Organic Matter Recycling Regulation
Audit Report
2003-2004

Ministry of Water Land and Air Protection
Vancouver Island Region
April 27, 2005

Conrad Berube, P.Ag., Environmental Protection Officer
John Collison-Baker, R.P.Bio., Environmental Protection Officer
Duncan McLaren, AScT, Environmental Protection Officer

Table of Contents

1 Executive Summary 5

2 Introduction 7

3 Scope and Objectives 7

4 Materials and Methods 8

5 Results 10

5.1 Compliance 10

5.1.1 Pathogen Reduction Processes (Schedule 1) 10

5.1.2 Pathogen Reduction Limits (Schedule 3) 11

5.1.3 Vector Attraction Reduction (Schedule 2) 13

5.1.4 Compost Quality (Schedule 4) 15

5.1.5 Feedstocks and Volumes (Schedule 12 & Sections 27, 28 and 29) 16

5.1.6 EIS, Plans, Specifications (Sections 23 & 24) 17

5.1.7 Leachate Management Requirements & EIA (Section 26) 18

5.1.8 Record keeping (Schedule 6) 21

5.2 Environmental Impact 21

5.2.1 Odour 21

5.2.2 Leachate and Groundwater Monitoring 22

5.2.3 Vector Nuisance 22

6 Conclusions and Recommendations 22

6.1 Compliance Summary 22

6.2 Recommendations 26

7 Appendices 27

7.1 Audit Checklist 27

List of Figures

Figure 1 On the left is a variation of the aerated static pile using an Ag-Bag (bag removed). Note the perforated pipe used to pump air through the pile to maintain aerobic conditions during composting. On the right, the photo shows open windrows of compost with steam rising from the windrows. 12
Figure 2 Typical feedstock storage consisting of yard waste, tree and brush trimmings or ground woodwaste. There may be leachate issues associated with feedstock storage. Under the right conditions, fires can break out in the stored materials (note the smoke in the upper right photo). 17
Figure 3 Leachate contained by an asphalt berm and directed to a collection sump. 18
Figure 4 The Site H invessel composting facility. To the left is the compost building housing the mixing, composting bins and screening facilities. To the right is the curing building. A leachate collection pond is shown in the lower left of the photo. 19
Figure 5 Leachate collection ponds at various sites. EPO's inspection assessments were that ponds are generally poorly constructed and/or maintained as there is no documentation that the underlying soil is impermeable and/or they appear to overflow in wet weather. 19
Figure 6 % of composting facilities able to demonstrate compliance during the audit to key sections of the OMRR. 25

List of Tables

Table 1 Site names, locations, and associated file numbers and date of audit, if applicable. 9
Table 2 Composting method used at the audited sites and composting temperature. n/a = not applicable, composting yard waste alone. Shading indicates the operation has documented compliance with Schedule 6, Section 1 record keeping requirements and Schedule 1 Sections 4 and 5 pathogen reduction measures (lighter shading indicates record-keeping was not required). 11
Table 3 Results of Ministry sampling of fecal coliform concentrations in sampled cured compost. Schedule 3, Section 5, specifies that fecal coliform levels for Class A compost must be met before, or at the same time as, the vector attraction reduction (VAR) requirements are met—therefore the data above, shown with cross hatching, cannot be used to document compliance with Class A compost standards. However, results with diagonal cross-hatching yielded values within acceptable limits had they been taken during VAR processes—those values with horizontal cross-hatching may have exceeded those limits. Shading (as opposed to cross hatching) indicates results that fall within fecal coliform limits (for Class B compost) defined in Schedule 3 (lighter shading indicates sampling and record-keeping was not required). 12
Table 4 Results of Ministry sampling of temperature and C:N ratios. Shading indicates that data reviewed or gathered during the audit may have been in compliance with C:N ratios and/or temperature above ambient set in Schedule 2, Section 2b (lighter shading indicates that scheduling for Class B compost does not

specify C:N ratios). Temperatures are averages of two or three temperature measurements taken at a 60 cm depth. 14
Table 5 Compost quality exceedances for the audited sites above limits set by Schedule 4. Shading indicates that the operation has documented compliance with limitations on content of metal and foreign matter. 15
Table 6 Feedstock for audited compost sites. Shading indicates that the operation has documented compliance with Schedule 12 16
Table 7 Capacity of audited compost sites. Shading indicates that the operation has submitted notification of operation in accordance with Section 25 of the OMRR and that on-site production rates were consistent with production allowances specified by OMRR. 16
Table 8 Leachate management and EIA submissions at the audited sites. Shading indicates that the operation has provided documentation of compliance with Section 26 of the OMRR. 20
Table 9 Analyses and record keeping requirements. Shading indicates that the operation has provided documentation of compliance with Schedule 6 of the OMRR. 21
Table 10 Compliance summary 24

1 Executive Summary

In accordance with the ministry service plan and the South Coast Compliance Activity Plan 2003-2004, staff from the Environmental Management Branch of the Vancouver Island Region of the Ministry of Water Land and Air Protection carried out an audit of 10 composting facilities in the mid- and southern portions of the island operating under the *Organic Matter Recycling Regulation* (OMRR). The sites audited were selected at random within large, medium and small size categories. Audits were conducted between September 2003 and February 2004.

The general goal of the audit was to gather information to help determine future compliance strategies for sites unable to demonstrate compliance with the regulation. Specific objectives flowing from this goal were to:

- provide a regional assessment of compliance to the OMRR,
- identify dischargers that have performed well and where improvements should be made,
- inform industries and the public of the findings in order to bolster compliance to the OMRR,
- provide protocols and forms to other regional offices that may wish to perform similar compliance inspections.
- to make a preliminary determination regarding the effectiveness of the OMRR in protecting human health and the environment.

Overall, none of the sites met all significant requirements of the OMRR:Results

- A pair of sites (two of six or 33%) were able to demonstrate compliance with requirements to record temperatures and retention times per Schedule 1, Pathogen Reduction, and Schedule 2, Vector Attraction Reduction. A single facility (1 of 6 or 7 % cases where required) could show evidence of having obtained analyses of samples to show successful pathogen reduction in accordance with Schedules 1 and 3 and acceptable compost quality in accordance with Schedule 4. Two of six (33%) operators retained records in accordance with Schedule 6; other facilities were unable to provide records to inspectors because the records were not created or obtained in the first place.

- Most relevant to issues of public safety and protection of the environment is compliance with section 26 of the OMRR requiring composting facilities to contain and reuse leachate or, alternatively, to demonstrate, through an Environmental Impact Assessment (EIA) vetted by a Qualified Professional that the environment will be protected and appropriate water quality criteria satisfied through the use of alternative leachate management processes Discharged leachate may have a serious effect on the environment or human health[1]. A single facility (1 of 6 or 17%) where leachate is discharged to the environment was able to demonstrate completion of an Environmental Impact Assessment in accordance with section 26(4) of the regulation.

Conclusions and Recommendations

Follow-up letters have been sent to the audited operations informing them of the results of the audit referent to their facility, including non-compliance issues and necessary remedial actions. The most significant of activities required for operations to come into compliance with the *Organic Matter Recycling Regulation* are to contain leachate or complete an environmental impact assessment to show that the discharged leachate will not impact the environment or human health as specified by Section 26.

