inevitably takes place in the Residuals Disposal Facility (RDF), thereby proportionately reducing the odour production potential and the corresponding production of liquid and gaseous by-products of anaerobic digestion.

A review of the Stantec and SNC-Lavalin reports indicates an incomplete and inaccurate assessment of the WSF that minimizes its effectiveness at stabilizing the organic constituents in the residuals waste stream, for both reports lack the scientific rigour necessary to quantify the process performance of the WSF. Until the facility is assessed (at least) in the detail presented in this report, comments such as those in the Stantec and SNC-Lavalin reports are inaccurate at best and unfounded at worst.

1.0 WSF Process

As the waste enters the facility and is placed on a trommel, material less than 2" is immediately diverted to the WSF while material greater than 2" and less than 6" is collected, shredded and then delivered to the WSF. A final sort of over-sized waste takes place so that any obvious remaining organic waste is also directed to the WSF.

Once the residual waste is screened and/or shredded, it is loaded into one of 14-30 m-long bays, each equipped with five aeration pipes located transversely at 6 m intervals down the length of each bay. Each bay is 5 m wide with the waste piled 3 m high. Aeration is provided through five gangs of seven 3 hp blowers located on the outside walls on both sides of the outermost bays, each delivering 700 CFM. Air is delivered to the bays overnight from 8 pm to 6:30 am and remains off during the operating day to avoid excessive steam and visibility problems; water (5.4 gpm at 60 psi) is sprayed over the length of the bays (with the exception of the final 5 m) for up to one hour from 6–7 am, five days per week.

The material is advanced through the bays with one of three agitators/rotating inclined conveyors that are supported on rails along the top of the walls of each bay. Each pass begins with the agitator cutting into material at the discharge end of the bay which represents product for final disposal. The agitator proceeds forward through the waste to ultimately provide 4 m of open space for additional material to be introduced at the front of the bay. On average, the agitator is advanced through the waste five days per week; on occasion, the agitator is run through the material twice per day.

2.0 Process Performance

Performance requirements for the WSF are defined in two documents; a) the Approval to Operate the Otter Lake Site as issued by NS Environment (NSE), (No. 2008-065580-A01), and b) the Operations Plan (FEP/WSF Performance Standards) from the 1997 Agreement between the Halifax Regional Municipality (HRM) and MIRROR NS. With reference to these two documents, the WSF performance requirements are summarized as follows:

NS Department of Environment Approval

- All putrescible organic feedstock must be incorporated into the WSF within 48 hours of being delivered to the WSF portion of the facility.
- The approval holder shall operate the WSF portion of the facility in a manner as outlined in the operations plan.

Operations Plan

- All materials processed through the WSF shall be subject to controlled bio-stabilization for a period not less than 18 days (subsequently revised to 15 days in consultation with NSE and HRM).
- The temperature of all waste material processed through the WSF shall be maintained at 55°C or greater for a minimum of 3 days to destroy pathogens.
- The temperature of waste material processed through the WSF shall be maintained as follows:
 - At the end of the first 24 hours of processing in the WSF, the material shall achieve a temperature of not less than 35°C.
 - Subject to paragraph (9) of the Appendix, throughout the remainder of the processing time until the material reaches zone 5, the temperature of the material shall be maintained between 40°C and 60°C.
 - All waste processed through the WSF shall be maintained at a moisture level above 45% nominal by weight at all times until the material reaches zone 5 of the WSF at which point the moisture content shall be reduced to 45% or less.

Based on discussions with MIRROR NS staff, the parameters identified in the NSE Approval and in the facility Operations Plan are monitored on an on-going basis with reports being forwarded to HRM staff each month. With reference to these contractual and regulatory performance requirements, it is understood that no significant issues of concern have been brought forward by either HRM or NSE during the WSF's 14 years of operation.

Notwithstanding the WSF's proven capability to meet its defined objectives, the analysis presented in this report examines the performance of the facility with a proven metric used to evaluate the effectiveness of the bio-stabilization process at composting facilities—respiration rate. As the purpose of the WSF is to stabilize the organic constituents in the residuals waste stream, it stands to reason that a test is selected that measures the stability of the organics as they proceed through the bays of the WSF.

3.0 Evaluation of WSF

Prior to a review of the WSF, a brief account of the testing method (respiration rate) used to measure organic decomposition performance is in order to clearly articulate how process performance is quantified, whether assessing a compost plant or the WSF.

3.1 Background: Respiration Rate

The respiration rate is the most accurate method of quantifying the relative stage of decomposition of organic waste. The test measures the rate at which microorganisms consume

oxygen as they oxidize the organic waste—a faster rate of oxygen consumption indicates the presence of easily biodegradable organic waste (fresh food waste), or in other words a highly unstable product. It is not uncommon for fresh organic feedstock to have a respiration rate of 10,000 mg of oxygen per kg organic matter per hour. As the decomposing matter moves through a stabilization process and the easily compostable constituents are consumed, the microbes turn to the less biodegradable matter and as a result, the rate of oxygen consumption declines, producing a characteristic curve (Figure 1). In composting facilities, if the readily available organic waste has been consumed to the point where the respiration rate is 400 mg of oxygen per kg organic matter per hour or less, it is deemed to be mature and is allowed to be released and sold commercially (Guidelines for Compost Quality, CCME, 2005). Like compost facilities, the purpose of the WSF is to stabilize (decompose) the organic fraction in the residual waste in a controlled, measureable manner to prevent the material decomposing in the RDF with the subsequent release of offensive gas and liquid. Unlike compost facilities, the stage of relative decomposition (threshold respiration rate) of the residual waste leaving the WSF was not established when the operations plan was created. Nonetheless, the use of the test can provide substantive evidence on the ability of the WSF to stabilize the organic fraction in the residuals waste stream.

