March 5, 2024

Transmitted via email to: tomh@pscleanair.org

Puget Sound Clean Air Agency
1904 3rd Avenue, Suite 105
Seattle, WA 98101

Attn: Tom Hudson

Re: First Quarter 2024 Biofilter Inspection Technical Memorandum and Smoke Test Report
Cedar Grove Composting – Maple Valley Facility
Maple Valley, Washington
Landau Project No. 1224005.110

Dear Mr. Hudson:

Cedar Grove's Everett facility received Notice of Violation (NOV) No. 3-010458 from the Puget Sound Clean Air Agency (PSCAA) on February 3, 2020, which cancels and replaces NOV No. 3-009155, issued March 18, 2019. NOV No. 3-010458 addresses testing, inspection, and reporting requirements for the Everett facility and incorporates Tables 4 and 5 of the attached technical memorandum to NOV No. 3-009155. Landau Associates, Inc. and Cedar Grove Composting understand that the topics discussed in these NOVs are subject to further evaluation and resolution before potentially affecting compliance requirements for either the Everett or the Maple Valley facility.

As Cedar Grove engages with PSCAA to address compliance issues, we request that PSCAA withhold issuance of further NOVs related to the same inspection and reporting topics identified in NOV No. 3-010458 until a mutual understanding of inspection and reporting requirements has been established between all parties involved. This will allow Cedar Grove and its representatives to work more effectively with PSCAA. We appreciate PSCAA's consideration of this request.

LANDAU ASSOCIATES, INC.

Amy Maule
Senior Scientist

Mark Brunner
Principal

AEM/MWB/ccy
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cc: Ron Westmoreland, Gabe Morrelli, and Jay Blazey, Cedar Grove Composting

Attachments: Technical Memorandum: Biofilter Inspections, First Quarter 2024
Smoke Test Report

LANDAU ASSOCIATES

TECHNICAL MEMORANDUM

TO: Ron Westmoreland and Gabe Morrelli, Cedar Grove Composting

FROM: Maddie Henry and Mark Brunner

DATE: March 5, 2024

RE: Biofilter Inspections, First Quarter 2024
Cedar Grove Composting Facility
Maple Valley, Washington

INTRODUCTION

Cedar Grove Composting (Cedar Grove) operates a facility located at 17825 Cedar Grove Road SE in Maple Valley, Washington. This facility is subject to conditions set forth in the Order of Approval, Notice of Construction No. 10645 (permit) issued by the Puget Sound Clean Air Agency (PSCAA). Condition 9 of the permit requires an independent, third-party review and evaluation of Cedar Grove's operation of biofilters and ventilation on a quarterly basis. This technical memorandum summarizes the findings of the evaluation for first quarter 2024.

The purpose of the evaluation was to review the performance of emission capture systems for facility buildings and the operating conditions of their respective biofilters. Criteria for evaluation include, but are not limited to:

- Operational condition and integrity of the exhaust/capture system
- Operational condition and integrity of the biofiltration system
- Adequacy and effectiveness of the system maintenance program and practices
- Repair history and troubleshooting errors
- Recommendations for continuous improvement of the integrated system operation.

Cedar Grove requested that Landau Associates, Inc. (Landau) evaluate the building ventilation systems and biofilters for the first quarter 2024. Landau conducted the evaluation on February 7, 2024. Pursuant to permit Condition 15, smoke tests were also conducted on February 7, 2024, and the results are provided under separate cover.

PROCESS DESCRIPTION

Cedar Grove receives yard waste, wood waste, and food waste, which it processes into compost. At its Maple Valley facility, Cedar Grove has two main buildings that receive, handle, and sort incoming waste. The Tipping Building is used to receive and temporarily store incoming organic waste and feedstock. The Sorting/Grinding Building is adjacent to the Tipping Building and receives mixed waste from the Tipping

Building via loader. In the Sorting/Grinding Building, waste is ground, separated from large debris, and sorted to contain appropriate levels of green waste, food waste, and wood waste. The building encloses the grinding operation, collecting emissions from grinding operations as well as from the Tipping Building through a second ventilation intake in the Tipping Building.

Ground waste material is transferred out of the Sorting/Grinding Building via conveyor belt to a truck that transfers waste to one of seven primary compost piles, designated as "zones." Zones 1 through 6 are outdoor primary compost piles that use a negative-pressure air collection system to direct emissions from the piles to the Primary Biofilter for odor removal. The Primary Biofilter has two separate zones, the Upper Primary Biofilter and the Lower Primary Biofilter. The two are served by different ventilation ducts.

Zone 7 is an indoor primary compost pile that is stored in a separate building on the north end of the property. The building is equipped with a continuous exhaust ventilation system. Waste material is transferred from the Zone 7 primary compost pile to a secondary compost system via a combination of mobile conveyers and trucks. Emissions and exhaust from the Zone 7 Building and the secondary compost system are delivered to the Secondary Biofilter for odor removal. Exhaust from these systems feeds into a single distribution box that distributes the combined exhaust to two different ventilation ducts, creating two different zones in the Secondary Biofilter—the East and West Biofilters.

INSPECTION PROCEDURES AND PARAMETERS

The purpose of the quarterly evaluations is to review the operational condition and integrity of emission control systems, including ventilation systems and biofilter media. Buildings and biofilters that are inspected are as follows:

- Tipping Building ventilation system and biofilter
- Sorting/Grinding Building ventilation system and biofilter
- Upper and Lower Primary ventilation systems and biofilters
- Zone 7 Building, East and West Secondary ventilation systems and biofilters.

The ventilation system of each building was evaluated to assess achievement of the design air exchange rate. Air flow from the building to the biofilter was measured at a minimum of three points across the ventilation ducts using a hot wire anemometer, Type S Pitot tube, and digital manometer. Ventilation systems are visually inspected for the deterioration to the ducting or fan that could affect system performance and ventilation efficacy.

Biofilters are visually inspected for the presence of any hotspots, fissures, plant growth, and rodent infestations. Biofilter media samples are collected at least once every 6 months and analyzed for bed temperature, moisture content, bulk density, pH, and void space. Desirable properties include warm temperature, moderate moisture content, low bulk density, low pH, a high void space, and larger

particle size distribution. These properties contribute to an optimal microbial environment.[1] After these analyses are completed, residence time (described below) is calculated.