Soon after receipt of analyses of samples collected during on-site inspections Ministry staff delivered to each of the audited facilities the results of their audit and instructions to rectify deficiencies with the regulations. A summary of this report, including direction to a website (http://wlapwww.gov.bc.ca/epd/epdpa/mpp/omrreg.html) containing guidance in achieving compliance with the OMRR, has been sent to all audited facilities as well as all known composting operations falling under the OMRR. Ministry staff have also begun follow up activities on inspections at the audited sites to ensure that operators have taken action to correct the non-compliances. In addition, sites operating under OMRR but not selected for the audit should be inspected to ensure that they also meet the legislated requirements. These actions should ensure that the audit has been successful in the project objectives of assessing compliance with legislative requirements of the OMRR, increasing awareness about those requirements, providing motivation to improve environmental management practices, identify non-compliance issues, and serving proof to the public, municipalities and industry that composting facilities are being accountably and appropriately managed and governed.

[1] *Total and Faecal Coliform Bacteria in Groundwater*-- Well Stewardship Information Series. September 2002. BC Ministry of Water, Land and Air Protection . Available at http://wlapwww.gov.bc.ca/wat/gws/ground_fact_sheets/coliform(020715)_fin2.pdf
Nitrate in Groundwater-- Well Stewardship Information Series. September 2002. BC Ministry of Water, Land and Air Protection . Available at: http://wlapwww.gov.bc.ca/wat/gws/ground_fact_sheets/no3(020715)_fin2.pdf

2 Introduction

The Ministry's 2003/04 – 2005/06 Service Plan states: "The Ministry of Water, Land and Air Protection is committed to protecting and enhancing the quality of British Columbia's environment… to help communities stay healthy, encourage recreational opportunities, contribute to a sustainable environment, and promote a strong and vibrant provincial economy."[2] Composting of organic refuse is a rational means of converting wastes into a useful resource, namely an amendment that improves the structure and fertility of soil. However, if not properly managed composting facilities can contaminate soil and groundwater with pathogenic microbes or potentially toxic chemicals, particularly nitrates[3], and can generate foul gases causing nuisance odours and even propagate airborne fungi harmful to humans[4]. Regulations under the *Environmental Management Act*, principally the Organic Matter Recycling Regulation (OMRR)[5], have therefore been put into place to safeguard human health and the environment from these potential negative impacts of composting. Administration and implementation of the *Act* and Regulation are the responsibility of the Environmental Protection Division of the Ministry of Water, Lands and Air Protection.

3 Scope and Objectives

In the South Coast Compliance Activity Plan 2003/2004, the Vancouver Island Regional office committed to carrying out inspections of 10 facilities operating under the OMRR. The audit focused on composting facilities only; therefore, land application plans were not audited[6]. Compliance to regulations assures that public safety and environmental quality are not being jeopardized. As the first phase of an escalating compliance strategy, the goal of the audit was to gather information to allow the ministry to determine how to focus future OMRR compliance activities. Specific objectives flowing from this goal were to:

- determine the level of compliance with the OMRR in this region (as an information-gathering exercise rather than an initiative to carry out immediate enforcement activities),
- ensure that operators can demonstrate they are complying with regulations pertaining to the large-scale production and storage of compost and that such activities are documented,

---

[2] *Service Plan-- Ministry of Water, Land and Air Protection 2003/04 – 2005/06.* January 2003. BC Ministry of Water, Land and Air Protection. Available at: http://www.bcbudget.gov.bc.ca/sp2003/wlap/wlap.pdf

[3] *Total and Faecal Coliform Bacteria in Groundwater*-- Well Stewardship Information Series. September 2002. BC Ministry of Water, Land and Air Protection . Available at http://wlapwww.gov.bc.ca/wat/gws/ground_fact_sheets/coliform(020715)_fin2.pdf
Nitrate in Groundwater-- Well Stewardship Information Series. September 2002. BC Ministry of Water, Land and Air Protection . Available at: http://wlapwww.gov.bc.ca/wat/gws/ground_fact_sheets/no3(020715)_fin2.pdf

[4] "Protecting Workers at Composting Facilities." *BioCycle*. September 1996. Epstein, E.
Compost Facility Requirements Guideline: How to Comply with Part 5 of the Organic Matter Recycling Regulation. March 2004. Forgie, D, Sasser, L, and Neger, M. available from the Ministry of Water, Land and Air Protection offices or from the internet at http://wlapwww.gov.bc.ca/epd/epdpa/mpp/compost.pdf.

[5] The *Environmental Management Act* is available at: http://www.qp.gov.bc.ca/statreg/stat/E/03053_00.htm and the Organic Matter Recycling Regulation is available at: http://www.qp.gov.bc.ca/statreg/reg/W/WasteMgmt/18_2002.htm

[6] *Organic Matter Recycling Regulation,* Section 5 requires land application plans for the purpose of describing how the application of Managed Organic Matter will be completed and monitored.

- inform the composting industry that the ministry is actively pursuing its compliance and enforcement role.
- provide protocols and forms to other regional offices that may wish to perform similar compliance inspections.
- to make a preliminary determination regarding the effectiveness of the OMRR in protecting human health and the environment.

On a broader scope, audit findings are applied to objectives and strategies in the Ministry Service Plan. The Plan states, "Both the public and industry increasingly demand transparent decision-making and clearly communicated standards, policies and guidelines based on impartial, scientific information. The ministry is continuing to explore opportunities (such as web-based communication) to provide transparency and accountability. Regular reports of ministry plans, initiatives and results related to the environment, public health and industry operations will enhance the ministry's capacity to make information public." Goal 4 of the Ministry plan is to: "Provide effective and efficient planning, support and enforcement for ministry programs", while one of the targets for 2003/04 and 2004/05 is to "streamline standards and improve monitoring, reporting and compliance". Both audits and summary reports such as this one contribute to the implementation of an effective data collection process and information network that supports air and water quality monitoring, tracks trends and provides for transparent progress reporting. In addition, this review of audit data will demonstrate the level of effectiveness of auditing as a performance management strategy for large-scale composting facilities and identify areas of improvement in the auditing process and in Ministry Regulations that can be targeted for streamlining.

4 Materials and Methods

Ten facilities operating in the Vancouver Island Region were selected for inspection and included those that have notified us of operation under s. 25 of the OMRR as well as those that are known to operate but have not provided notification. The facilities inspected were selected at random; however there was an effort to reflect all sizes of operations and feedstock types in the selection process. Because the location of compost facilities reflects that of the island's population centers, the selected sites fell out in the mid and southern portions of the island.

The 10 facilities to be audited were selected on July 15, 2003. To do this, a list was developed of all known composting sites operating under the OMRR (composting facilities operating under a Waste Management Permit were excluded). Included on the list were both composting facilities that have notified the ministry of their operation in accordance with the OMRR and those identified in the last compost study (conducted in March 2002[7]) that have not notified the ministry of their operation. Sites in operation prior to the OMRR are not required to notify the manager of their operation. 25 sites were identified and sorted according to size:

- 13 small sites producing less than 10 tonnes/day,
- 5 medium sites producing from 10 – 20 tonnes/day and
- 8 large sites producing greater than 20 tonnes/day.

[7] *Survey of Composting Facilities on Vancouver Island* March 2002, available from the Vancouver Island Region—Environmental Protection Division, Ministry of Water, Lands and Air Protection, 2080-A Labieux Road, Nanaimo, BC V9T 6J9

The ratio of small, medium and large sites was 5:2:3. To obtain 10 sites, each of the 25 sites was assigned a number in its size category and, in accordance with size-class ratios, 5 small, 2 medium and 3 large sites were selected by drawing numbers randomly. The selected sites were evaluated and determined to have a good variety of feedstocks including yard and garden waste, manure, biosolids, fish waste and woodwaste representative of the industry as a whole. Several sites originally selected were not operating during the audit period; therefore, they were not audited. Alternative sites were drawn in the same manner as the original sites to replace those not audited (see Table 1).