The acidity (or pH) of the decomposing waste also follows a characteristic pattern as fresh waste is usually acidic; as the organic acids are oxidized, the pH typically increases to approximately eight, then declines marginally to below eight once the product is mature. The pH characteristic curve is also shown in Figure 1.

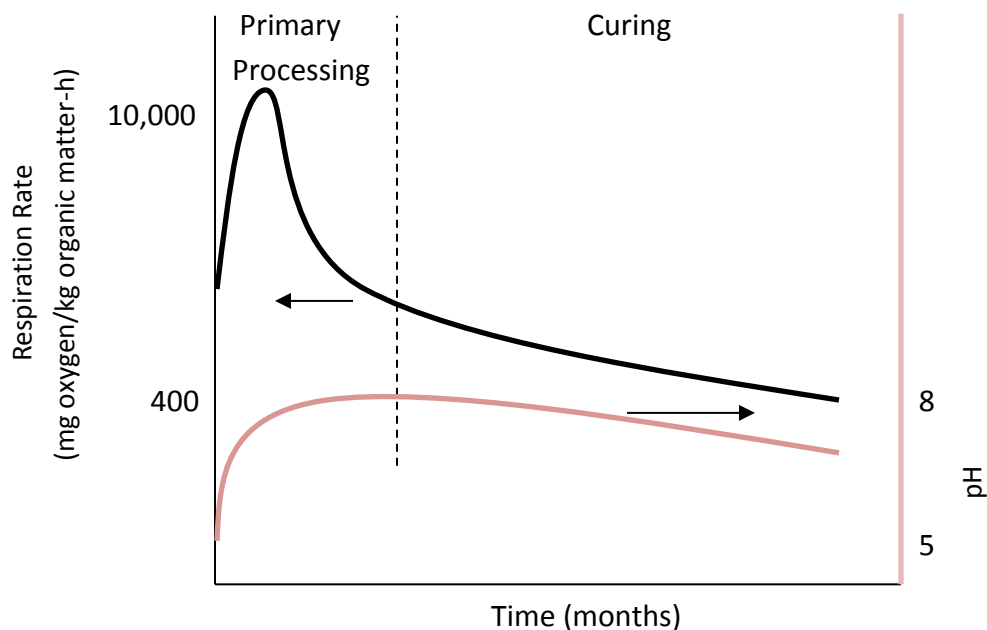


Figure 1. Typical Process Performance Curve in Terms of Respiration and pH.

Because the respiration rate declines over time as the organic matter moves through the process, it can be plotted if samples are extracted and tested at various stages of the process. This is, in effect, a method of assessing the performance of a given technology—the faster the process can produce a mature, stable product, the more efficient the process (Figure 2).

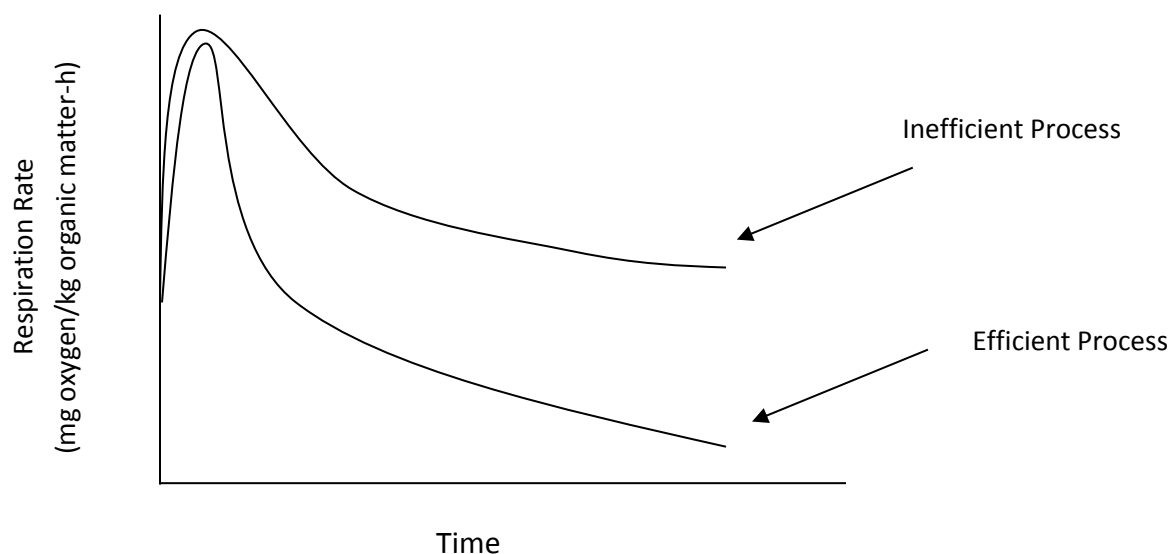


Figure 2. Comparing Process Performance Curves.