Bed Temperature

Bed temperature refers to the average temperature of the biofilter media, which are affected by the temperatures of the ambient air and inlet process air. Biofilters contain multiple microbial species, each with its own optimum temperature. Thus, optimal bed temperature is a compromise and has been identified to be between 86° and 104°F (30° and 40°C). Acceptable temperatures are between 57° and 104°F (14° and 40°C).

Moisture Content

Moisture content refers to the water content of the biofilter media. A sufficient moisture content is required to provide micro-organisms with enough water and facilitate the degradation of odorous compounds. Sufficiently moist media are also important to maintain the structural integrity of the biofilter. When too dry, biofilters are more susceptible to cracks and fissures and, therefore, the ineffective distribution of inlet gases. When too wet, a biofilter may be susceptible to the creation of anaerobic zones, gas channeling, and increased back-pressure. The optimal range for moisture content is between 20 and 60 percent and the acceptable range is between 20 and 70 percent.

Bulk Density

Bulk density refers to the mass per unit volume of biofilter media. A lower bulk density is desirable because it indicates a higher void space and greater surface area for contact between air and micro-organisms. Bulk density is reported in grams per cubic centimeter or pounds per yard.

pH

The acidity and alkalinity of the media are indicated by pH value. The acceptable pH range for normal operation is between 5 and 8; optimal operation occurs at a pH between 6 and 7.5. Organic acids that may cause the acidification of media are by-products of microbial degradation; therefore, lower pH values indicate an aged microbial environment and may indicate the need for biofilter media replacement. A pH value lower than 8 is desirable because ammonia is converted into nitrate in these conditions, avoiding the alkalization of the media. A significant increase of ammonia, or absence of nitrates, can be an indication that media replacement is required.

[1] In Notice of Violation (NOV) No. 3-009155 issued for Cedar Grove's Everett facility, PSCAA stated that it had determined "the acceptable ranges of a few parameters." The acceptable ranges for biofilter performance identified in NOV No. 3-009155 do not have a regulatory basis and have not been established as facility-applicable criteria in any of Cedar Grove's permit documents. Furthermore, NOV No. 3-009155 is subject to further discussion and resolution following two meetings between Cedar Grove and PSCAA in 2019 and subsequent replacement of NOV No. 3-009155 by NOV No. 3-010458. With that context, the optimal and acceptable ranges presented in Table 1 of this report have not been modified to reflect the ranges in NOV No. 3-009155—the ranges presented herein are consistent with past reports for the Maple Valley facility.

Empty Bed Residence Time

Empty bed residence time (EBRT) is the amount of time microbes are in contact with the contaminated air stream. Residence time is calculated by dividing the empty bed volume by volumetric flow rate. Longer residence times produce higher efficiencies; however, a design air flow rate must minimize residence time to accommodate larger flow rates. An acceptable EBRT is any amount of time greater than 25 seconds and an optimal EBRT is between 60 and 120 seconds.

Void Space

Biofilter samples are measured for total void space. Total void space consists of both the void space that is unoccupied by water, called free air space, and the void space that is occupied by water. Void space is an indicator of available media surface area. Adequate void space is required for minimal air flow resistance, pressure drop, and blower power requirements. Greater void space is desirable for both contaminant absorption and microbial growth. The desired optimum porosity or void space for the media is in the 30 to 60 percent range. A void space less than 30 percent is undesirable because it increases the pressure drop across the biofilter. It also indicates that the media are breaking down and need to be replaced. There is no upper limit of acceptable void space. It should be noted that the act of collecting a sample to analyze void space actually alters the void space of the media. Therefore, bulk density and particle size distribution are also monitored as an indicator of media porosity and useful life. Void space is reported as a percentage.

A summary of biofilter operational parameters is provided in Table 1. The repair history is described in Table 2.

INSPECTION FINDINGS AND RECOMMENDATIONS

Tipping Building Biofilter

Ventilation System

The Tipping Building exhaust ventilation system was visually inspected for any indication of malfunction. The ventilation system appeared to be structurally sound, and no visual indicators of inoperability or malfunction (e.g., duct leaks or vent cracks) were observed. Measured air flow through the Tipping Building exhaust ventilation system was approximately 16,356 standard cubic feet per minute (scfm). The resulting EBRT was 58 seconds, which is within the acceptable range, indicating that the ventilation system continues to operate effectively with respect to biofilter performance.

Biofilter Media

The Tipping Biofilter media were observed to have an average depth of approximately 8 feet. The media appear to have settled evenly. The surface media were observed to be moist across the surface and to a depth of at least 2 feet. Observed temperatures were between 46° and 58°F. The average bed temperature was 53°F, which is slightly below the acceptable range for biofilter performance, but the lower temperatures were expected due to seasonal weather conditions. The bed temperature is

expected to come back into an acceptable operating range as the winter season ends. No indicators of rodent holes, hotspot formation, cracks, or fissures were observed. Scattered instances of plant growth was observed throughout the surface of the biofilter.

No composite sample of the biofilter media was collected.

Data for the Tipping Building Biofilter, including biofilter media temperatures and air flows, are provided in Attachment 1 and a photograph is provided in Attachment 6.

Recommendations

Visually-observed operating parameters indicated that the biofilter is operating effectively. Raking and weeding of the biofilter surface were recommended to disturb plant growth.

Sorting/Grinding Building and Biofilter

Ventilation System

The Sorting/Grinding Building exhaust ventilation system was visually inspected for any indication of malfunction. All seals appeared to be in good working order. Overall, the ventilation system appeared to be structurally sound, and no visual indicators of inoperability were observed. Measured air flow through the Sorting/Grinding Building fan was approximately 40,925 scfm. The resulting EBRT was 52 seconds, which is within the acceptable range, indicating that the biofilter continues to operate effectively with respect to biofilter performance. A photograph of the ventilation system is provided in Attachment 6.

Biofilter Media

The Sorting/Grinding Building Biofilter media were observed to have an average depth of approximately 8 feet. The material has settled evenly. The surface media were observed to be moist across the surface and to a depth of at least 2 feet throughout the biofilter. Observed temperatures were between 41° and 51°F. The average bed temperature was 46.9°F. These temperatures were below the acceptable range for biofilter performance, but the lower temperatures were expected due to seasonal weather conditions. The bed temperature is expected to come back into an acceptable operating range as the winter season ends. No indicators of hotspot formation, plant growth, cracks, or fissures were observed. A few rodent holes were observed throughout the biofilter.