The following sites were considered and/or selected for auditing:

	Site	Location	Date Audited
Sites originally selected but not operating during the audit period	Site 1	Victoria	
	Site 2	Saanich	
	Site 3	Victoria	
	Site 4	Ucluelet	
Small Size Sites – <10 tonnes/day production	Site A	Victoria	Sep 23 2003
	Site B	Saanich	Oct 14, 2003
	Site C	Victoria	Feb 10, 2004
	Site D	Ladysmith	Feb 10, 2004
	Site E	Nanaimo	Feb 17, 2004
Medium Size Sites – 10 – 20 tonnes/day production	Site F	View Royal	Nov 12, 2003
	Site G	Sooke	Jan 27, 2004
Large Size Sites -- >20 tonnes/day production	Site H	Cumberland	Oct 28, 2003
	Site I	Courtenay	Jan. 13, 2004
	Site J	Port Alberni	Feb 24, 2004

Table 1 Site names, locations, and associated file numbers and date of audit, if applicable.

Site operators were contacted approximately 2 to 3 days prior to the inspection to ensure that they would be available on-site. Files were reviewed prior to visiting the site. Each inspection was conducted by a pair of Environmental Protection Officers (EPO). One EPO interviewed the operator while the other took photos of the facility. The interview results were recorded on a checklist included in Appendix 1 in Section 7.1. The interview included requests for records of temperature, feedstocks, analytical results and if appropriate the results of any EIA completed. An assessment of compliance with all relevant sections of the regulation was made as each section of the check list was completed. Following the interview and photographing the EPO's collected samples of compost to assess compliance with the OMRR's product classification requirements.

To comply with the OMRR, compost facility operators producing Class A compost from feedstocks other than yard waste alone must record temperatures and collect samples at different steps in the composting and curing process. Ministry staff took temperature readings during audit inspections to get a general "snapshot" of composting activity to compare to composter records (if any). Two or three temperature measurements were taken at a 60 cm depth in curing or finished product piles. Temperatures in excess of 20 degrees above ambient temperatures were considered as a qualitative indication that piles were still actively composting.

Similarly, Schedule 3, Section 5, indicates fecal coliform levels must be met before, or at the same time as, the vector attraction reduction requirements are met. EPO's initiated bacteriological analyses in order to generally describe microbial populations in finished compost for comparison to composter results (if any). In addition, analyses were conducted to ascertain the agronomic value of compost regarding carbon to nitrogen (C:N) ratios. For analyses of compost quality and fecal coliform counts, 7 locations, approximately equal distances apart, were selected in the finished compost. At each such spot, using a metal shovel, an excavation 30-40 cm deep was dug into the side of the compost windrow . EPO's scraped the excavation with a plastic shovel to remove any metal contamination introduced from the metal shovel. (The plastic shovel was rinsed with deionized water between samples.) Seven "grab samples" were collected for bacteriological analyses at each audited composting facility. Sterile plastic sample jars were filled by scraping the jar along the bottom of each excavation until full. Jars were capped, labeled and packed on ice for shipment to the lab. In addition, two scoops of compost were removed from the deepest portion of the excavation and placed in a plastic bucket. After samples were collected from all seven test pits in each compost pile, the contents of the bucket were mixed and placed into 2 zip-lock plastic bags, labeled and packed on ice for shipment to the lab for analyses for metals, carbon, nitrogen, and foreign matter. All samples were shipped by courier the day collected. Where appropriate, EPO's collected samples of leachate discharges, receiving streams, and groundwater where groundwater wells exist. These samples were collected using protocols detailed in the *British Columbia Field Sampling Manual: 2003 - For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples*, January 2003, as these are the same protocols composters would be obliged to follow in accordance with Schedule 5, section 3 of OMRR. Further direction regarding analytical procedures may be found under *Water and Air Monitoring and Reporting: Laboratory Services / Sampling, Methods and Quality Assurance* (available at: http://wlapwww.gov.bc.ca/wat/wamr/labsys/lab_man_03.html).

5 Results

5.1 Compliance

5.1.1 Pathogen Reduction Processes (Schedule 1)

Pathogen reduction is a process whereby salmonella and fecal coliform bacteria, enteric (intestinal) viruses, and helminth ova (parasitic worm eggs) concentrations are reduced by maintaining high temperatures during the composting process. Pathogen reduction requirements are specified in the OMRR in Schedule 1, Sections 4 and 5. For Class A compost not produced from yard waste alone, the feedstocks are to be composted at temperatures of at least 55°C in windrows, aerated static piles or in-vessel. The minimum residence time at 55°C is 3 days for in-vessel and aerated static piles and 15 days with 5 turnings for windrows. Pathogen reduction is less tightly regulated for compost made from yard waste alone as specified by Section 5; this section does not set numeric pathogen reduction standards but rather specifies a general composting process to help with pathogen reduction and vector attraction reduction. For Class B compost, feedstocks are to be composted in windrows, aerated static piles or in-vessel at temperatures not below 40°C for 5 days, and must, during that interval, attain a temperature of at least 55°C for a minimum of 4 consecutive hours.

Site	Compost method	Highest Compost Temperature from Required Records
Site A	Aerated static pile	N/A
Site B	Windrow	N/A
Site C	Windrow	N/A
Site D	Windrow	Not recorded
Site E (Class B)	Windrow	>40°C
Site F	Windrow	N/A
Site G	Windrow	Not recorded
Site H	In-Vessel	>60°C
Site I	Windrow	Not recorded
Site J	Windrow	Not recorded

Table 2 Composting method used at the audited sites and composting temperature. n/a = not applicable, composting yard waste alone. Shading indicates the operation has documented compliance with Schedule 6, Section 1 record keeping requirements and Schedule 1 Sections 4 and 5 pathogen reduction measures (lighter shading indicates record-keeping was not required).

Nine of the sites audited were attempting to produce Class A compost and one (Site E) was producing Class B compost. Four of these sites were composting yard waste alone and, therefore, pathogen reduction requirements were minimal and non-numeric. Although Site H provided documentation that appropriate temperatures were achieved, it is uncertain if minimum composting temperatures were met at the other four Class A compost sites as operators did not keep adequate records of daily temperatures and records of windrow turning during the thermophilic phase. Therefore, as shown in Table 2, two of seven sites (29%) required to maintain temperature measurements were able to provide documentation confirming adherence to the applicable composting temperature standards of Schedule 1. Operators advised that, based on experience, they were certain the minimum temperatures and times were met or exceeded. Minimum temperature requirements were met at Site E which produces Class B compost.

5.1.2 Pathogen Reduction Limits (Schedule 3)

Fecal coliform bacteria are a class of related bacteria found in the intestines of warm-blooded animals; the presence of coliforms indicates possible contamination with disease-causing (pathogenic) microorganisms. Schedule 3 requires that fecal coliform bacteria concentrations be less than 1000 MPN/g[8] (dry weight) in Class A compost and less than 2,000,000 MPN/g (dry weight) in Class B compost. Fecal coliform concentrations in the compost must be sampled at the rate of 7 samples/1000 tonnes or 7 samples/year whichever occurs first. All 7 samples must meet the coliform limit. No strict guidelines have been established for sampling protocols pursuant to Schedule 5 of the OMRR; reasonable industry initiatives were accepted when/if they had been implemented.

[8] MPN, the Most Probable Number, is an estimate of coliform-group organism density expressed as the number of organisms per gram of compost.

Figure 1 On the left is a variation of the aerated static pile using an Ag-Bag (bag removed). Note the perforated pipe used to pump air through the pile to maintain aerobic conditions during composting. On the right, the photo shows open windrows of compost with steam rising from the windrows.