3.2 Quantifying WSF Performance

The performance of the WSF was evaluated in two related ways: the respiration rate at various stages was measured to discover if the waste was truly experiencing some degree of stabilization, and the oxygen levels were measured to determine whether there was sufficient oxygen being delivered to the microorganisms responsible for the consumption of the organic constituents in the waste stream. If sufficient air is delivered to a process, one should expect a substantive reduction in the respiration rate.

3.2.1 Respiration Rate

Samples were collected from the WSF on July 30, August 12 and August 23, 2013. During each visit, six screened samples were retrieved from Bay #1 at approximately equi-distant locations through the length of the bay; on August 23, an additional six samples were also retrieved from Bay #2 providing a total of 24 samples. Estimated process time at the point of sampling ranged

from 1.5 days for the sample recovered at the inlet of the bay, to 21 days at the discharge end. Although the location of the samples was the same for all four sets of samples, the waste sampled would be somewhat different on each occasion as it would have been advanced through the bay over the interval between sampling times. The intention was to assess the nature of the sample in terms of their physical characteristics and measure the respiration rates at each stage to determine the degree of stabilization occurring throughout the length of the bay. Samples were obtained from 10–20 cm below the surface of the waste on the top of the pile and screened through a 10 mm mesh to remove most of the non-compostable/inorganic waste until approximately 300 g was recovered; the samples were then further screened through an 8 mm mesh upon return to the lab. The samples were then subdivided: 10 g was used to measure pH (5:1 water:sample ratio), 15 g was used to measure moisture and organic matter content, and 15 g was placed in a 1-L Mason jar and filled with water. The jars' contents were then aerated in a water bath at 25°C for 24 h at which time the air supply was removed and a dissolved oxygen probe inserted. The rate of decline of oxygen in the compost-water mixture was then recorded over a 15-minute period at which point the air was reintroduced and the samples were returned to the water bath. The process of recording the rate of dissolved oxygen decline was then repeated after 48 and 72 h to provide three respiration rates over three days for all 24 samples.

Table 1 summarizes the physical characteristics of the samples. Clearly the moisture content is below saturated levels which provides sufficient void space for the microbes to conduct their decomposition activities, however, the material becomes drier as it proceeds through the bay, possibly at the expense of continued performance. The organic matter in the screened samples is naturally lower than a typical SSO feedstock as they contain more contaminants (glass/plastic) and inert matter by its nature as was evident by visual inspection.

The respiration rates of the four sets of samples, based on one-, two- and three-day averages, are provided in Figures 3–6. As the respiration rates were taken over three days, the highest rate is recorded as day 1 and results of subsequent days averaged. While the respiration rates vary due to the heterogeneous nature of the feedstock and subsequent variation in samples collected, there was a clear decline in respiration rate for all sets of samples over the 21-day period, experiencing a decline from approximately 6000–8000 to between 2000–3000 mg oxygen per kg of organic matter per hour (a decline of 50–75%). If the four trials are consolidated (Figure 7), the reduction in respiration rate based on a one-, two- and three-day average is 63%, 61% and 61% respectively. Of note is the levelling-off of respiration rates after two weeks of processing, indicating that either the decomposing mass was naturally slowing, or was being inhibited. The lower moisture content of the samples at the end of the bays from Table 1 imply the latter, indicating that performance could be further improved through the addition of more moisture.

Table 1. Summary of Sample Characteristics.

Process Days	Moisture %				Organic Matter %				pH			
	July 30	Aug 12	Aug 23(1)	Aug 23(2)	July 30	Aug 12	Aug 23(1)	Aug 23(2)	July 30	Aug 12	Aug 23(1)	Aug 23(2)
1.5	42	38	33	33	45	33	25	29	5.8	6.6	8.0	5.9
4.5	42	33	37	36	41	35	36	34	5.4	6.6	5.8	6.3
9	34	33	37	39	39	38	36	34	6.3	6.4	6.7	6.0
14.5	34	25	27	36	45	42	30	40	7.1	7.0	7.9	7.8
18.5	24	27	22	22	35	42	33	33	7.6	7.1	8.2	8.2
21	28	20	22	22	39	41	39	36	7.7	7.0	8.2	8.2