A composite sample of the biofilter media was collected. Laboratory analysis indicates that the media are aging as expected.

- The moisture content of the biofilter was 59 percent, which is within the optimal operating range.
- The void space of the biofilter was 33 percent, which is within the optimal operating range. Particle size degradation resulting in an increased bulk density and decreased void space is normal and expected in the biofilter aging process.

- The pH was 7.1, which is within the optimal operating range. Additionally, ammonia concentrations were within the typical range of historical data. These laboratory-reported chemical characteristics support the conclusion that the biofilter continues to perform acceptably and effectively.

Data for the Sorting/Grinding Building Biofilter, including biofilter media temperatures and air flows, are provided in Attachment 2. Laboratory analytical reports are provided in Attachment 5, and a photograph is provided in Attachment 6.

Recommendations

Visually-observed and laboratory-reported operating parameters indicated that the biofilter is operating effectively, except for a few rodent holes. Raking of the biofilter surface was recommended to disturb rodent holes.

Upper Primary Biofilter

Ventilation System

The Upper Primary Biofilter ventilation system was visually inspected for any indication of malfunction. The ventilation system appeared to be structurally sound, and no visual indicators of inoperability or malfunction (e.g., duct leaks or vent cracks) were observed. Air flow through the Upper Primary ventilation system was approximately 12,194 scfm. The resulting EBRT was 301 seconds, which is within the acceptable operating range. A photograph of the ventilation system is provided in Attachment 6.

Biofilter Media

The Upper Primary Biofilter media were observed to have an average depth of approximately 5 feet. The material has settled evenly. The media were observed to be moist across the surface and to a depth of at least 2 feet. Observed temperatures were between 52° and 70°F. The average bed temperature was 58.6°F, which is within the acceptable operating range. No indicators of rodent holes, hotspots, cracks, or fissures were observed. Scattered plant growth was observed throughout the surface of the biofilter.

A composite sample of the biofilter media was collected. Laboratory analysis indicates that the media are aging as expected.

- The moisture content of the biofilter was 57.7 percent, which is within the optimal operating range.
- The void space of the biofilter was 34 percent, which is within the optimal operating range. Particle size degradation resulting in an increased bulk density and decreased void space is normal and expected in the biofilter aging process.
- The pH was 6.2, which is within the optimal operating range. Additionally, ammonia concentrations were within the typical range of historical data. These laboratory-reported chemical characteristics support the conclusion that the biofilter continues to perform acceptably and effectively.

Data for the Upper Primary Biofilter, including biofilter media temperatures and air flows, are provided in Attachment 3. Laboratory analytical reports are provided in Attachment 5, and a photograph is provided in Attachment 6.

Recommendations

Visually-observed and laboratory-reported operating parameters indicated that the biofilter is operating effectively, except for scattered plant growth throughout the biofilter. Raking and weeding of the biofilter surface were recommended to disturb plant growth.

Lower Primary Biofilter

Ventilation System

The Lower Primary Biofilter exhaust ventilation system was visually inspected for any indication of malfunction. All seals appeared to be in good working order. Overall, the ventilation system appeared to be structurally sound, and no visual indicators of inoperability were observed. Measured air flow through the Lower Primary fan was approximately 10,961 scfm. The resulting EBRT was 161 seconds, which is within the acceptable range, indicating that the biofilter continues to operate effectively with respect to biofilter performance. A photograph of the ventilation system is provided in Attachment 6.

Biofilter Media

The Lower Primary Biofilter media were observed to have an average depth of approximately 3 feet. The material has settled evenly. The surface media were observed to be moist across the surface and to a depth of at least 2 feet. Observed temperatures were between 69° and 73°F. The average bed temperature was 70.7°F, which is within the acceptable operating range. No rodent holes, fissures, or hotspots were observed. Scattered plant growth was observed throughout the surface of the biofilter.

No composite sample of the biofilter media was collected.

Data for the Lower Primary Biofilter, including biofilter media temperatures and air flows, are provided in Attachment 3 and a photograph is provided in Attachment 6.

Recommendations

Visually-observed operating parameters indicated that the biofilter is operating effectively, except for scattered plant growth throughout the biofilter. Raking and weeding of the biofilter surface were recommended to disturb plant growth.

Zone 7 Building

Ventilation System

The Zone 7 Biofilter exhaust ventilation system was visually inspected for any indication of malfunction. The ventilation system appeared to be structurally sound, and no visual indicators of inoperability were observed. Measured air flow through the Zone 7 ventilation system was approximately 39,432 scfm. A photograph of the ventilation system is provided in Attachment 6.

West Secondary Biofilter

Ventilation System

The West Secondary Biofilter ventilation system was visually inspected for any indication of malfunction. Most of the ventilation system is buried; the observable extent of the duct was visually inspected. No visual indicators of inoperability were observed. Measured air flow through the West Secondary ventilation system was approximately 26,433 scfm. The resulting EBRT was 121 seconds, which is within the acceptable range, indicating that the ventilation system continues to operate effectively.

Biofilter Media

Media were observed to have a depth of approximately 4 feet. The material has settled evenly. The media were observed to be moist across the surface and to a depth of at least 2 feet. Observed temperatures were between 53° and 64°F. The average bed temperature was 56.4°F. These temperatures were slightly below the acceptable range for biofilter performance, but the lower temperatures were expected due to seasonal weather conditions. The bed temperature is expected to come back into an acceptable operating range as the winter season ends. No rodent holes, fissures, or hotspots were observed. Scattered plant growth was observed throughout the surface of the biofilter.

A composite sample of the biofilter media was collected. Laboratory analysis indicates that the media are aging as expected.

- The moisture content of the biofilter was 65.9 percent, which is within the acceptable operating range.
- The void space of the biofilter was 3 percent, which is below the optimal operating range. Since EBRT is within the acceptable operating range, low void space is not an immediate concern, but based on decreasing void space over the past two sampling periods, addition or replacement of media will be scheduled. Particle size degradation resulting in an increased bulk density and decreased void space is normal and expected in the biofilter aging process.
- The pH was 6.6, which is within the optimal operating range. Additionally, ammonia concentrations were within the typical range of historical data. These laboratory-reported chemical characteristics support the conclusion that the biofilter continues to perform acceptably and effectively.