Site	Fecal coliform concentration (MPN/g dry weight)						
Site A	N/A						
Site B	N/A						
Site C	N/A						
Site D	<1.8	7.9	<1.8	7	<1.8	220	1.8
Site E (Class B)	22,000	3,000	17,000	790	24,000	7,900	49,000
Site F	N/A						
Site G	1600	240	4.9	<1.8	<1.8	<1.8	<1.8
Site H[9]	24	>160	>160	>160	>160	>160	>160
Site I	1.1	<0.2	0.54	0.4	1.3	0.2	8.0
Site J	<2	<1.8	<2	<1.8	<1.8	<2	<1.8

Table 3 Results of Ministry sampling of fecal coliform concentrations in sampled cured compost. Schedule 3, Section 5, specifies that fecal coliform levels for Class A compost must be met before, or at the same time as, the vector attraction reduction (VAR) requirements are met—therefore the data above, shown with cross hatching, cannot be used to document compliance with Class A compost standards. However, results with diagonal cross-hatching yielded values within acceptable limits had they been taken during VAR processes—those values with horizontal cross-hatching may have exceeded those limits. Shading (as opposed to cross hatching) indicates results that fall within fecal coliform limits (for Class B compost) defined in Schedule 3 (lighter shading indicates sampling and record-keeping was not required).

To produce Class A compost, OMRR's Schedule 3, Section 5, indicates fecal coliform levels must be determined to be < 1,000 MPN per gram of total solids. Seven representative samples must be collected at least once per year or for every 1,000 tonnes of compost produced, whichever comes first. The samples must be collected and analyzed before, or at the same time as, the vector attraction reduction requirements are met. (Sites producing Class A compost from yard waste are not required to meet the criteria of Schedule 3, Pathogen Reduction Limits [bacteriological analyses] and Schedule 5, Sampling and Analyses [temperature recordkeeping].) None of the facilities required to conduct bacteriological sampling and analyses had actually

[9] Site H samples were collected at the end of the pathogen reduction phase of composting, however, the analytical laboratory did not perform adequate dilutions to accurately determine faecal coliform concentrations.

done so. As mentioned, as part of the audit, Ministry staff collected compost samples at all audited facilities; the samples were submitted to an accredited laboratory for analyses (as per Schedule 5, section 3 of OMRR). In only one case (for Site H) were EPO's able to collect those samples before or during the vector attraction reduction process. However, as a weak indicator of risk to public health and the environment, samples taken by EPO's at four of six (66.7%) of the operations audited, for which bacteriological sampling is required, yielded results that would have fallen within acceptable limits had they been taken during VAR processes (Table 3). There was no strong indication that microbial populations in samples from the remaining two sites varied from these limits. (Analyses of samples from Site H and Site G's compost sites had, or may have had, coliform bacteria counts higher than 1,000 MPN/g dry weight but the samples at the latter site might have fallen within set limits—the laboratory analyses returned to the Ministry for that set of samples inadvertently used an upper limit [beyond which counts were curtailed] well below that required to compare to Schedule 3 limits.) Nonetheless, a strong indicator is also lacking that potentially pathogenic microbes (that may exist in feedstocks) were heat-destroyed by the processes set forth in OMRR Class A standards. Therefore, the Ministry has little data on which to base a scientific assurance that human health and the environment will be safeguarded from pathogens and toxins which may be found in improperly processed compost.

5.1.3 Vector Attraction Reduction (Schedule 2)

Putrescibility is the capacity of a substance containing proteins to support anaerobic microbial digestion; these chemical reactions generate foul odours. These odours can attract vectors, organisms that can transfer pathogens from the compost site. Vector attraction reduction reduces the putrescibility of the compost and therefore, the attraction of rodents, bears, birds, insects, and other animals which may cause a nuisance or carry away pathogens, spreading diseases to animals and humans. Putrescibility varies proportionately with the carbon to nitrogen (C:N) ratio. Compost with low C:N ratios can cause harm to groundwater or plants from leaching excess nitrogen and, therefore, should be applied only in agronomic rates as a fertilizer. Moderate C:N ratios, about 25:1 – 30:1 can be used as a soil amendment as the nitrogen is bound up in a form that is slowly released to plants. High C:N ratios provide little nutrient value to soils and are useful only as a soil mulching or compost bulking agent.

Schedule 1, Section 3 specifies that, for Class A compost, vector attraction reduction criteria be met after the pathogen reduction requirements are successfully completed. Schedule 2, Section 2 requires that one of two processes must be followed:

1. Class A compost must be treated aerobically for greater than 14 days at an temperature greater than 40°C with an average temperature of greater than 45°C After the vector attraction process is complete, the C:N ratio is to be greater than or equal to 15:1 and less than or equal to 35:1.
2. Alternatively compost must be cured for at least 21 days. After curing, the C:N ratio is to be between 15:1 to 35:1 and the pile must not reheat more than 20°C above ambient temperature upon mixing and standing. A reheat test procedure is described in the schedule.

Class B compost vector attraction reduction requirements state that the compost must meet the requirements of Schedule 2, Section 1 that specifies that compost must be cured according to one of several processes. These processes include:

1. Aerobic or anaerobic digestion to reduce volatile solids by greater than 38%;
2. maintain the pH at greater than 12 for more than 2 hours followed by pH at greater than 11.5 for an additional 22 hours;
3. dry the compost is to greater than 90% solids.

Alternatively, compost can be incorporated into the soil within 6 hours after application or be applied to the land in accordance with best management practices approved by a director. A land application plan is required, under Section 15(1), prior to the use Class B compost.

Site	Compost Temperature above ambient (as determined by EPO's during audit)	C:N Ratio
Site A	17	27:1
Site B	41	185:1
Site C	30	90:1
Site D	4	145:1
Site E (Class B)	Not recorded	125:1
Site F	37	12:1
Site G	35	15:1
Site H	30	9:1
Site I	31	25:1
Site J	22	432:1

Table 4 Results of Ministry sampling of temperature and C:N ratios. Shading indicates that data reviewed or gathered during the audit may have been in compliance with C:N ratios and/or temperature above ambient set in Schedule 2, Section 2b (lighter shading indicates that scheduling for Class B compost does not specify C:N ratios). Temperatures are averages of two or three temperature measurements taken at a 60 cm depth.

All operators audited opted for the greater than 21 day curing process. Most operations attested to having cured their product for 1 – 2 years prior to sale or use; however, no facility kept records to document the curing duration of any batch of compost. Similarly, operators were not measuring temperatures in a test pile as described in Schedule 2, Section 2(b) to determine that the endpoint of the vector attraction reduction process had been reached. Temperature measurements of finished compost taken by Ministry staff during the audit indicated that only at Site A and Site D might the curing process have been complete—however, compliance cannot be confirmed because test piles were not re-mixed as specified in Schedule 2, Section 2(b). At these two sites the pile or windrow of finished compost was not greater than 20 degrees above ambient temperature-- at other sites the relative temperature differential strongly indicated that chemical processes of composting were still active.

C:N ratios varied widely at the sites audited, ranging from 8.5:1 to 435:1. C:N ratios for most sites were outside the range set in the regulation. Only 3 sites (33% of sites for which C:N specifications apply), the facilities of Site A, Site I, and Site G, met the C:N requirements for Class A compost (Table 4). There is no C:N ratio requirement for the Class B compost produced by Site E.