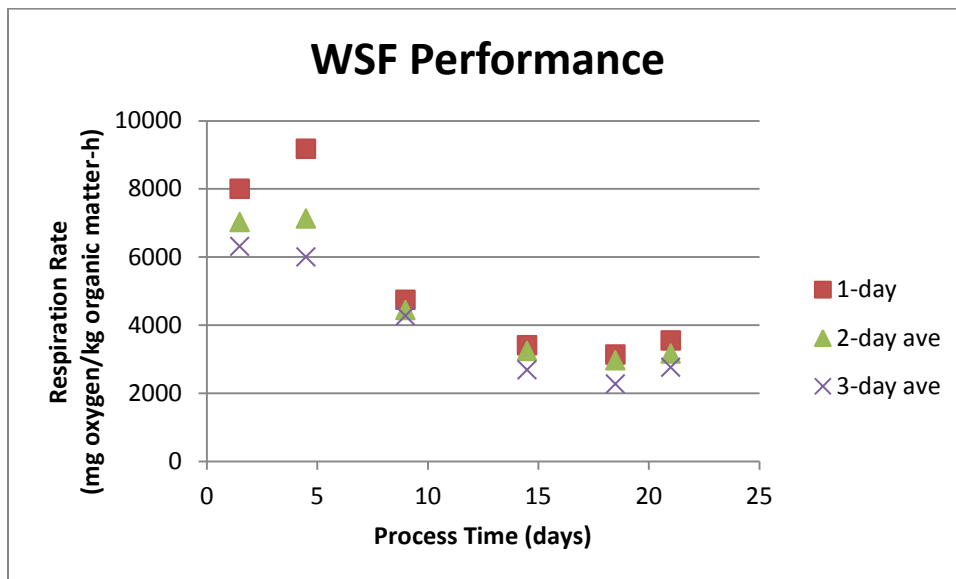


Figure 3. WSF Performance Based on Respiration July 30, 2013 .

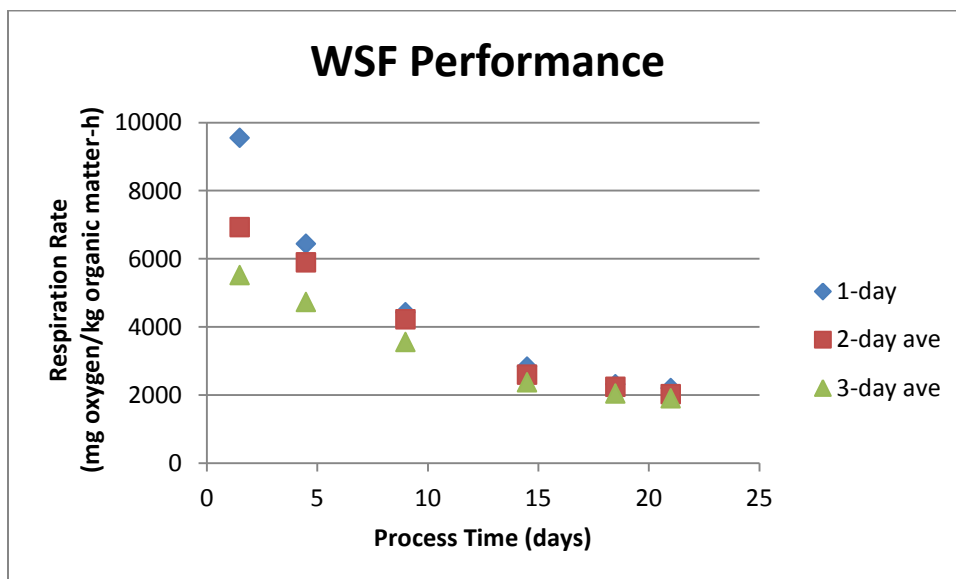


Figure 4. WSF Performance Based on Respiration August 12, 2013.

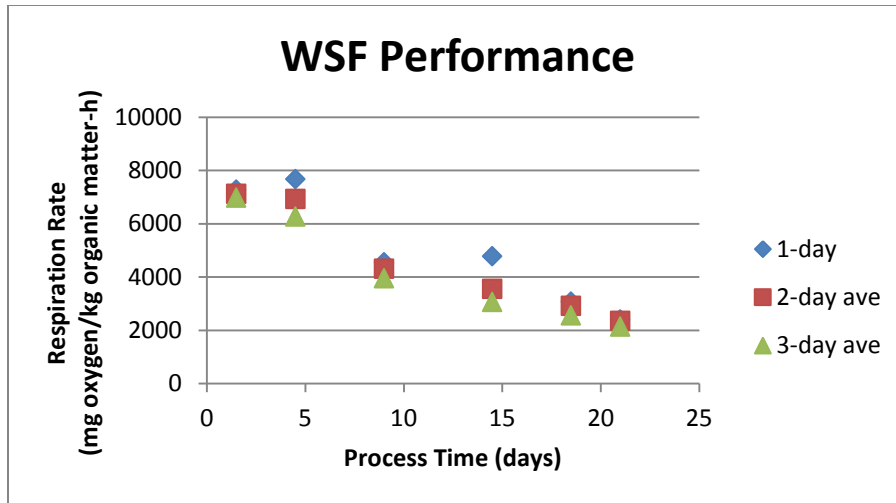


Figure 5. WSF Performance Based on Respiration August 23(1), 2013.