Data for the West Secondary Biofilter, including biofilter media temperatures and air flows, are provided in Attachment 4. Laboratory analytical reports are provided in Attachment 5, and a photograph is provided in Attachment 6.

Recommendations

Visually-observed and laboratory-reported operating parameters indicated that the biofilter is operating effectively, except for scattered plant growth throughout the biofilter and low void space. Raking and weeding of the biofilter surface were recommended to disturb plant growth. Addition or replacement of media will be scheduled.

East Secondary Biofilter

Ventilation System

The East Secondary Biofilter ventilation system was visually inspected for any indication of malfunction. Most of the ventilation system is buried and the observable extent of the duct was visually inspected. From the observable extent, no visual indicators of inoperability or malfunction were observed. Measured air flow through the East Secondary ventilation system was approximately 29,649 scfm. The resulting EBRT was 185 seconds, which is within the acceptable range, indicating that the ventilation system continues to operate effectively. A photograph of the ventilation system is provided in Attachment 6.

Biofilter Media

The East Secondary Biofilter media were observed to have an average depth of approximately 5 feet. The material has settled evenly. The media were observed to be moist across the surface and to a depth of at least 2 feet. Observed temperatures were between 64° and 70°F. The average bed temperature was 67°F. These temperatures were within the acceptable range for biofilter performance. Moderate plant growth was observed across the biofilter. No indicators of hotspots, rodent holes, or fissures were observed.

A composite sample of the biofilter media was collected. Laboratory analysis indicates that the media are aging as expected.

- The moisture content of the biofilter was 63.5 percent, which is within the acceptable operating range.
- The void space of the biofilter was 9 percent, which is lower than the acceptable operating range. Since EBRT is within the acceptable operating range, low void space is not an immediate concern, but based on decreasing void space over the past two sampling periods, addition or replacement of media will be scheduled. Particle size degradation resulting in an increased bulk density and decreased void space is normal and expected in the biofilter aging process.
- The pH was 6.3, which is within the optimal operating range. Additionally, ammonia concentrations were within the typical range of historical data. These laboratory-reported chemical characteristics support the conclusion that the biofilter continues to perform acceptably and effectively.

Data for the East Secondary Biofilter, including biofilter media temperatures and air flows, are provided in Attachment 4. Laboratory analytical reports are provided in Attachment 5, and a photograph is provided in Attachment 6.

Recommendations

Visually-observed and laboratory-reported operating values indicate that the East Secondary Biofilter is operating effectively, except for the moderate plant growth and low void space. Raking and weeding of the biofilter surface were recommended to disturb plant growth. Addition or replacement of media will be scheduled.

CONCLUSIONS AND RECOMMENDATIONS

An evaluation of Cedar Grove's Maple Valley facility was conducted on February 7, 2024, by Landau to assess the operability and efficacy of the exhaust/capture systems and biofilter systems. All ventilation systems appeared to be effectively maintaining the biofilter residence times intended to achieve odor control objectives.

Biofilters were visually inspected to evaluate moisture content, plant growth, rodent holes, and media settlement. The moisture content for all biofilters appeared to be within the effective operating range. Rodent holes were observed in the Sorting/Grinding Building Biofilter. Plant growth was observed in the Tipping Building, Upper Primary, Lower Primary, West Secondary, and East Secondary Biofilters. Regular raking and weeding of media are recommended for all biofilters to continue to prevent vegetation growth and rodent holes.

Laboratory analyses of biofilter media evaluated void space, bulk density, particle size distribution, pH, and ammonia content. Laboratory analytical results indicate that the biofilters continue to operate effectively. Addition or replacement of media in the West and East Secondary Biofilters is recommended. Table 3 summarizes visual inspections of the ventilation systems. Table 4 summarizes visual inspections of the biofilters. Table 5 summarizes overall biofilter performance.

LANDAU ASSOCIATES, INC.

Maddie Henry
Staff Scientist

Mark Brunner
Principal

MPH/AEM/MWB/ccy
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Attachments

Table 1
Summary of Biofilter Operational Parameters
Cedar Grove Composting
Maple Valley, Washington

Parameter	Acceptable Range	Optimal Range
Bed Temperature	14-40°C (57-104°F)	30-40°C (86-104°F)
Moisture Content	20 - 70 percent	20 - 60 percent
pH	5 to 8	6 to 7.5
Residence Time	> 25 seconds	60 seconds to 2 minutes
Void Space	> 30 percent	30 to 60 percent

Abbreviations:

°C = degrees Celsius

°F = degrees Fahrenheit

Table 2
Corrective Action, Maintenance, and Repair History
Cedar Grove Composting
Maple Valley, Washington

Date	Activity
May 2009	Retractable doors were installed on the Tipping Building.
February 2010	A sprinkler system was installed on the Tipping Building Biofilter.
March 2011	The Tipping Building Biofilter media were replaced.
October 2011	A new belt and bearings were installed for the Zone 7 Building fan.
June 2014	The Tipping Building Biofilter was redesigned and new media were added.
March 2015	The Sorting/Grinding Building Biofilter was redesigned and went into operation.
November 2015	The East Secondary Biofilter media were replaced.
September 2017	The West Secondary Biofilter media were replaced.
November 2017	The Lower Primary Biofilter media were replaced.
February 2018	New media were added to the top of the Tipping Building Biofilter.
March 2018	Biofilters were sprayed and raked in response to the first quarter inspection.
April 2019	The Tipping Building Biofilter block wall seams were sealed with foam. The Grinding Building Biofilter header pipe was sealed with foam, new media were added to the top. New media were added to the top of the Lower Primary Biofilter.
November 2019	The Grinding Building Biofilter was rebuilt.
February/March 2020	The Upper Primary Biofilter was rebuilt.
April 2020	Media were added to the top of the Tipping Building Biofilter.
May 2020	The East Secondary Biofilter media were replaced.
August 2020	The Upper Primary Biofilter media were replaced.
February 2022	West Secondary Biofilter media were replaced.
October 2023	Media were added to the top of the Tipping Building and Grinding Building Biofilters.