5.1.4 Compost Quality (Schedule 4)

Schedule 4, Sections 1 and 2, sets limits for specified metal concentrations and foreign matter concentrations in compost. Sampling frequencies are specified in Schedule 5 and parallel the sampling frequencies specified in Schedule 3 for pathogen reduction determination. None of the audited facilities maintained documentation regarding metal and foreign matter concentrations. Results of analyses of samples collected by Ministry staff during the audit appear in Table 5

Site	Metal exceedances See Schedule 4	Foreign matter Class A compost, must be less than 1%
Site A	No exceedances	0.04%
Site B	No exceedances	0%
Site C	No exceedances	0%
Site D	No exceedances	0%
Site E (Class B)	No exceedances	N/A
Site F	No exceedances	0%
Site G	No exceedances	0%
Site H	Copper, Selenium, Zinc	0%
Site I	No exceedances	0.44%
Site J	No exceedances	0%

Table 5 Compost quality exceedances for the audited sites above limits set by Schedule 4. Shading indicates that the operation has documented compliance with limitations on content of metal and foreign matter.

Nine sites (90%) met the metal concentration restrictions; Site H composting facility for biosolids exceeded the limits for copper, selenium and zinc. All sites met foreign matter requirements (Table 5).

5.1.5 Feedstocks and Volumes (Schedule 12 & Sections 27, 28 and 29)

Site	Feedstock
Site A	Yard waste
Site B	Yard waste
Site C	Yard waste
Site D	Woodwaste and biosolids
Site E (Class B)	Woodwaste and biosolids
Site F	Yard waste
Site G	Woodwaste and chicken manure
Site H	biosolids and woodwaste
Site I	Woodwaste and fish mortalities
Site J	Woodwaste, fish mortalities & offal, some yard waste

Table 6 Feedstock for audited compost sites. Shading indicates that the operation has documented compliance with Schedule 12

Organic matter suitable for producing Class A or B compost is listed in Schedule 12. Feedstocks for the audited sites included yard waste, fish mortalities and offal, manure and biosolids. All sites audited met the requirements of this schedule (Table 6).

Site	Capacity	Volume on site
Site A	900 t/y	800 t
Site B		5000 t
Site C	600 t/y	600 t
Site D	800 t/y	550 t
Site E (Class B)	1680 $m^{3/y}$	1600 m^3
Site F	4,000 t/y	3,000 m^3
Site G		4,000 m^3
Site H	4500 t/y	10,000 m^3
Site I	15,000 $^{m3/y}$	18,000 m^3
Site J	10,000 t/y	15,000 t

Table 7 Capacity of audited compost sites. Shading indicates that the operation has submitted notification of operation in accordance with Section 25 of the OMRR and that on-site production rates were consistent with production allowances specified by OMRR.

Sections 27 and 28 specify that the amount of organic matter in a composting facility must not at any time exceed the total design capacity. At least half the compost must be removed annually from the facility beginning in the third year after start-up. Section 29 specifies that residuals must not at any time exceed 15 cubic metres in total and that storage of residuals prevent vector attraction and must be disposed of regularly. All sites met requirements for residuals management (Section 29).

All sites were operating within the production rates stated in their notifications, if submitted (Table 7). Some site operators have not provided a notification under Section 25 of the regulation; therefore, a design capacity was not available. An estimate of compost onsite is provided. It is noted that some sites have more compost on site than that stated in the facility's notification; however, in this regard, Section 28 of the OMRR requires that ½ the product be removed from the site annually after the third year after start-up-- and some facilities have not yet reached the third-year benchmark.

Figure 2 Typical feedstock storage consisting of yard waste, tree and brush trimmings or ground woodwaste. There may be leachate issues associated with feedstock storage. Under the right conditions, fires can break out in the stored materials (note the smoke in the upper right photo).

5.1.6 EIS, Plans, Specifications (Sections 23 & 24)

Section 23 requires an environmental impact study (EIS) for facilities proposed to have a production capacity of more than 20,000 t/y, which will expand an existing 20,000 t/y capacity by more than 10% or which will expand to a capacity of more than 20,000 t/y. The EIS should not be confused with the environmental impact assessment (EIA) required when a composting facility is implementing alternative leachate management practices (section 26 of the OMRR). The EIS addresses a broad spectrum of environmental concerns including surface water, ground water, vegetation, wild life, odour impacts, traffic nuisance and residential or commercial neighbours concerns.

Section 24 requires dischargers to have a qualified professional (QP) develop the plans and specifications for the construction and operation of all new facilities and for any modifications of existing facilities which increase the annual production by more than 10% or to greater than 20,000 m^3/y. The plans must include all works at the facility, leachate management, odour management, and operating and closure protocols.

Except for Site H site, all audited sites existed at the time the regulation came into effect and none has increased in capacity. Therefore, the requirements to have a QP develop plans and specifications, leachate and odour management plans, and operating and closure plans does not apply to them. Due to the small capacity of the sites, the requirement for an EIS does not apply.

5.1.7 Leachate Management Requirements & EIA (Section 26)

Section 26 requires that the receiving, storage, processing and curing areas of a composting facility be located on asphalt, concrete or other impermeable surface and that it be protected from precipitation by a roof or other cover. Run-on and run-off control and a leachate collection system are required. No leachate is to be discharged to the environment without authorization under the *Environmental Management Act*. Section 26 (4) allows relief from these requirements if an environmental impact assessment, vetted by a Qualified Professional, shows that "the environment will be protected and appropriate water quality criteria satisfied through the use of alternative leachate management processes". Thus the EIA primarily addresses the impact of alternative leachate management practices on surface water, groundwater and other receptors, and users of the water resource.

Figure 3 Leachate contained by an asphalt berm and directed to a collection sump.

Leachate control is limited at a number of sites (Table 8). Four sites have leachate management systems incorporating impermeable surfaces, leachate collection and appropriate disposal of the liquid waste. However, in some cases leachate is directed to unlined leachate collection ponds (Figure 5) or, more frequently, allowed to escape from the site through pond overflow or infiltration. Four facilities had leachate collection ponds that appeared to be unlined and therefore be unable to prevent leachate loss to the underlying soils and water table. Six facilities appeared to overflow to surface waters during wet weather. These facilities had not completed EIA's to assess environmental protection.

Figure 4 The Site H invessel composting facility. To the left is the compost building housing the mixing, composting bins and screening facilities. To the right is the curing building. A leachate collection pond is shown in the lower left of the photo.

The Site H facility (Figure 4) has a leachate management system constructed with a cover and an asphalt work surface. Leachate from this site is mainly contaminated runoff from the asphalt apron surrounding the facility buildings. The runoff is directed to an exfiltration pond. The Site H has completed a brief EIA to determine there will be no impact to the environment from exfiltration. The Site C directs the leachate to the municipal sanitary sewer as does Site D and Site E directs leachate to a holding tank for reuse; thus, these three sites and Site H composting facilities comply with Section 26(2) of the OMRR by collecting leachate on an impermeable surface.

Figure 5 Leachate collection ponds at various sites. EPO's inspection assessments were that ponds are generally poorly constructed and/or maintained as there is no documentation that the underlying soil is impermeable and/or they appear to overflow in wet weather.

The Site A site, composting yard waste, used the Ag-Bag system which protected the compost from precipitation and reduced leachate. This site appeared to be on natural clay which was graded toward a leachate collection pond. However, the collection pond was observed to overflow to the roadside ditch at times of heavy precipitation. The Site B site, also apparently constructed on clay, directs leachate by perimeter ditches to a collection pond where water levels are controlled to some extent by evaporation in warm weather but which may infiltrate into soil or overflow in wet weather. Site F collects some leachate in a pond and allowed the remaining leachate to flow to a roadside ditch. At Site I, leachate eventually reaches a wetland area

draining to the Tsolum River, a salmon bearing stream. In summary, these facilities allow leachate to flow to the environment without an assessment to assure that the discharge will not have an adverse impact on the environment -- thus failing to comply with Section 26(4) of OMRR.

Section 26 stipulates that an EIA is required if a facility is not equipped with specified infrastructure by (an impermeable surface, roof, cover, prepared surface or leachate collection system). An EIA was completed for Site H site. Three sites, the composting facilities of Site C, Site D, and Site E have appropriate leachate management works in place and do not require the completion of an EIA, the remaining six sites have neither complete leachate management works nor a completed EIA (see Table 8).