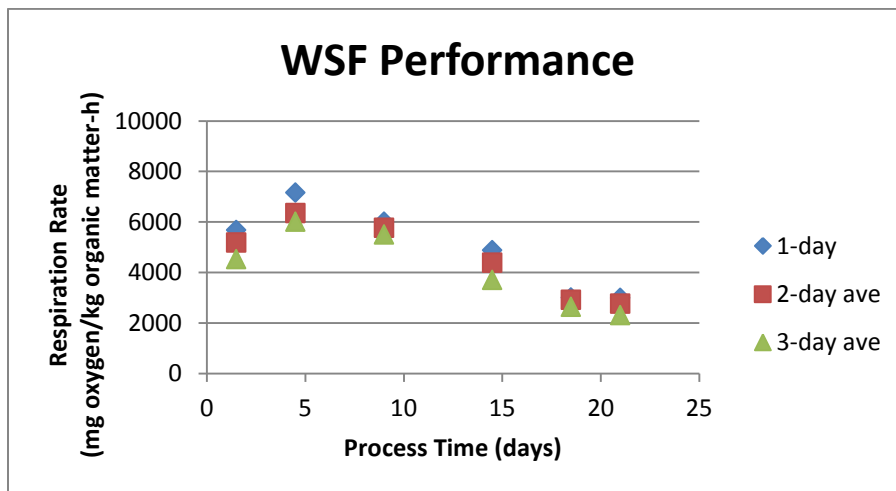


Figure 6. WSF Performance Based on Respiration August 23(2), 2013.

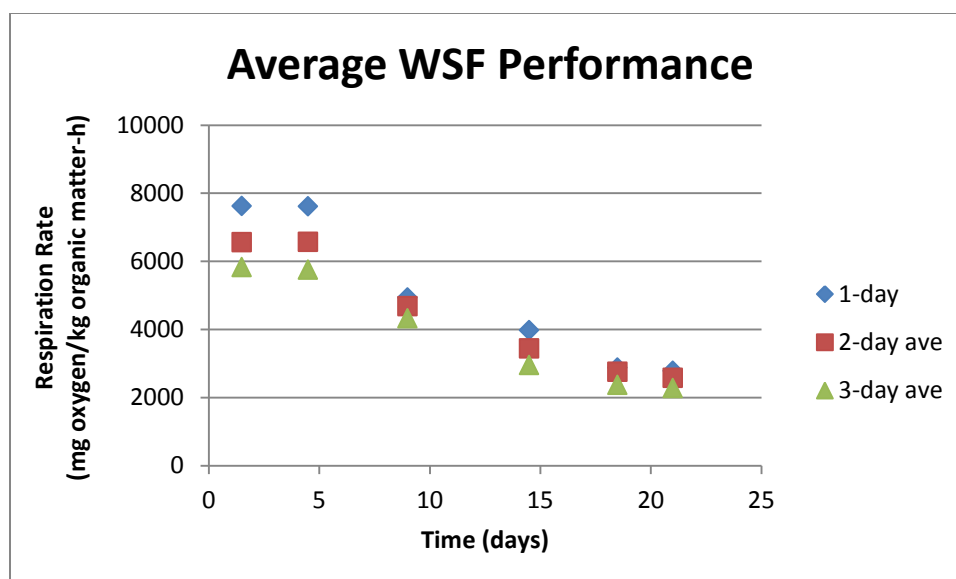


Figure 7. WSF Performance Based on 4-Sample Average Respiration.

In order to provide an independent assessment of the WSF, two additional samples at the front and discharge ends of Bay #1 were collected on August 23 and sent to an independent lab (the Centre de Recherche Industrielle du Québec (CRIQ)) for comparative purposes. Following the CRIQ protocol listed in BNQ 0413-220A, the organic matter and moisture contents were comparable as were the relative % declines in respiration rate (Table 2).

Table 2. In-house & Independent Sample Comparison August 23(1).

Process Days	Moisture %		Organic Matter %		Respiration Rate (mg O ₂ /kg OM-h)		Respiration Rate % Reduction
					2-day average		
	1.5	21	1.5	21	1.5	21	
Bio-Logic	33	22	25	39	7117	2357	67%
CRIQ	31	23	28	43	4420	1531	65%

The lower respiration rates from the CRIQ (which measures carbon dioxide production rather than oxygen consumption) are attributed to a protocol that is not as sensitive at detecting carbon dioxide as the *Bio-Logic* test is at detecting oxygen consumption. The issue of underestimating the relative maturity of compost products is currently under investigation in a partnership between *Bio-Logic* and the Ontario Ministry of Environment. In any event, both tests demonstrate a clear and similar reduction in respiration on a per cent basis, confirming the WSF is indeed stabilizing the organic constituent of the residuals waste stream.

3.2.2 Oxygen Content in Bays

The measurement of oxygen within the piles is a supporting test that determines the efficacy of air delivery to the material in the bays through the aeration system and the mechanical turning device. On August 8, 2013 the oxygen levels in Bay #1 were measured in duplicate at the same intervals as the respiration sampling exercises using a Teledyne 320-P oxygen analyser to determine whether sufficient oxygen was being supplied to the organic constituents in the waste stream.

A 1.5 m probe connected to the oxygen analyser was inserted 0.75 m into the pile at various points; the analyser, equipped with a vacuum pump pulled the interstitial gases up through the probe and across the detection cell to register the oxygen content. The measurements were taken at approximately 12 noon, over 5 hours after the air blowers were turned off for the day as is custom.