Table 3
Ventilation System Assessment Summary
Cedar Grove Composting
Maple Valley, Washington

Ventilation System	Flow Rate (scfm)	Empty Bed Residence Time (s)	Visual Observations	Corrective Action Recommended
Tipping Building	16,356	58	No structural deficiencies observed	None
Sorting/Grinding Building	40,925	52	No structural deficiencies observed	None
Upper Primary	12,194	301	No structural deficiencies observed	None
Lower Primary	10,961	161	No structural deficiencies observed	None
Zone 7	39,432	N/A	No structural deficiencies observed	None
West Secondary	26,433	121	No structural deficiencies observed	None
East Secondary	29,649	185	No structural deficiencies observed	None

Abbreviations and Acronyms:

scfm = standard cubic feet per minute
N/A = not applicable
s = seconds

Table 4
Biofilter Visual Inspection Summary
Cedar Grove Composting
Maple Valley, Washington

Biofilter	Visual Inspection Parameter					Corrective Action Recommended
	Rodent Holes	Plant Growth	Cracks or Fissures	Uneven Settling	Hotspots	
Tipping Building	--	Scattered	--	--	--	Raking and Weeding *(completed daily)*
Sorting/ Grinding Building	Few	--	--	--	--	Raking *(completed daily)*
Upper Primary	--	Scattered	--	--	--	Raking and Weeding *(completed daily)*
Lower Primary	--	Scattered	--	--	--	Raking and Weeding *(completed daily)*
West Secondary	--	Scattered	--	--	--	Raking and Weeding *(completed daily)*
East Secondary	--	Moderate	--	--	--	Raking and Weeding *(completed daily)*

Table 5
Biofilter Performance Summary
Cedar Grove Composting
Maple Valley, Washington

Biofilter	Performance Parameter					Corrective Action Recommended
	Average Bed Temperature (°F)	Moisture Content (% or field observation)	pH	Empty Bed Residence Time (s)	Void Space (%)	
Tipping Building	53.0	Moist	N/A	58	N/A	None
Sorting/ Grinding Building	46.9	59.0	7.1	52	33	None
Upper Primary	58.6	57.7	6.2	301	34	None
Lower Primary	70.7	Moist	N/A	161	N/A	None
West Secondary	56.4	65.9	6.6	121	3	Schedule media addition or replacement
East Secondary	67.0	63.5	6.3	185	9	Schedule media addition or replacement

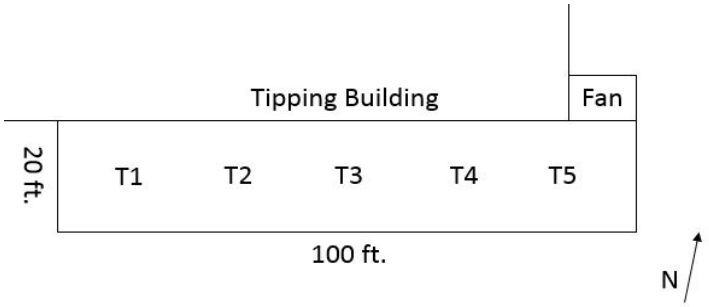
Note:
Biofilter composite samples are collected semiannually.

Abbreviations and Acronyms:
°F = degrees Fahrenheit
N/A = not applicable
s = seconds

ATTACHMENT 1

Tipping Building Ventilation System and Biofilter Evaluation

Attachment 1
Tipping Building Ventilation System and Biofilter Evaluation
Cedar Grove Composting
Maple Valley, Washington



Tipping Building		
Feedstock Stockpile Width =	100	ft
Feedstock Stockpile Depth =	40	ft
Feedstock Stockpile Height =	20	ft
Volume of Feedstock in Building =	80,000	ft^3
Building Capacity =	120,000	ft^3
Feedstock Percentage of Building Capacity =	67	%

Ventilation System				
Building Fan Diameter =	36	in.		
Duct Area =	7	ft^2		
Temperature =	70.6	^oF		
Velocity Pressure =	0.46	in. H_2O		
Static Pressure =	15.25	in. H_2O		
Stack Velocity =	2,325	ft/min	39	ft/s
Airflow =	16,435	ft^3/min	16,356	scfm

Biofilter		
T1 =	46	^oF
T2 =	52	^oF
T3 =	55	^oF
T4 =	54	^oF
T5 =	58	^oF
Average Bed Temperature =	53.0	^oF
Area =	2,000	ft^2
Height =	8	ft
Volume =	16,000	ft^3
Residence Time =	0.97	min (58 s)

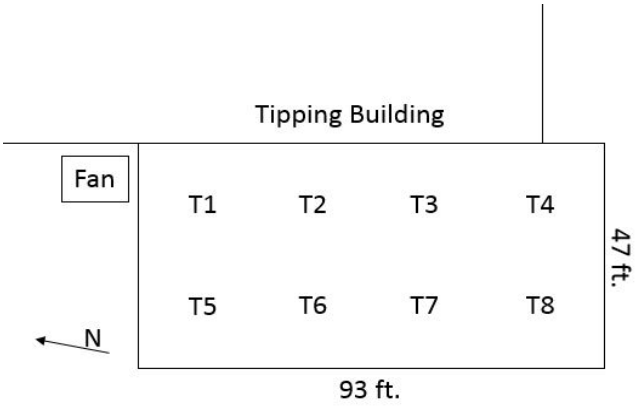
Abbreviations and Acronyms:

ft = foot/feet	in = inches
ft^2 = square feet	min = minute
ft^3 = cubic feet	s = second
H_2O = water	scfm = standard cubic feet per minute

ATTACHMENT 2

Sorting/Grinding Building Ventilation System and Biofilter Evaluation

Attachment 2
Sorting/Grinding Building Ventilation System and Biofilter Evaluation
Cedar Grove Composting
Maple Valley, Washington



Ventilation System			
Building Fan Diameter =	48	in.	
Duct Area =	13	ft^2	
Temperature =	58.7	^oF	
Velocity Pressure =	0.87	in. H_2O	
Static Pressure =	5.37	in. H_2O	
Stack Velocity =	3,199	ft/min	53 ft/s
Airflow =	40,203	ft^3/min	40,925 scfm

Biofilter			
T1 =	49 ^oF	T5 =	47 ^oF
T2 =	51 ^oF	T6 =	47 ^oF
T3 =	48 ^oF	T7 =	50 ^oF
T4 =	41 ^oF	T8 =	42 ^oF

Average Bed Temperature =	46.9	^oF	
Area =	4,371	ft^2	
Height =	8.0	ft	
Volume =	34,968	ft^3	
Residence Time =	0.87	min	52 s

Abbreviations and Acronyms:

ft = foot/feet	in = inches
ft^2 = square feet	min = minute
ft^3 = cubic feet	s = second
H_2O = water	scfm = standard cubic feet per minute