Site	Leachate Management Requirements (s. 26)	EIA completed which demonstrates that there will be no adverse impacts?
Site A	Clay surface, Pond with evaporation and overflow to storm water system	No
Site B	Clay surface ditches to pond, evaporation	No
Site C	Paved surface, discharge to municipal sanitary sewer.	Not required
Site D	Discharge to municipal sanitary sewer.	Not required
Site E (Class B)	Paved surface, tarped, leachate to holding tank for reuse.	Not required
Site F	Pond and direct flow to roadside ditch	No
Site G	Ditches direct leachate to woodwaste landfill leachate collection ponds.	No
Site H	Paved, covered, runoff from paved apron to exfiltration pond	Yes
Site I	Ditches to collection pond, discharge to environment.	No
Site J	Ditches direct leachate to woodwaste landfill leachate collection ponds.	No

Table 8 Leachate management and EIA submissions at the audited sites. Shading indicates that the operation has provided documentation of compliance with Section 26 of the OMRR.

5.1.8 Record keeping (Schedule 6)

Schedule 6 specifies that, during the thermophilic and curing phases, temperature and retention times be monitored and recorded each working day for Class A compost not produced from yard waste alone. These records and the results of analyses are to be kept for a minimum of 36 months and be made available for inspection.

Site	Analyses	Temperature	Records kept
Site A	n/a	n/a	n/a
Site B	n/a	n/a	n/a
Site C	n/a	n/a	n/a
Site D	No	No	No
Site E	Yes	Yes	Yes
Site F	n/a	n/a	n/a
Site G	No	No	No
Site H	No	Yes	Yes
Site I	No	No	No
Site J	No	No	No

Table 9 Analyses and record keeping requirements. Shading indicates that the operation has provided documentation of compliance with Schedule 6 of the OMRR.

5.2 Environmental Impact

It is worthwhile to examine, in concert with a determination of the compliance to regulations, whether the regulations are serving their intended purpose, namely the protection of human health and the environment. Conversely, it is useful to assess if non-compliance with regulations is actually resulting in significant adverse impacts to the environment. Observations along these lines were recorded in the course of the audits.

5.2.1 Odour

Section 24 requires that operators of new sites and sites increasing capacity by 10% or more or to 20,000 m^3/y or more have a qualified professional develop an odour management plan. Except for Site H (which had an odour management plan), all other audited sites existed prior to the regulation, therefore, are exempt from section 24. Odours can therefore, only be addressed through the operator's desire to run a neighbour-friendly business, or, if strong odours can be shown to be associated with pollution, through orders from the Regional Waste Manager. Odours may be regulated by bylaws at the municipal government level.

The audited sites were, by and large, exempt from the requirement that odour management plan to be in place. Most sites at various times have significant odour problems as reported to the ministry through public complaints. Once the public becomes sensitised due to a strong odour incident, they are more likely to respond with complaints at milder odour levels[10]. Most sites are situated in areas surrounded by residential, commercial or industrial facilities. Of those audited, only Site H had an odour management plan in place. The Site H facility has a biofilter to receive

[10] "Bouncing Back from a Public Nuisance Setback," *Biocycle.* September 1996. C. Pick

odorous gases for processing prior to release to the environment. This site is also located relatively remotely from residential areas with a large buffer zone around it. Odours, while noticeable in and around the buildings, were not noticed at the property boundary.

5.2.2 Leachate and Groundwater Monitoring

One of the principle means by which composting can impact the environment is by contamination of surface waters or groundwater. The OMRR does not authorize any leachate discharge unless an EIA demonstrates that there will be no adverse impact to the environment or public health. Monitoring requirements for leachate and/or the receiving environment can be specified in an EIA. In the absence of EIA's, little can be concluded in regards to the impacts of leachate. (As follow-up to the audit, Ministry staff have received commitment for the completion of EIA's from the six facilities for which they are required.) Most sites operated without a formal surface water and groundwater monitoring program. Monitoring wells are in place at Site H by virtue of the site being on the landfill property. It is the landfill monitoring program that is tracking leachate concerns from that property. There are several groundwater and surface water sites at Site I site. Monitoring was last completed in March 2000. The boring of test wells and the cost of laboratory analyses of leachate and groundwater sampling were beyond the resources allocated for the current audit project.

5.2.3 Vector Nuisance

Large vertebrates such as eagles, raccoons and bears can be attracted to composting facilities when potential food sources in compost are allowed to remain available. Potentially nutritious foods such as fish mortalities may become harmful to wildlife once mixed with other waste. In addition, the concentration of wildlife, of bears in particular, may cause potential risks to humans or conversely expose wildlife to risks from machinery or poachers. These and other vectors, especially flies, may also transfer potentially pathogenic microbes that can originate in compost feedstocks to other locations where the public, wildlife or livestock may be exposed. Vector reduction is therefore an important component of the management of compost facilities and is reflected in the requirements of Schedule 2 the OMRR. During inspections of the audited sites, no significant vector problems were noted. While this could have been a seasonal variance, it is also possible that diligent management has prevented vectors from using the sites.

6 Conclusions and Recommendations

6.1 Compliance Summary

Compliance was assessed for 10 criteria of the regulation for the 10 sites audited. Most sites were unable to demonstrate compliance in at least one of the criteria. The common issues for which only a low rating of compliance was assessed were:

- **Pathogen Reduction Processes (Schedule 1)** (obtaining and retaining records of temperature and retention times): Two of the six sites (33%) for which pathogen reduction processes are required were able to demonstrate compliance to Schedule 1 of the OMRR .

- **Pathogen Reduction Limits (Schedule 3):** One facility (1 of 9 or 11%) was able to demonstrate the effectiveness of the vector attraction reduction requirements set by Schedule 2. Other operations either did not perform the required test to determine completion of the curing of the compost or did not pass the test as the compost reheated beyond the maximum 20°C above the ambient temperature.
- **EIS, Plans, Specifications (Sections 23 & 24):** Four of the ten sites (40%) adhered to leachate management infrastructure requirements (or completion of an EIA for alternative leachate management). One of seven (14%) of sites was able to demonstrate compliance in having completed an EIA in the absence of required infrastructure or because they were discharging leachate directly to the environment without any other form of authorization. Clear guidelines and terms of reference are required to help ensure that qualified professionals and operators understand the requirements for an EIS and/or EIA. These are outlined in a recently issued guidance document, *Compost Facility Requirements Guideline*.[11]
- **Sampling:** Staff from one of six facilities (17%) verified that they had taken samples required for analyses; similarly, operators of two out of six (33%) of facilities reported that they had taken temperature readings as specified under the OMRR.
- **Record keeping (Schedule 6):** As only a few of the operations required to conduct analyses and temperature monitoring actually did so they could not keep records as required and, thus, only two of six (33%) produced records of required measures during the inspection.

Although compliance with the OMRR would require that the operations conduct their own sampling at the critical points defined in the various schedules, evidence collected by Ministry staff during the audit indicated that many sites may be in compliance with the actual intent of the regulation with respect to the following:

- **Pathogen Reduction Limits (Schedule 3)** (bacteriological analyses): Bacteriological analyses of samples from four of six (67%) of the sites for which pathogen reduction limits applied were documented to satisfy coliform concentrations may have exceeded the 1000 MPN/g standard for Class A compost. (It is noted that the upper and lower MPN indices associated with a 95% confidence limit[12] are wide enough that it is uncertain whether coliform concentrations nominally greater than 1000 MPN/g actually exceeded the OMRR specifications.)
- **Compost Quality (Schedule 4):** Analyses of samples from all 10 sites (100%) indicated that the content of foreign matter in the finished compost product fell within acceptable levels. Nine of 10 (90%) met requirements for concentrations of heavy metals.
- **Feedstocks and Volumes (Schedule 12 & Sections 27, 28 and 29):** Observations of feedstocks and volumes at all 10 audited sites (100%) indicated that feedstocks and volumes were allowable under the regulations.