The results of Table 3 indicate that on average, there is sufficient oxygen in the piles to support the microbial decomposition of the organic waste. Given that atmospheric air is 21% oxygen, of the twelve samples taken, only three indicated oxygen-deprived sites despite the fact that fresh air had not been mechanically delivered to the pile in over 5 hours. In addition, the oxygen content in some locations was not constant as evidenced by the range of oxygen detected in some zones. A changing oxygen concentration indicates a high degree of permeability (inter-connectedness) such that when gas in the immediate vicinity of the probe tip is drawn up through the probe, it is easily replaced by surrounding gas in the vicinity. When the oxygen content rises for a given sample, it indicates that the material nearby is richer in oxygen; when the oxygen content drops, it indicates that nearby gas pockets have less oxygen in them than immediately adjacent to the probe. In either case, unlike many industrial compost processes, it shows there is connectivity throughout the waste which is a positive feature. Finally, the lower oxygen levels towards the end of the bay indicates an oxygen-deprived zone that could be improved upon with greater aeration. In summary, while the oxygen values do vary significantly amongst the samples collected, the predominant presence of oxygen confirms that the WSF process is indeed aerobic.

Table 3. Oxygen Content at Various Stages Through Bay #1.

Process Days	Sample 1	Sample 2
1.5	4%	21%
4.5	21%	12% to 20%
9	17.5% to 19%	7% to 15%
14.5	21%	8% to 15% to 7%
18.5	3%	11% to 20%
21	1.5%	10% to 1.2%

4.0 Comments on the Stantec Report

The following review of the Stantec report (Waste Resource Strategy Update, January, 2013) relate to aspects associated with the WSF and are presented as quoted citations followed by original comments. In general, the report's comments surrounding the WSF are presented in a non-technical manner with little detail and a lack of input from specialists; there is effectively no measure of the WSF performance in the document despite the conclusion that the facility "does not provide a useful function" and "yields few benefits". The presumption that the WSF presently serves little purpose with no opportunity for process refinements to enhance operations does not appear to be supported by any credible data or analysis.

To characterize the result of the WSF process as simply a "drying out" of the material is inaccurate and misleading. It is true that the material loses moisture throughout the stabilization process. But as confirmed by the tests conducted to support the completion of this report, the aerobic composting process applied within the WSF does indeed serve to effectively biostabilize the waste material; a fact that is absent from the Stantec and SNC-Lavalin reports.

Page ii, Line 8; Page 12.2, Line 8:

"The front-end processing (FEP) and waste stabilization facility (WSF) at Otter Lake do not provide a useful function compared to their stated purpose in the 1995 Strategy."

The report contains no quantifiable performance thresholds that can be applied against this statement, nor does it contain any type of evaluation of the WSF against which the threshold can be compared.

Page iii, Line 14; Page 12.3, Line 15:

"The FEP and WSF do not function in a manner envisaged in the 1995 Strategy. These facilities were intended to stabilize organic wastes and produce a low-grade compost product. Few organics are now actually processed, and the multiple shredding of the waste prior to disposal may actually increase the generation of landfill gas over the short term in the period before gas collection systems can be installed. This may contribute to additional odours from the site."

Once again, the manner envisaged has not been quantified. The WSF clearly stabilizes organic wastes and could in fact produce low-grade compost with further screening and hydration. Multiple shredding does increase the ability of the waste to be stabilized *before* it enters the landfill; provided the containment is in place, the release of a finite amount of (more concentrated) landfill gas over a shorter period of time could be considered a benefit rather than a liability since the collection period (and associated costs) is reduced.

Page 3.1, Line 19:

"The rationale for sending smaller particles to the WSF was the assumption that most compostable organics would be smaller than most non-compostable materials after coarse

shredding. While this reasoning has some merit, the operational reality is that any smaller objects such as steel bottle caps and crushed glass, as well as plastic film, pass on to the WSF for stabilization rather than being sent to landfill. Likewise, larger compostables such as wet paper and cardboard are not sent to the WSF.”

It is agreed that sorting organics by size does contribute to contamination (this is the challenge for the facilities in Edmonton and Moncton), however unlike SSO compost, it is not intended for sale. The issue of adding (shredded) wet paper and cardboard to the WSF would not be inappropriate as it provides a carbon source with some needed moisture. The present understanding is that MIRROR is not currently obligated to compost this material.

Pg 3.2, Material Flow Figure:

The material flow figure indicates a moisture loss of 2,500 t (roughly 10% of incoming waste (25,100 t) to the WSF) as the only mass loss from the system. This underestimates the moisture loss and completely ignores the mass loss due to the decomposition of the organic waste. The actual moisture loss is considerably higher based on the (screened) test samples which show a drop from about 40% to 25% (one has to be careful here in direct comparisons as the amount of matter leaving the facility is naturally less due to the decomposition process). In addition, removing over 60% of the activity from the organic fraction of the waste and turning it into carbon dioxide has a significant impact on reducing the mass of the outgoing product as well. Regardless of the subtleties, the WSF clearly removes far more mass than 10% of the incoming waste through processing.

Page 3.3, Line 20; Page 3.6, Line 5:

“Compostable materials that are recovered from the mixed residue stream will be processed in composting facilities separate from the source-separated compostable materials. While compost produced in these kinds of facilities is likely to be of lower quality than from source-separated composting, it will still be a valuable and useful resource.”

“As previously identified in Section 3.2.1, the 1995 Strategy recognized that the output from the WSF would be low quality compost, but it was anticipated that it would still be a valuable and useful resource.”