ATTACHMENT 3

Primary Compost Pile Ventilation System and Biofilter Evaluation

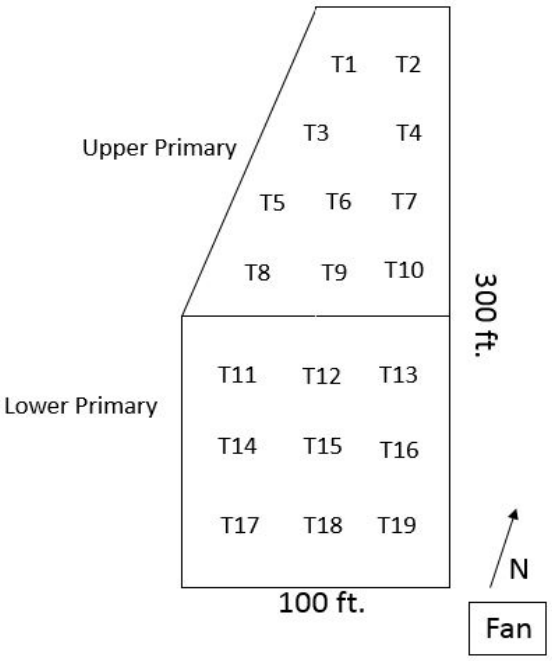
Attachment 3
Primary Compost Pile Ventilation System and Biofilter Evaluation
Cedar Grove Composting
Maple Valley, Washington

Upper Primary Ventilation System			
Building Fan Diameter =	48	in.	
Duct Area =	13	ft^2	
Temperature =	64	°F	
Velocity Pressure =	0.13	in. H_2O	
Static Pressure =	14.39	psia	
Stack Velocity =	983	ft/min	16 ft/s
Airflow =	12,355	ft^3/min	12,194 scfm

Upper Primary Biofilter			
T1 =	70 °F	T6 =	53 °F
T2 =	67 °F	T7 =	55 °F
T3 =	61 °F	T8 =	54 °F
T4 =	59 °F	T9 =	57 °F
T5 =	52 °F	T10 =	58 °F
Average Bed Temperature =	58.6	°F	
Area =	12,400	ft^2	
Height =	5	ft	
Volume =	62,000	ft^3	
Residence Time =	5.02	min	301 s

Lower Primary Ventilation System			
Building Fan Diameter =	48	in.	
Duct Area =	13	ft^2	
Temperature =	62	°F	
Velocity Pressure =	0.11	in. H_2O	
Static Pressure =	14.24	psia	
Stack Velocity =	890	ft/min	15 ft/s
Airflow =	11,179	ft^3/min	10,961 scfm

Lower Primary Biofilter			
T11 =	70.0 °F	T16 =	72.0 °F
T12 =	71.0 °F	T17 =	70.0 °F
T13 =	70.0 °F	T18 =	69.0 °F
T14 =	73.0 °F	T19 =	70.0 °F
T15 =	71.0 °F		
Average Bed Temperature =	70.7	°F	
Area =	10,000	ft^2	
Height =	3	ft	
Volume =	30,000	ft^3	
Residence Time =	2.68	min	161 s



Total Primary Ventilation System and Biofilter		
Total Airflow =	23,534	ft^3/min
	23,155	scfm
Total Area =	22,400	ft^2
Total Height =	4	ft
Total Volume =	89,600	ft^3
Residence Time =	3.81	min
	228	s

Notes:
NS = not sampled

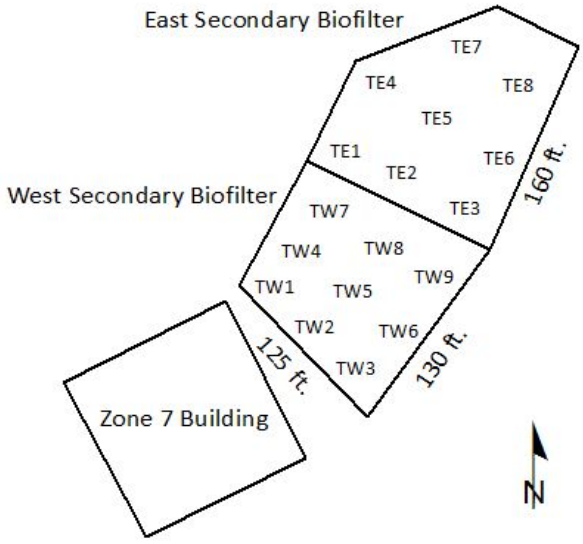
Abbreviations and Acronyms:

ft = foot/feet	min = minute
ft^2 = square feet	s = second
ft^3 = cubic feet	scfm = standard cubic feet per minute
H_2O = water	
in = inches	

ATTACHMENT 4

Secondary Compost Pile Ventilation System and Biofilter Evaluation

Attachment 4
Secondary Compost Pile Ventilation System and Biofilter Evaluation
Cedar Grove Composting
Maple Valley, Washington



Zone 7 Building Fan				
Building Fan Diameter =	42	in.		
Duct Area =	10	ft^2		
Temperature =	52.95	^oF		
Velocity Pressure =	0.97	in. H_2O		
Static Pressure =	1.80	in. H_2O		
Stack Velocity =	3,982	ft/min	66	ft/s
Airflow =	38,308	ft^3/min	39,432	scfm

Inlet 2 - West Biofilter Ventilation System				
Fan Diameter =	60	in.		
Duct Area =	20	ft^2		
Temperature =	55.0	^oF		
Velocity Pressure =	0.11	in. H_2O		
Static Pressure =	0.48	in. H_2O		
Stack Velocity =	1,313	ft/min	22	ft/s
Airflow =	25,782	ft^3/min	26,433	scfm

Inlet 1 - East Biofilter Ventilation System				
Fan Diameter =	60	in.		
Duct Area =	20	ft^2		
Temperature =	56.3	^oF		
Velocity Pressure =	0.13	in. H_2O		
Static Pressure =	0.66	in. H_2O		
Stack Velocity =	1,477	ft/min	25	ft/s
Airflow =	28,992	ft^3/min	29,649	scfm

Attachment 4
Secondary Compost Pile Ventilation System and Biofilter Evaluation
Cedar Grove Composting
Maple Valley, Washington