[11] *Compost Facility Requirements Guideline: How to Comply with Part 5 of the Organic Matter Recycling Regulation* March 2004, Forgie, D, Sasser, L, and Neger, M. available from the Ministry of Water, Land and Air Protection offices or from the internet at http://wlapwww.gov.bc.ca/epd/epdpa/mpp/compost.pdf.

[12] B*ritish Columbia Environmental Laboratory Manual* by Water & Air Monitoring and Reporting Section, Water, Air and Climate Change Branch, Ministry of Water, Land and Air Protection, Province of British Columbia and The British Columbia Quality Assurance Users Committee and the Technical Subcommittee available from the Ministry of Water, Land and Air Protection offices or from the internet at http://wlapwww.gov.bc.ca/wat/wamr/labsys/lab_man_03_pdfs/section_e.pdf

Compliance area	Sites documented as in compliance*	Sites not able to demonstrate compliance	Not required
Pathogen Reduction Processes (Schedule 1) Retention time/temperature limit (see Table 2)	2 Site H, Site E	4 Site I, Site G, Site D, Site J	4 Site C, Site A, Site B, Site F
Pathogen Reduction Limits (Schedule 3) bacteriology limit (see Table 3)	1 Site E	5 Site H, Site G, Site I, Site D, Site J	4 Site C, Site A, Site B, Site F
Vector Attraction Reduction (Schedule 2) Retention time/temperature/reheat test (see Table 4)	1 Site A	8 Site D, Site J, Site C, Site B, Site F, Site I, Site G, Site H	1 1 Site E
Compost Quality (Schedule 4) (metals and foreign matter content) (See Table 5)	9 Site E, Site I, Site G, Site D, Site J, Site C, Site A, Site B, Site F	1 Site H	
Feedstocks and Volumes (Schedule 12 & Sections 27, 28 and 29) (See Table 6)	10		
Volume Capacity (Sections 27 & 28) (See Table 7)	10		
EIS, Plans, Specifications (Sections 23 & 24) (See Table 8)	1 Site H	6 Site I, Site G, Site J, Site A, Site B, Site F	3 Site C, Site D, Site E
EIA (Section 26) (See Table 8)	4 Site C, Site D, Site E, Site H	6 Site I, Site G, Site J, Site A, Site B, Site F	0
Sampling (schedule 6) (See text of 5.1.1 and Table 9)	1 Site E	5 Site I, Site G, Site D, Site J, Site H	4 Site C, Site A, Site B, Site F
Record keeping (Schedule 6) (see Table 9)	2 Site E, Site H (partial)	4 Site I, Site G, Site D, Site J	4 Site C, Site A, Site B, Site F

Table 10 Compliance summary

* for a number of criteria, to fully comply with OMRR specifications, composting facilities should have conducted and maintained records of their own sampling or analyses.

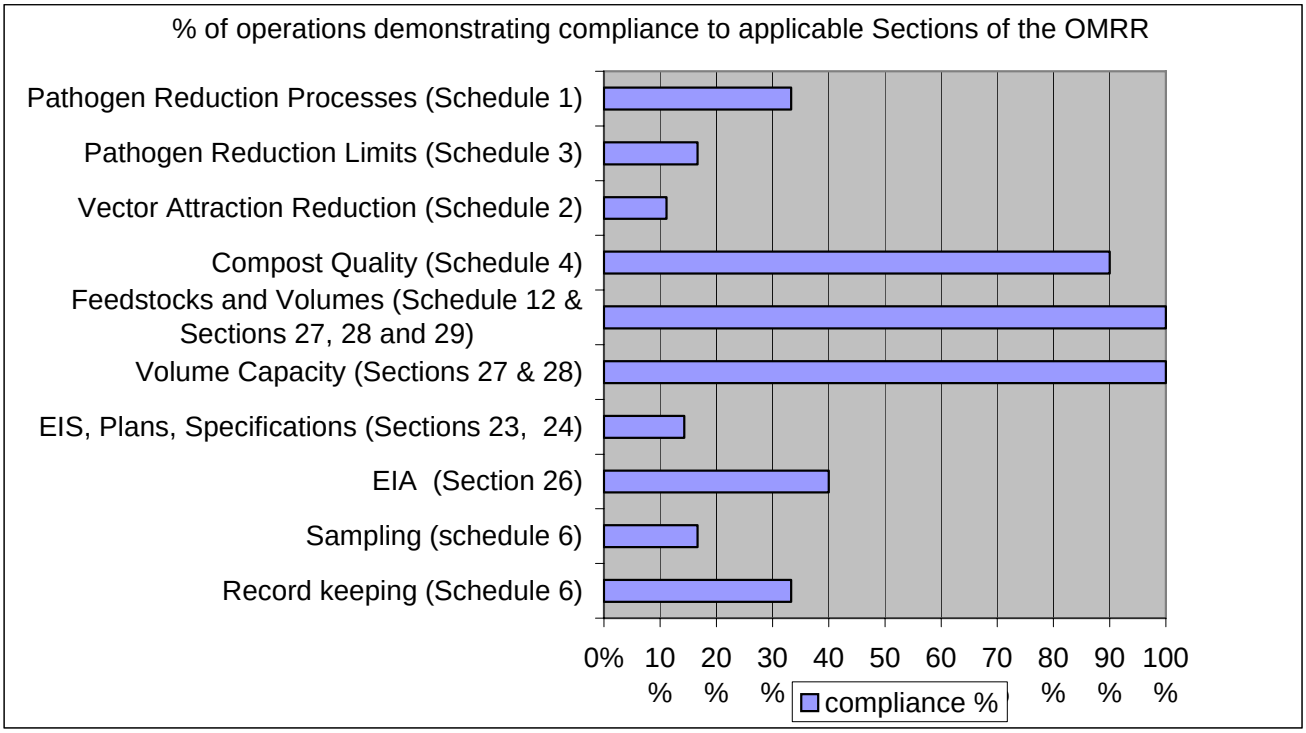

Figure 6 % of composting facilities able to demonstrate compliance during the audit to key sections of the OMRR.

Overall, it was apparent that no operator could demonstrate compliance with all of the key requirements of the OMRR. Most pertinent to the protection of human health and the environment, is the finding that, at the majority of the audited sites, the audit could not confirm compliance with the OMRR's requirements for Pathogen Reduction Processes and Vector Attraction Reduction. If pathogens are present in compost in large amounts, these can be released to the environment through leachate, vectors or distributed to clients in the finished compost. However, these concerns were offset by the fact that coliform levels in finished compost were generally within limits acceptable under the OMRR. Similarly, nitrate[13] and heavy metal concentrations can be a hazard if they enter groundwater or surface waters—but nitrogen levels (and by association nitrates) were generally low and metal content at most sites fell within acceptable parameters.

The Ministry's 2003/2004-2004/2005 Service Plan commits to "developing meaningful partnerships in and out of government with those who share our stewardship interests". This includes a greater dependence on regulated industries using the skills of qualified professionals to ensure that their activities will not adversely impact the environment. Section 26 of the OMRR sets specific conditions for the preparation of an EIA. This is a crucial component of the

[13] Nitrate concentrations are a function of the C:N ratio; the C:N ratio at most sites either fell within acceptable limits or was higher than limits set by the OMRR, indicating that the amount of carbon in the compost was "diluting" nitrogen contributions. Therefore, nitrogen could be expected to be bound with carbon through biochemical processes rather than generating high levels of nitrate.