The production of low-grade compost is possible, as the most important parameter associated with low quality compost (stability) is being met to a large degree by the WSF (although the definition of “low quality compost” was never defined). Greater hydration in the bays followed by curing and screening would probably produce a Category B compost product. It is however, presently understood that MIRROR is not currently obligated to produce a Category B compost product.

Page 3.6 Section 3.2.2:

“An 18 day period in the WSF does not necessarily improve landfill performance with respect to gas, odour and leachate.”

This statement is only true if the WSF is not performing at all since gas, odour and leachate are derived from organic decomposition; if organic decomposition occurs in the WSF, then the total amount of gas, odour and leachate have to be reduced in the landfill. The fact that the performance tests indicate that over 60% of the decomposition activity is completely removed before entering the landfill negates the statement entirely.

Page 3.7, Line 18:

“With the benefit of hindsight, it is now clear that the FEP/WSF concept yields few benefits if curbside diversion programs are in place; has the potential for unintended negative impacts with respect to odour production at the landfill; and is very costly compared to the benefits achieved.”

While comments regarding cost-benefits are outside the scope of this report, this statement is clearly inaccurate—sample analyses have proven that there are measureable benefits in terms of stabilizing the waste before it enters the landfill reducing the propensity for odour production and anaerobic decomposition (being mindful of the accelerated decomposition of the remaining organics that do reach the landfill).

Page 7.16, Line 12:

“The existing WSF is no longer an asset to HRM’s landfill operation. An opportunity exists for HRM to repurpose the WSF to compost clean, source separated organic (SSO) waste.”

The fact that the report’s authors believe the WSF can effectively compost SSO but is incapable of stabilizing the organic constituents in the residuals stream appears to be inconsistent. The comment that the WSF is no longer an asset is clearly inaccurate unless more of the facility is expected than an average 60% reduction in residual activity. The notion to re-purpose the WSF to manage SSO is appropriate *if* the WSF was unable to effectively stabilize the residual waste. Since it has been shown that the WSF *is* capable of stabilizing the residual waste, then consideration could be given to expanding the WSF to include *both* residual waste and SSO.

5.0 Comments on the SNC-Lavalin Report

The following comments on the SNC-Lavalin report (A Peer Review of the January 2013 Stantec Report “Waste Resource Strategy Update”, April 2013) relate to aspects associated with the WSF. As many of the SNC-Lavalin conclusions regarding the WSF are similar to those of Stantec, the following points will address statements unique to this report as well as re-emphasize particular points. Report comments associated with the WSF are presented as quoted citations followed by original comments.

Unlike the Stantec report, the SNC-Lavalin report does contain numbers that attempt to quantify the performance of the WSF, however the predominant emphasis on hydrocarbons rather than the constituents of MSW organics (carbohydrates, fats, and proteins) contribute

little to an accurate assessment of the facility although there were results in terms of VOC presence and organic matter content that supported active stabilization in the WSF.

Furthermore, the repeated belief that the existing infrastructure within the RDF is capable of handling the organic constituents in the residual waste without the stabilization provided by the WSF is premature as the authors have not accurately estimated the degree of substantive stabilization that the WSF is currently capable of achieving.

Page v, Line 10; Page 27, Line 14:

“A1 – Closure of FEP and WSF by the end of 2013

We support this recommendation because the FEP and WSF have never operated as originally envisioned.”

“The WSF does not provide a useful function compared to their stated purpose in the 1995 strategy.”

Once again, since there is no quantifiable measure to assess performance from either report, the experimental finding of a 60% decline in respiration rate surely refutes this comment. Further, this conclusion makes no reference to the actual performance objectives for the WSF as defined in the NSE Operating Approval for the Otter Lake site and the contractual agreement between HRM and MIRROR.

Page 8, Line 9; Page 8, Line 26; P 32, L 24:

“In 2011, about 25% of material entering the RDF was first “stabilized” at the WSF (i.e. the material is mechanically shredded, and the volatilization, the biodegradation, and the leachate potentials are reduced through a mechanical air drying process, that also reduces the moisture content).”

“In 2011, the WSF processed about 25% of the waste material being placed in the RDF. The WSF stabilization process reduces the moisture content, and to some extent reduces the volatilization and leachate potential of the waste material.”

“The WSF ...to some extent reduces the volatilization and leachate potential of the waste material”

Although there is some recognition of qualitative potential process performance, it is not quantified.

Page 8, Line 34; Page 33, Line 23:

“We took four waste samples and had a laboratory analyze them for volatile and leachate potential..... Sample C material was shredded in the FEP / WSF but not yet stabilized. Sample D was shredded stabilized material leaving the WSF for the RDF.”

“Each sample (2 x 1 litre) contained sufficient material to perform our desired analytical tests.

Some results of the laboratory program are presented in tables attached to this investigative report:

- Table 1 – BTEX / TPH in mg/kg, and as leachate mg / litre
- Table 2 – Leachable metals in ug / litre
- Table 3 – Volatile Organic Compounds (# of distinct compounds detected)”

Firstly, there has to be a better understanding of how these very heterogeneous samples were screened for sampling purposes. Most of the testing techniques require very fine samples in small quantities. The methodology for how the material was screened is missing.

The unnecessary preoccupation with hydrocarbon-based tests is unusual. Unless there is a suspicion of petroleum hydrocarbons in the waste stream, there is no reason to test for BTEX/TPH as a measure of assessing the ability of the facility to stabilize the waste. The expectations regarding volatilization and leaching potential at the top of Page 34 were never realized in the BTEX and TPH results further down the page. One could easily predict that there would be little change between the samples simply because there is a negligible amount present to begin with.

Leachable metals is also of little use to assess performance; in general metals in the feed remain in the product (notwithstanding significant leaching which would only occur under saturated conditions); this has little use when measuring the ability of the system to stabilize the waste.

Finally, measuring the volatile organic compounds is basically measuring the concentration of a few select (predominately hydrocarbon) odours that are being released from the sample and contributes next-to-no value regarding the ability of the facility to stabilize organic waste. Measuring the presence of hydrocarbons has little significance regarding the decomposition/ stabilization process and furthermore, their concentrations are not quantified. In summary, these tests provide no credible evidence as to the performance of the WSF.

Page 34, Line 26, 27, 30, 33, 34:

“VOC compounds”

This is a redundant term.

Page 9, Line 12:

“Our sample results indicated some relative differences in volatile and leachate potential.”

Although testing for VOCs is only a very indirect method of assessing process performance, the reduction of VOCs from 15 to 7 between the WSF feedstock and the discharge (Page 34, Line 32) provides some substantiation that SNC Lavalin recognizes the process is performing to some degree

Page 34, Line 7:

“The moisture content was greatest in Sample A (FEP), least in Sample B (RDA), and similar in Samples C (WSF) and D (RDF).”

The FEP moisture content of 54% followed by the RDA moisture content of 39% is possible as the unshredded waste is likely to be drier, however unless significant drying is taking place through the FEP, the WSF sample should be wetter (on a per cent basis) than the FEP sample which it is clearly not. Furthermore, the insignificant change between the WSF sample and the RDF sample indicates no loss of moisture through the WSF which is clearly incorrect and contradicts the (correct) claims made of material drying as it is processed through the WSF.

Page 34, Line 11:

“The relative difference with the 78% result for Sample C (WSF) reflects that materials chosen to be stabilized are perceived to have a greater organic content than the Sample B material. The 52% result for Sample D (RDF) reflects material that has been handled and heated.”

Loss on ignition can be somewhat of a useful tool in assessing the degree of stabilization of organic waste, since stabilized organic waste loses a measureable amount of carbon to carbon dioxide. The fact that carbon content was reduced between Samples C and D indicates measureable process performance that was not underscored in the report.

Page 9, Line 16; Page 9, Line 20; Page 18, Line 33:

“If future RDF waste material has a higher moisture content, and a greater leachate potential or concentration, we believe the existing infrastructure and flexible operational capacity is such that the current documented trends in groundwater and air quality performance at Otter Lake would continue.”

“....if there was no FEP or WSF there is sufficient infrastructure and a demonstrated operational capacity at Otter Lake such that the trend in environmental groundwater and air quality performance will continue”

“The differences were such that we believe that if shredding and biostabilization were not happening, that the RDF infrastructure and operational capacity is such, that the overall performance goals regarding groundwater and air quality would continue to be achieved. This is consistent with the seven month experience in 2010, when shredding and stabilization did not occur.”

The repeated belief that the existing infrastructure is capable of protecting groundwater and air quality in the absence of the WSF deserves comment. While the existing landfill containment system is robust enough to control leachate production, the release of gaseous by-products of

uncontrolled anaerobic digestion, or a less secure liner system, would create a degree of uncertainty in terms of pollution production potential as there simply has not been enough quantitative evidence generated from the WSF that can predict an outcome, particularly since the authors have not yet accurately measured the performance of the WSF.

Page 9, Line 19:

“The operating and monitoring results during and after a seven month period when the WSF was not operating – similar to if there was no operating FEP and WSF - indicated that monitored groundwater and air quality goals were met.”

The impact of having no WSF is not immediate; the impact of fresh organics added to a landfill in terms of groundwater and air quality takes years to manifest itself.

Page 21, Line 34:

“It may be more accurate to describe the waste leaving the WSF as being drier, rather than being more physically or chemically stabilized.”

With reference to the analysis presented in this report, this statement is clearly incorrect.

Page 22, Line 13; Page 33, Line 6:

“If the same waste was not processed in the WSF, the same gas would be released at a slower rate in the landfill cell...”

“We did not perceive that the long term biodegradation potential for producing landfill off gasses significantly differed if the materials were shredded or not; or stabilized or not.”

Clearly both of these statements fail to appreciate the fact that stabilized organic waste will no longer release the same quantity of gas as raw waste—due to the decomposition process and the release of carbon dioxide, less potential gas is available. Further, a slower and longer release of gas will lead to gas management activities that will have to be performed for an extended period of time, which has the potential to lead to increased costs.

In summary, the performance of the WSF is quantifiable and has proven to be effective at stabilizing many of the organic constituents in the residuals waste stream. Suggesting that the facility be closed at this point is inappropriate as there is no evidence or justification to support this recommendation. Please contact the undersigned if subsequent questions arise from the memo’s comments.

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