West Secondary Biofilter				
TW1 =	54 °F		TW6 =	53 °F
TW2 =	54 °F		TW7 =	64 °F
TW3 =	55 °F		TW8 =	60 °F
TW4 =	57 °F		TW9 =	57 °F
TW5 =	54 °F			
Average Bed Temperature =	56.4 °F			
Area =	13,000 ft^2			
Height =	4 ft			
Volume =	52,000 ft^3			
Residence Time =	2.02 min			121 s

East Secondary Biofilter				
TE1 =	69 °F		TE5 =	66 °F
TE2 =	67 °F		TE6 =	68 °F
TE3 =	70 °F		TE7 =	64 °F
TE4 =	65 °F		TE8 =	67 °F
Average Bed Temperature =	67.0 °F			
Area =	17,900 ft^2			
Height =	5 ft			
Volume =	89,500 ft^3			
Residence Time =	3.09 min			185 s

Total Secondary Biofilter		
Total Airflow =	54,774 ft^3/min	
Area =	30,900 ft^2	
Height =	5 ft	
Volume =	139,050 ft^3	
Residence Time =	2.54 min	152 s

Abbreviations and Acronyms:

ft = foot/feet	in = inches
ft^2 = square feet	min = minute
ft^3 = cubic feet	s = second
H_2O = water	scfm = standard cubic feet per minute

ATTACHMENT 5

Laboratory Analytical Data

US Composting Council ® STA Certified Lab

soiltest farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Client: **Cedar Grove Composting**
Attn: Ron Westmoreland
17825 Cedar Grove RD SE
Maple Valley, WA 98038
206-832-3225

Product: **SORTING-GRINDING BUILDING BIOFIL**
Date Sampled: 02/07/24
Date Received: 02/12/24
Laboratory # C24-262

Date Reported: 2/22/2024
Project # 1224005.110
Invoice #: C24-262 **Amount: $220.00**
Reveiwed by Brent Thyssen, CPSSc

	Method	As Rcvd.	Dry Wt.	Units
Moisture	70 C	**59.0**		%
Solids	70 C	**41.0**		%
pH	1:5	**7.1**	**NA**	SU
E.C	1:5	**0.32**	**0.78**	mmhos/cm
Total N	TMECC 04.02D	**0.54**	**1.31**	%
Organic C	TMECC 04.01A	**14.5**	**35.4**	%
Ammonium -N	TMECC 05.02C	**11**	**27**	mg/Kg
Phosphorous	TMECC 04.12B/04.14A	**0.07**	**0.16**	%
P2O5		**0.15**	**0.37**	%
Potassium	TMECC 04.12B/04.14A	**0.09**	**0.22**	%
K2O		**0.11**	**0.26**	%
C/N ratio			**27**	ratio
Bulk Density	TMECC 03.10A		**1100**	Lb/Yard
Free Air Space	TMECC 03.10A		**33**	%
Pore Space	TMECC 03.10A		**78**	%
WHCvol	TMECC 03.10A		**45**	%v/v
WHCwt	TMECC 03.10A		**170**	%w/w

Particle Size Distribution TMECC 2.02 B & C

inches	mm	% Passing	Inerts	% by wt.
3	**76.2**	**100.0**		
2	**50**	**100.0**	Total Plastic	**0.19**
1	**25**	**100.0**	Film Plastic	**0.19**
3/4	**19.1**	**93.2**	Glass	**0.00**
5/8	**16**	**86.9**	Metal	**0.00**
1/2	**12.5**	**69.9**	Sharps	**0.00**
3/8	**9.5**	**45.9**	Total Inerts	**0.19**
1/4	**6.3**	**28.2**		

Sample was received, handled and tested in accordance with TMECC procedures

US Composting Council ® STA Certified Lab

soiltest farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Client: **Cedar Grove Composting**
Attn: Ron Westmoreland
17825 Cedar Grove RD SE
Maple Valley, WA 98038
206-832-3225

Product: **UPPER PRIMARY BIOFILTER**
Date Sampled: 02/07/24
Date Received: 02/12/24
Laboratory # C24-263

Date Reported: 2/22/2024
Project # 1224005.110
Invoice #: C24-263 **Amount: $220.00**
Reveiwed by Brent Thyssen, CPSSc

	Method	As Rcvd.	Dry Wt.	Units
Moisture	70 C	**57.7**		%
Solids	70 C	**42.3**		%
pH	1:5	**6.2**	**NA**	SU
E.C	1:5	**0.17**	**0.40**	mmhos/cm
Total N	TMECC 04.02D	**0.51**	**1.20**	%
Organic C	TMECC 04.01A	**9.8**	**23.1**	%
Ammonium -N	TMECC 05.02C	**28**	**66**	mg/Kg
Phosphorous	TMECC 04.12B/04.14A	**0.08**	**0.19**	%
P2O5		**0.18**	**0.43**	%
Potassium	TMECC 04.12B/04.14A	**0.07**	**0.16**	%
K2O		**0.08**	**0.19**	%
C/N ratio			**19**	ratio
Bulk Density	TMECC 03.10A		**1083**	Lb/Yard
Free Air Space	TMECC 03.10A		**34**	%
Pore Space	TMECC 03.10A		**77**	%
WHCvol	TMECC 03.10A		**43**	%v/v
WHCwt	TMECC 03.10A		**160**	%w/w

Particle Size Distribution TMECC 2.02 B & C

inches	mm	% Passing	Inerts	% by wt.
3	**76.2**	**100.0**		
2	**50**	**100.0**	Total Plastic	**0.56**
1	**25**	**87.7**	Film Plastic	**0.00**
3/4	**19.1**	**76.0**	Glass	**0.00**
5/8	**16**	**68.9**	Metal	**0.00**
1/2	**12.5**	**61.5**	Sharps	**0.00**
3/8	**9.5**	**49.0**	Total Inerts	**0.56**
1/4	**6.3**	**32.5**		

Sample was received, handled and tested in accordance with TMECC procedures

US Composting Council ®
STA Certified Lab

soiltest
farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Client: **Cedar Grove Composting**		Product: **WEST SECONDARY BIOFILTER**		Date Reported:	2/22/2024
Attn: Ron Westmoreland		Date Sampled:	02/07/24		
17825 Cedar Grove RD SE		Date Received:	02/12/24	**Project #**	**1224005.110**
Maple Valley, WA 98038		Laboratory #	C24-264	**Invoice #: C24-264**	**Amount: $220.00**
206-832-3225				Reveiwed by Brent Thyssen, CPSSc	

	Method	As Rcvd.	Dry Wt.	Units
Moisture	70 C	**65.9**		%
Solids	70 C	**34.1**		%
pH	1:5	**6.6**	**NA**	SU
E.C	1:5	**0.08**	**0.23**	mmhos/cm
Total N	TMECC 04.02D	**0.35**	**1.02**	%
Organic C	TMECC 04.01A	**8.8**	**25.8**	%
Ammonium -N	TMECC 05.02C	**5**	**15**	mg/Kg
Phosphorous	TMECC 04.12B/04.14A	**0.05**	**0.15**	%
P2O5		**0.12**	**0.34**	%
Potassium	TMECC 04.12B/04.14A	**0.06**	**0.18**	%
K2O		**0.07**	**0.22**	%
C/N ratio			**25**	ratio
Bulk Density	TMECC 03.10A		**1570**	Lb/Yard
Free Air Space	TMECC 03.10A		**3**	%
Pore Space	TMECC 03.10A		**80**	%
WHCvol	TMECC 03.10A		**77**	%v/v
WHCwt	TMECC 03.10A		**243**	%w/w

Particle Size Distribution TMECC 2.02 B & C

inches	mm	% Passing	Inerts	% by wt.
3	**76.2**	**100.0**		
2	**50**	**100.0**	Total Plastic	**0.00**
1	**25**	**94.1**	Film Plastic	**0.00**
3/4	**19.1**	**77.6**	Glass	**0.00**
5/8	**16**	**63.7**	Metal	**0.00**
1/2	**12.5**	**48.4**	Sharps	**0.00**
3/8	**9.5**	**31.6**	Total Inerts	**-**
1/4	**6.3**	**10.0**		

Sample was received, handled and tested in accordance with TMECC procedures

US Composting Council ®
STA Certified Lab

soiltest
farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Client: **Cedar Grove Composting**
Attn: Ron Westmoreland
17825 Cedar Grove RD SE
Maple Valley, WA 98038
206-832-3225

Product: **EAST SECONDARY BIOFILTER**
Date Sampled: 02/07/24
Date Received: 02/12/24
Laboratory # C24-265

Date Reported: 2/22/2024
Project # 1224005.110
Invoice #: C24-265 **Amount: $220.00**
Reveiwed by Brent Thyssen, CPSSc

	Method	As Rcvd.	Dry Wt.	Units
Moisture	70 C	**63.5**		%
Solids	70 C	**36.5**		%
pH	1:5	**6.3**	**NA**	SU
E.C	1:5	**0.06**	**0.16**	mmhos/cm
Total N	TMECC 04.02D	**0.43**	**1.17**	%
Organic C	TMECC 04.01A	**9.0**	**24.6**	%
Ammonium -N	TMECC 05.02C	**16**	**44**	mg/Kg
Phosphorous	TMECC 04.12B/04.14A	**0.04**	**0.11**	%
P2O5		**0.10**	**0.26**	%
Potassium	TMECC 04.12B/04.14A	**0.05**	**0.14**	%
K2O		**0.06**	**0.16**	%
C/N ratio			**21**	ratio
Bulk Density	TMECC 03.10A		**1307**	Lb/Yard
Free Air Space	TMECC 03.10A		**9**	%
Pore Space	TMECC 03.10A		**69**	%
WHCvol	TMECC 03.10A		**60**	%v/v
WHCwt	TMECC 03.10A		**211**	%w/w

Particle Size Distribution TMECC 2.02 B & C

inches	mm	% Passing	Inerts	% by wt.
3	**76.2**	**100.0**		
2	**50**	**100.0**	Total Plastic	**0.27**
1	**25**	**92.1**	Film Plastic	**0.27**
3/4	**19.1**	**88.0**	Glass	**0.00**
5/8	**16**	**85.1**	Metal	**0.00**
1/2	**12.5**	**79.4**	Sharps	**0.00**
3/8	**9.5**	**70.3**	Total Inerts	**0.27**
1/4	**6.3**	**53.4**		

Sample was received, handled and tested in accordance with TMECC procedures

ATTACHMENT 6

Selected Site Photographs

1. Tipping Building Biofilter.

2. Grinding Building Biofilter.

LANDAU ASSOCIATES

Cedar Grove Composting Facility Maple Valley, Washington	**Selected Site Photographs**	Figure 6-1

3. Upper Primary Biofilter and Ventilation System.

4. Lower Primary Biofilter and Ventilation System.

LANDAU ASSOCIATES

Cedar Grove Composting Facility Maple Valley, Washington	**Selected Site Photographs**	Figure 6-2

5. West Secondary Biofilter.

6. East Secondary Biofilter.

LANDAU ASSOCIATES

Cedar Grove Composting Facility Maple Valley, Washington	**Selected Site Photographs**	Figure 6-3

ATTACHMENT 7

Corrective Action Log

Attachment 7
Corrective Action Log
Biofilter Inspections and Ventilation System Assessments – 4th Quarter 2023
Cedar Grove Composting – Maple Valley Facility

Date	Affected Equipment	Issue Description	Corrective Action Recommended	Date of Corrective Action	Corrective Action Performed By
2/7/2024	Tipping Building Biofilter	Scattered plant growth	Raking and weeding to disturb plant growth	Raking and weeding completed daily.	Cedar Grove Facility Staff
2/7/2024	Grinding Building Biofilter	Few rodent holes	Raking to disturb rodent holes	Raking completed daily.	Cedar Grove Facility Staff
2/7/2024	Upper Primary Biofilter	Scattered plant growth	Raking and weeding to disturb plant growth	Raking and weeding completed daily.	Cedar Grove Facility Staff
2/7/2024	Lower Primary Biofilter	Scattered plant growth	Raking and weeding to disturb plant growth	Raking and weeding completed daily.	Cedar Grove Facility Staff
2/7/2024	West Secondary Biofilter	Scattered plant growth; low void space	Raking and weeding to disturb plant growth; addition or replacement of media	Raking and weeding completed daily; media addition/replacement to be scheduled.	Cedar Grove Facility Staff
2/7/2024	East Secondary Biofilter	Moderate plant growth; low void space	Raking and weeding to disturb plant growth; addition or replacement of media	Raking and weeding completed daily; media addition/replacement to be scheduled.	Cedar Grove Facility Staff