OMRR and one in which the majority of facilities was deficient; completion of this requirement should address the gamut of corollary concerns.

6.2 Recommendations

Soon after receipt of analyses of samples collected during on-site inspections Ministry staff delivered to each of the audited facilities the results of their audit and instructions to rectify deficiencies with the regulations. A summary of the findings of the audit, including direction to a website (http://wlapwww.gov.bc.ca/epd/epdpa/mpp/omrreg.html) containing guidance in achieving compliance with the OMRR, has been sent to all audited facilities as well as all known composting operations falling under the OMRR. Ministry staff have also begun follow up activities on inspections at the audited sites to ensure that operators have taken action to correct the non-compliances. In addition, sites operating under OMRR but not selected for the audit should be inspected to ensure that they also meet the legislated requirements. These actions should ensure that the audit has been successful in the project objectives of assessing compliance with legislative requirements of the OMRR, increasing awareness about those requirements, providing motivation to improve environmental management practices, identify non-compliance issues, and serving proof to the public, municipalities and industry that composting facilities are being accountably and appropriately managed and governed.

7 Appendices

7.1 Audit Checklist

Ministry of Water, Land and Air Protection
Organic Matter Recycling Regulation
Audit Checklist

Date of Inspection _____

Inspected by _____

File:	Site Name:	Address:	
Operator:		Phone:	Cell phone:
Start date of site	Date of Notification:	Registered Capacity	Volume onsite:

Feed stock:		Product:	
□ Animal bedding	□ Manure	Biosolids	Compost
□ Biosolids	□ Milk process waste	☐ Class A	☐ Class A
□ Brewery/winery waste	□ Plant processing waste	☐ Class B	☐ Class B
□ Domestic septic sludge	□ Poultry carcasses	☐ Growing Medium	
□ Fish waste	□ Untreated wood waste (no C&D)		
□ Food waste	□ Whey		
□ Poultry hatchery waste	□ Yard waste		

Plans and Specifications

Plans & Specs required ☐Y ☐N New facility or capacity increased by 10% or to >20000 m^3/y	Plans/Specs onsite ☐Y ☐N
Signed by QP ☐Y ☐N	Name of QP
Plans include: Design of Works ☐Y ☐N Leachate mgmt plan ☐Y ☐N Odour plan ☐Y ☐N Site Preparation ☐Y ☐N Operating plan ☐Y ☐N Closure plan ☐Y ☐N	

Environmental Impact Study

EIS applicable ☐Y ☐N Capacity >20,000 t/y or increased to >20,000 t/y or >20,000 t/y increased by >10% Report Prepared ☐Y ☐N Date rec'd by Mgr. _____	Study identifies: Impact of design ☐Y ☐N Odour impacts ☐Y ☐N Leachate impact ☐Y ☐N Buffer Zones ☐Y ☐N

Leachate Management Facilities

Composting area covered ☐Y ☐N ☐ Roof ☐ Tarps ☐Other _____

Impermeable work surface ☐Y ☐N ☐ Asphalt/Concrete ☐Other _____

Run-on prevention ☐Y ☐N Runoff control ☐Y ☐N

Leachate collection ☐Y ☐N Lechate reuse ☐Y ☐N if No, then _____

EIA determines alternative leachate management practices OK ☐Y ☐N

Alternative leachate management practice includes:

_____

_____

Pathogen Reduction Process

Class A Biosolids Process	Class A Compost Process	Class B biosolids & compost
Thermophilic aerobic digestion Heat, >7% solids in biosolids Heat, >7% solids in biosolids with particles Heat, <7% solids in biosolids, time >15 sec and <30 min Heat, <7% solids in biosolids ocess Temp _____°C @ Time_____ Calc time:_____ mp ☐ Low ☐ OK ☐ High me ☐ Short ☐ OK ☐ Long Thermophilic anaerobic digestion ≥50°C for ≥10 days Alkaline Stabilization pH >12 for 72 hrs. with >52°C for 12 hrs. Meet requirement ☐Y ☐N	Windrow >55°C for ≥15 days, 5 row-turns Static aerated pile >55°C for ≥3 days Enclosed Vessel >55°C for ≥3 days ☐ Yard waste only Measured Temperature _____ Days at temperature _____ Number of row turns _____ Meet requirement ☐Y ☐N	☐ Aerobic digestion 40 day @20°C to 60 days @ 15°C ☐ Air drying ≥3 months ☐ Anaerobic digestion Between 15 days @ 35-55°C & 60 days @ 20°C ☐ In-vessel, static aerated pile or windrow 5 days @ >40°C and 4 hrs @ >55°C ☐ Lime stabilization pH 12 for 2 hrs Meet requirement ☐Y ☐N

Operator's Sampling, Analyses, Records

Compost Samples: ☐/1000 t ☐/year ☐ No samples

Biological samples: ☐7/1000 t ☐7/year ☐ Other _____

Sampling Results

Bacteria conc. meets Class A requirements
Fecal coliform <1000 MPN/g

Bacteria conc. meets Class B requirements
Fecal coliform <2,000,000 MPN/g

Metal analyses: (maximum µg/g)

Substance	Class A compost	Biosolids growing medium	Class B biosolids Class B compost

☐Y ☐N Daily temperature records kept

Records maintained for 36 months:

☐Y ☐N Sampling results

☐Y ☐N Temperature records

Class A Biosolids:

☐ Meets Trade Memorandum T-4-93

Arsenic	13	□Y	□N	13	□Y	□N	75	□Y □N
Cadmium	3	□Y	□N	1.5	□Y	□N	20	□Y □N
Chromium	100	□Y	□N	100	□Y	□N	1 060	□Y □N
Cobalt	34	□Y	□N	34	□Y	□N	150	□Y □N
Copper	400	□Y	□N	150	□Y	□N	2 200	□Y □N
Lead	150	□Y	□N	150	□Y	□N	500	□Y □N
Mercury	2	□Y	□N	0.8	□Y	□N	15	□Y □N
Molybdenum	5	□Y	□N	5	□Y	□N	20	□Y □N
Nickel	62	□Y	□N	62	□Y	□N	180	□Y □N
Selenium	2	□Y	□N	2	□Y	□N	14	□Y □N

Vector Attraction Reduction

Class A biosolids
Class B biosolids used for growing medium

☐ Digestion - 38% reduction of volatile solids

☐ Aerobic 30 day bench test <15% volatile reduction

☐ Anaerobic 40 day bench test <17% volatile reduction

☐ SOUR <1.5 mg/g O_2 uptake @ 20°C

☐ pH >12 for 2 hours → pH>11.5 for 22 hours

☐ Solids >90%

Class B biosolids

Fecal coliform <2,000,000 MPN/g with incorporation into soil

Class A compost

Aerobic process 14 days; @ >40°C with avg. temp >45°C; C:N ratio 15:1 to 35:1

Cure 21 days with no reheat; C:N ratio 15:1 to 35:1

Class B compost

Meet Class A biosolids standard above or

Incorporate into soil within 6 hours

In accordance with BMP

Vector Observations

☐No vectors observed

☐ Eagles _____

☐ Crows/Ravens _____

☐ Seagulls _____

☐ Bears _____

☐ Rodents _____

☐ Other _____

_____

Residuals Management

Ministry Samples

Ministry Samples collected: ☐Y ☐N

Samples: ☐Fecal coliform ☐Metals ☐C:N ratio ☐Foreign matter

☐_____

Temperature measured: _____Ambient temp _____ ☐ Not taken

Comments/Notes:

Compliance Summary: