Notice of Construction (NOC) Worksheet

PUGET SOUND Clean Air Agency

Applicant: King County South WWTP	NOC Number: 12082
Project Location: 1200 Monster Road SW, Renton WA 98057	**Registration Number**: 28503
Applicant Name and Phone: Christopher Dew (206) 477-5448	**NAICS: 325314**
Engineer: Alfredo Arroyo & Brian Renninger	**Inspector**: Nina Lawonn

A. DESCRIPTION

For the Order of Approval:

Establishment of an aerated static pile (ASP) composting facility. Incoming feedstock for composting is limited to Loop® biosolids and 780 wet tons per year. The facility includes a bulking material bunker, a biosolids bunker, a mixing area with a bunker, four active composting bunkers, a curing area and a screening area. Mixing of biosolids and bulking material occurs on the same day the biosolids are received. ASPs for active composting are built individually in one of the four active composting bunkers, each holding up to 70 cubic yards of total material. Each active composting bunker is covered by a tent/fabric structure that is not fully enclosed but protects the bunkers from rainfall. Built ASPs in the active composting bunkers are covered with a 6 to 12-inch biolayer. The aeration capacity of the ventilation system supplying the ASPs in the active composting bunkers is 5 cfm per cubic yard of total material. The curing area comprises of zones where ASPs are stacked in an extended bed configuration with a maximum of four ASPs built at any one time. The aeration capacity of the ventilation system supplying the ASPs in the curing is 2.5 cfm per cubic yard of total material. Emissions from built ASPs in the active composting bunkers and curing area during negative aeration will be controlled by a biofilter. The biofilter provides an empty-bed residence time of 75 seconds.

Permitting Action Description:

Prior to the establishment of a new source, the source is required by Section 6.03(a) of the Agency's Regulation I to undergo New Source Review (NSR). The establishment of the composting facility and its operations and equipment will result in increases of emissions of air contaminants. The composting facility's operations and equipment are not exempt new sources identified in Sections 6.03(b) and (c) of the Agency's Regulation I. The establishment of a composting facility and its operations and equipment is required to undergo NSR and King County is required to submit a Notice of Construction (NOC) application to the Agency prior to operating and installing the equipment.

New source is defined in WAC 173-400-030 as, "the construction or modification of a stationary source that increases the amount of any air contaminant emitted by such source or that results in the emission of any air contaminant not previously emitted; and any other project that constitutes a new source under the Federal Clean Air Act."

<u>New Source Review Criteria:</u>
Approval of the NOC application submitted by King County is contingent on verifying that the establishment of the composting facility and its operations and equipment meets the following NSR criteria:

- **Air Quality Regulations [***Regulatory Basis: adopted by reference WAC 173-400-113(1)***].** Establishment of the composting facility and its operations and equipment will comply with all applicable air quality regulations such as federal new source performance standards (NSPS), national emission standards for hazardous air pollutants (NESHAPs), performance standards adopted under chapter 70.94 of the Revised Code of Washington (RCW), and the Agency's Regulations I, II, and III.
- **BACT [***Regulatory Basis: adopted by reference WAC 173-400-113(2)***].** The composting facility and its operations and equipment will implement "Best Available Control Technology" (BACT) for all new emissions of regulated air contaminants.
- **Protection of Ambient Air Quality [***Regulatory Basis: adopted by reference WAC 173-400-113(3)***].** Predicted worst case impacts of criteria air pollutants from the composting facility and its operations and equipment will not cause or contribute to violation of any National and Washington Ambient Air Quality Standards (NAAQS and WAAQS).
- **Washington State Air Toxics Rule [***Regulatory Basis: adopted by reference WAC 173-460-040(3)***].** The composting facility and its operations and equipment will implement tBACT to control all new emissions of toxic air pollutants (TAPs). Predicted worst case impacts of all TAPs from the establishment of the composting facility and its operations and equipment are below the Small Quantity Emissions Rates (SQERs) and Acceptable Source Impact Levels (ASILs) as prescribed under Chapter 173-460 WAC.
- **Agency Evaluation of Air Toxics Impacts [***Regulatory Basis: Regulation III, Section 2.07***].** Quantification of toxic air pollutant emissions from the composting facility and its operations and equipment are based on potential-to-emit (PTE) calculations. Predicted worst case impacts of all TAPs from the establishment of the composting facility and its operations and equipment are below the SQERs and ASILs as prescribed under WAC 173-460-150.
- **State Environmental Policy Act (SEPA) [***Regulatory Basis: Regulation I, Article 2***]:** Agency SEPA procedures and policies in conjunction with Chapter 197-11 WAC are fulfilled for this permitting action.

<u>New Source Review Determination:</u>
The Agency completed review of the NOC application and determined that the establishment of the composting facility and its operations and equipment will most likely meet the Agency's criteria for approving new sources as required under Regulation I. Based on this outcome the Agency recommends conditional approval subject to the enforceable conditions summarized in Section L. These conditions impose emission limitations, management practices, recordkeeping, and monitoring requirements. The Agency will issue conditional approval via the Order of Approval (OA) No. 12082.

<u>Facility and Process Information:</u>
The composting facility will be located at King County's South Wastewater Treatment Plant (WWTP) in Renton, Washington. The South WWTP site is a 94-acre property owned by King County. The

composting facility will be within the fence line of the South WWTP property at the location of the former Fuel Cell Power Plant.

Shown below: approximate location and extent of the composting facility is outlined in yellow and the South WWTP fence line is shown in blue.

Figure 2: Aerial view of project site

King County's composting facility feedstock capacity is 780 wet tons per year and will only be composed of Class B Loop® biosolids. King County's South WWTP currently produces Class B Loop® biosolids. Biosolids are a soil amendment (a natural soil conditioner and fertilizer replacement) that are made by cleaning the water that arrives at the South WWTP. King County's Loop® biosolids are Class B, which have some detectable pathogens and therefore restrictions for use. At the South WWTP, King County's anaerobic digester tanks use naturally occurring bacteria and other microorganisms to break down the waste and kill disease-causing pathogens. These microorganisms transform the solids into a renewable, nutrient-rich, fully digested resource called biosolids. Most biosolids are used directly on farms and forests to improve crop yield and soil health. But Class B biosolids can also be mixed with bulking agents such as yard clippings and wood chips and processed further into a compost. Biosolids compost has a Class A regulatory designation from the Washington State Department of Ecology (Ecology), which allows for unrestricted use, just like any other retail garden product.

King County's composting operation includes the following:

- **Mixing Phase.** Biosolids are mixed with bulking material (large wood chips) immediately upon receipt of a load of biosolids. This occurs on the same day of receipt. Doing so will reduce the propensity of odorous emissions and remove the biosolids from exposure to vectors. The mixing activities can occur within a few hours, leaving time for the frontend loader to immediately move the mixed material into an active composting bunker. The mixer will be powered by electricity.
- **Active Phase.** Mixed material is placed in one of the four active ASP composting bunkers. Built ASPs are covered with a 6 to 12-inch biolayer of finished compost or overs (large wood chips) from the screening operation. The bunkers are covered by a tent/fabric structure that is not fully enclosed but is intended to protect the bunkers from rainfall. During the active phase time (a 28-day period), the compost material will remain static but managed by forced aeration coupled with temperature monitoring. The surface of the ASPs are irrigated with sprinklers when the material becomes too dry. During negative aeration, the ventilation system draws air from beneath the ASP through the air ducts placed on-grade beneath the ASP, and out to the manifold that vents to the biofilter. During this time, the temperature of the compost material is intended to rise to the range of 160 to 165 degrees Fahrenheit (°F) to meet the federal *Process to Further Reduce Pathogens* requirements for composting biosolids. Each ASP has two temperature probes, with each probe having two temperature sensors: one sensor is located 3 feet deep (from the ASP's surface) and the other is located near the surface of the ASP. When the temperature monitoring system records a difference between the two sensors of the probes of more than 5°F to 10°F (a user-changeable set point), aeration reverses to the opposite direction (positive aeration) to reduce the ASP's temperature differential. During negative aeration, the surface is cooler than the rest of the ASP as fresh air (oxygen rich) is drawn onto the surface of the ASP. As a result, exothermic reactions in the surface sublayer occur, generating heat. The ventilation system draws the heat along with active composting process air through the ASP (top to bottom) toward the fan. Eventually, as the ASP gets hotter, the sensors located 3 feet deep heat up, and when they measure 5°F to 10°F above the surface sensors, the aeration direction switches. Positive aeration pushes fresh air into the air ducts beneath the ASP first and then up through the ASP. The sensors at the surface of the pile will eventually get hotter than the sensors located 3 feet deep because of the heat transfer through the ASP. Every time the temperature monitoring system records a set temperature differential between the surface sensors and the sensors located 3 feet deep, the aeration is reversed. The principal objective of reversing aeration is to homogenize the temperature throughout the ASP and improve the stability of the final product.
- **Curing Phase.** After the 28-day active phase, the compost material is moved from the active composting bunkers and placed in the curing area for 28 additional days. Once moved to curing, the separation of batches becomes less critical and an extended bed configuration is used where successive batches moved to curing are placed next to each other to build the ASPs, with the side(s) of the ASPs stacked against one another. In the extended bed curing configuration, there is a break maintained between the youngest (recently placed) material and oldest material (nearly ready to be screened). This break is one ASP width's wide and thus the curing area is five zones wide, but only ever holds four ASPs (four zones occupied) at any one time. One curing zone is never fully filled up, as this would result in the youngest material touching and mixing with the oldest material. Each curing ASP is covered with a 6 to 12-inch biolayer and equipped with air ducts beneath the ASP. During negative aeration, the ventilation system continues to

cool the compost material diminishing the biological process. Process air drawn from the curing ASPs during negative aeration will be vented to the biofilter. The ventilation system will also switch to positive aeration that is controlled by temperature differential set points in the same fashion as active composting. Temperature probes (each having two sensors) will be placed into each curing ASP. The temperature sensors will inform the monitoring system of the conditions within each ASP.

- **Screening Phase.** The screening and final product area receives material from the curing area using a frontend loader. The material should be stable, friable, and ready for screening to remove large wood items. The screening will be performed by a small- diameter, relatively short 51 hp diesel-fired trommel screen (e.g., 4 to 5 feet in diameter, 12 to 14 feet long) that will fit within the constraints of the screening area available. The screen will have a 3/8-inch screened opening to allow small material to fall through the screen ("unders") and larger-diameter materials to pass through the end of the trommel barrel ("overs"). The unders will be moved to the final product storage and the overs will be added to the bulking material storage bunker or used as biocover material.

<u>Ventilation System and Biofilter Information:</u>
A layout of the facility with the biofilter is shown below in Figure 2. The biofilter's characteristics and specifications are summarized in Table 1. The biofilter's ventilation system will use three blowers: one negative aeration blower to draw process air from the active composting bunkers and curing zones, one positive blower to push air into the active composting bunkers, and a positive blower to push air into the curing zones. All of the blowers will be in nearly constant operation. Each bunker or zone will be controlled independently by the process control system.

From a design perspective, assurance is provided by supplying fans, ducting, and plenum than can supply sufficiently high and uniform aeration per cubic yard of material (cfm/cy). For this project, with biosolids, bulking material and biolayer (total material), the biofilter is designed to provide the active composting bunkers with 5 cfm per cubic yard of total material of aeration capacity. The biofilter is designed to provide the curing zones with 2.5 cfm per cubic yard of total material of aeration capacity. The majority of active carbon compounds have already been oxidized in active composting, diminishing the heat production rate in curing. **The biofilter and its ventilation system has the capacity to provide aeration at the design rates mentioned above during simultaneous operation of the four active composting bunkers and four curing zones.**

Preliminary design of the biofilter uses a bed of relatively coarse, stable media with a base layer of coarser media to provide more uniform flow, higher surface area, lower friction loss, and a longer lifetime than a bed of finer degradable media. The bed's media only has up to 2 percent degradable fines such as compost, to otherwise coarse, clean, freshly shredded root/stump wood (best) or trunk wood. Hardwood is best for longevity, fir is acceptable, with cedar or soft deciduous woods like cottonwood or hybrid poplar (fast growing pulp trees) are avoided. The wood is processed in a shear shredder with semi-coarse grates (6 – 8"). The shredded wood is screened to make the base layer using a 4"+ screen. When building the biofilter's base layer, the woody material is not wetted, nor will it contain any degradable material such as compost. The base layer is at a minimum 12 inches deep. When building the biofilter's bed, the material (all shredded wood and up to 2 percent compost fines) is screened using a 2"+ screen and is fully wetted. The bed is at a minimum 36 inches deep.

An empty-bed residence time of 75 seconds is recommended by ECS. Biofilter media settles and compacts over time, resulting in an increase in headloss through the media. ECS recommends replacing biofilter media when the maximum pressure drop through the biofilter media exceeds 0.8 in W.C. of static pressure per foot of depth at full design airflow. Overall biofilter specification data is summarized in Table 1.

Figure 2: Layout of facility

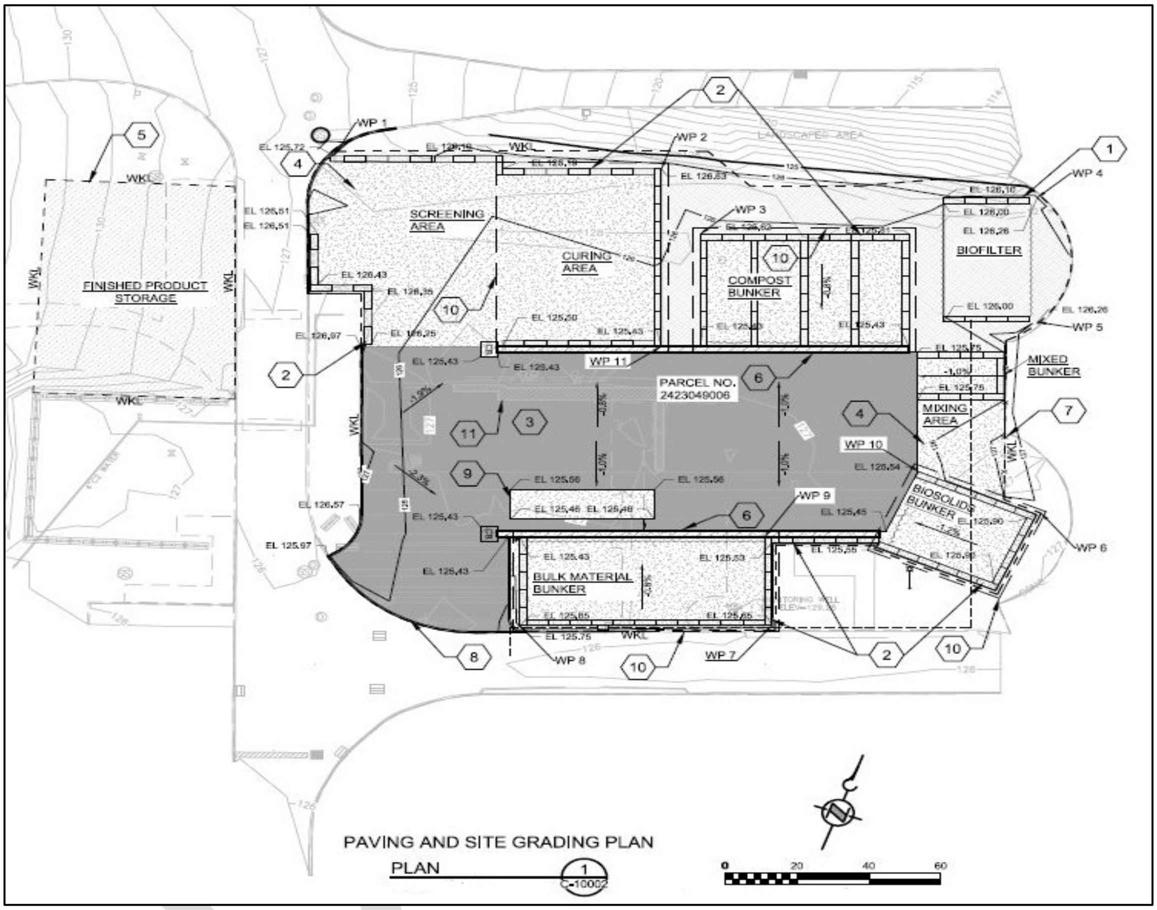
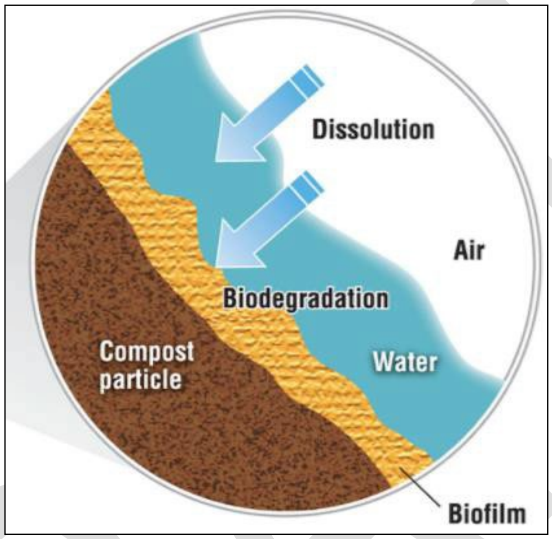


Table 1: Biofilter specification information

Specifications

- Biofilter bed media: coarse, clean, freshly shredded root/stump wood (best) or trunk wood with up to 2 percent degradable material such as compost
- Biofilter bed media screen size: 2”+
- Biofilter minimum bed depth: 3 feet
- Biofilter base layer media: coarse, clean, freshly shredded root/stump wood (best) or trunk wood
- Biofilter base layer media screen size: 4”+
- Biofilter minimum base layer depth: 1 foot
- Air flow rate capacity: aeration to the active composting bunkers at 5 cfm per cubic yard of total material and aeration to the curing zones at 2.5 cfm per cubic yard of total material during simultaneous operation of the four active composting bunkers and four curing zones.
- Minimum empty -residence time: 75 seconds
- Initial pressure drop across fresh biofilter: < 0.2” w.c. per foot of depth
- Maximum pressure drop across aged biofilter: < 0.8” w.c. per foot of depth

Biofiltration must capture and biodegrade the emissions. Adequate capture of emissions in a biofilter means that the media’s surface area is actively absorbing the emissions (dissolution). And biodegradation of emissions means that the media is actively sustaining bacterial cultivation and growth and ultimately maintaining a healthy population of bacteria (biofilm) that consumes the nutrient-rich emissions. The image below (from an ECS white paper included in King County’s NOC application) shows the watery biofilm on the surface of coarse wood chips required to dissolve the emissions so that bacteria can consume the emissions. As is the case in the composting process, the biochemical conditions in the biofilm on the media are the most important to the biofilter’s performance, or removal efficiency.



The dissolution of emissions is determined by moisture content, contact time, surface area, and ultimately the pressure drop across the biofilter. The biodegradation of emissions is determined by monitoring biofilter temperature, pH, oxygen level, ammonia loading rate, sulfate levels and non-ammonia levels. Research is available that gives us a better understanding of what criteria must be met for the biofilter to operate efficiently. The Agency has conducted a review (including applicant's proposals) to determine the acceptable ranges of a few parameters. These are shown below.

Table 2: Acceptable biofilter performance

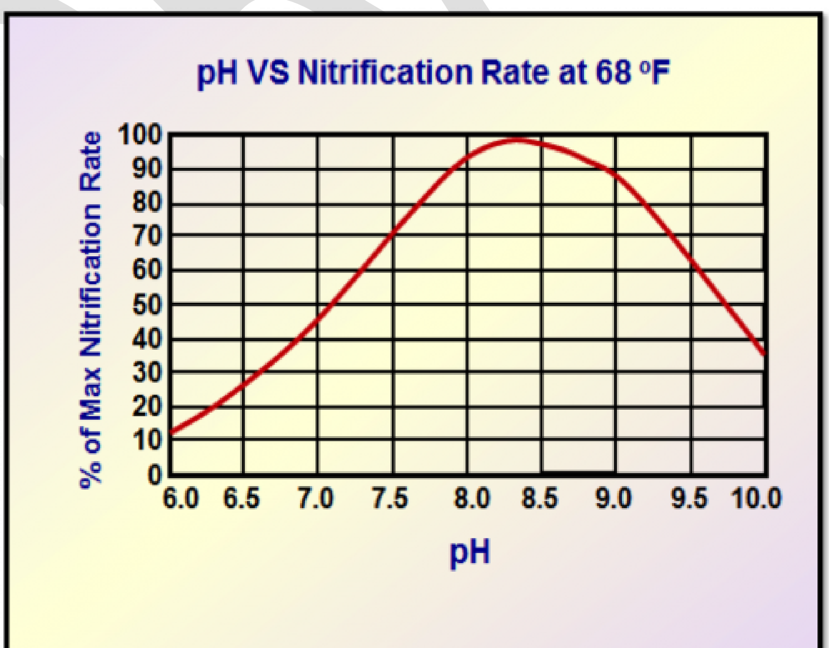
Biofilter Bed Parameter	Acceptable Operational Range
pH level	6.0 – 9.5
Moisture content (wet basis %)	40 – 60
Temperature (°C)	15 – 40
Nitrates and nitrites nitrogen level (g/kg)	0.15 – 7
Free air space (volume %)	40 – 60
Ammonia loading rate (mg/m^3)	< 550

King County will control emissions from the active composting and curing ASPs during negative aeration using a biofilter. Biofilters have been used for odor removal for many years. It is critical for the biofilter to be operated within appropriate operational ranges and to have sufficient monitoring and regular testing to demonstrate the biofilter is in good working order and the media's surface area is actively dissolving and biodegrading emissions.

<u>pH Level</u>

The pH level in biofilters is often used as an indicator of biological activity since aerobic bacterial metabolisms function at the expense of alkalinity. Aerobic metabolisms use dissolved oxygen (i.e., carbonaceous BOD) to convert food to energy. Certain classes of aerobic bacteria (like those found in biofilters), called nitrifiers, use ammonia (NH_3) for food instead of carbon-based organic compounds. This type of aerobic metabolism, which uses dissolved oxygen to convert ammonia to nitrate, is referred to as "nitrification." Nitrifiers are the dominant bacteria when organic food supplies have been consumed. Further processes include denitrification, or anoxic metabolism, which occurs when bacteria utilize nitrate as the source of oxygen. In an anoxic environment, the nitrate ion is converted to nitrogen gas while the bacteria convert the food to energy. Finally, anaerobic conditions will occur when dissolved oxygen and nitrate are no longer present and the bacteria will obtain oxygen from sulfate. The sulfate is converted to hydrogen sulfide and other sulfur-related compounds.

Alkalinity is lost during nitrification; thus, it becomes important to monitor pH levels. Nitrification is pH-sensitive, and rates of nitrification will decline significantly below a pH level of 8.0 to 8.5. The image below (EPA-625/4-73-004a, Revised Nitrification and Denitrification Facilities Wastewater Treatment, U.S. Environmental Protection Agency Technology Transfer Seminar) shows how nitrification is a function of pH at a specific temperature. Biofilter research indicates that biofilters perform well when pH levels are between 6.5 and 9.5.



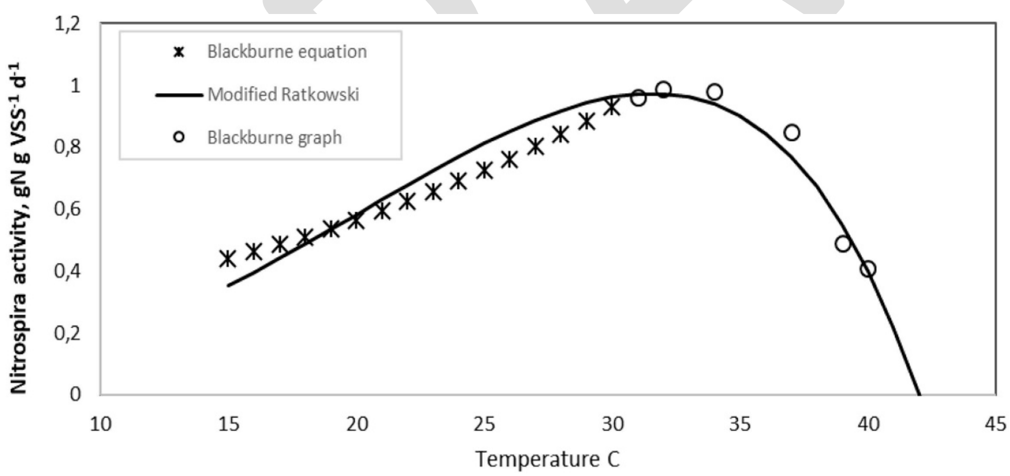
<u>Moisture Content</u>

Biodegradation can't happen without water, and ultimately without water adequately encapsulating the biofilter's media. Biofilter research indicates that a biofilter's water content (weight basis) must be between 40 to 60 percent to perform well.

In general, rates of nitrification, ammonification, and denitrification are closely related to the availability of water. In soils, nitrification and ammonification proceed at their maximal rates near 60 percent water-filled pore space (or 50 percent weight basis using a soil bulk density of 1.2 g/cm^3); and denitrification takes over nitrification in soils too waterlogged for active nitrification. Only a small overlap exists in the conditions suitable for nitrification and denitrification. Nitrifier activity abruptly shifts from one process to the other when water-filled porosities become waterlogged. The biofilter must be built to efficiently maintain and drain moisture. Since moisture content of a biofilter has a gradient from inside to outside and bottom to top, it's important to make sure that the biofilter's media is irrigated during hot ambient temperatures and drained during heavy rainfall to avoid waterlogging. Since the biofilter is open-topped, moisture content must be monitored throughout the year.

<u>Temperature</u>

Bacterial activity is significantly dependent on temperature. There is a sharp cutoff at which high temperatures can't sustain nitrifier activity. Biofilter research indicates that a biofilter's temperature must be between 15 to 40 degrees Celsius to perform well. As an example, the plot below shows how the activity of the most common nitrifier is sensitive to temperature.



Source of graphics (Figure 3):

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Availability of water for nitrification ceases when the water of the biofilter beings to freeze or evaporate. Only a specific window in biofilter temperatures exists suitable for nitrification and denitrification. Nitrifier activity abruptly ends when the temperatures reach 42 degrees Celsius. The biofilter must be built to efficiently maintain a temperature that supports the bacterial activity required to control emissions. Since temperature, like water content of a biofilter has a gradient from inside to outside and bottom to top, it's important to make sure that the biofilter's media is cooled during hot ambient temperatures. Since the biofilter is exposed to ambient temperatures, the biofilter's temperature must be monitored throughout the year.

<u>Other Parameters</u>

King County identified oxygen levels in the biofilters as an important parameter for proper operation, and specifically that there is a lower floor below which biofilters will not function properly which is at or above 10 percent. The oxygen levels in the biofilter are interconnected with the oxygen levels in the composting process. The availability of oxygen decreases at the expense of the composting process. If oxygen levels in the composting process are not enough to maintain aerobic conditions, the air extracted from the composting piles will not have enough oxygen to sustain aerobic activities for nitrification and denitrification in the biofilters. King County noted that the composting industry has not developed basic principles on what it means to maintain aerobic composting, nor can a definition of aerobic composting be readily found in North America. Using examples from United Kingdom and European research, aerobic composting can be defined as a process where oxygen is maintained above 2 ppm oxygen in the biofilm of decomposing waste. This is accomplished by forced aeration which delivers more than sufficient oxygen to supply aerobic reactions and removes heat to maintain optimal temperatures for composting.

The biofilter's design includes a minimum bed depth requirement (at least 3 feet), a minimum residence time (at least 75 seconds), and an allowable pressure drop < 0.8" w.c. per foot of depth to detect potential degradation. Monitoring of the biofilter will also reduce vegetation growth on the biofilters.

Another key parameter is how long before media replacement. It is suggested that media must at least be replaced after 4 years continuous operation Colon et al.[1] (2009); however the frequency at which biofilter media needs to be changed will vary for each biofilter. Traditional biofilters typically use a combination of wood chips, bark, and compost as media. To evaluate the biofilter media, monitoring of the static pressure is required. A higher than normal static pressure would indicate the biofilter is clogged or too compacted. King County indicates that the media will be replaced when the pressure drop reaches 0.8" w.c. per foot of depth.

Biofilters and biolayers in general achieve 80-98% control of VOC emissions. A worst-case efficiency is used for the potential project and facility-wide emission calculations. The new and existing biofilters will also be required to achieve at least 80.0% removal of ammonia, consistent with SCAQMD Rule 1133.3. In addition, the negative aeration systems for both the active and secondary ASPs will be required to achieve at least 98% capture of emissions, which will all be routed to and controlled by a biofilter. This capture efficiency is consistent with the assumption used for WDOE's

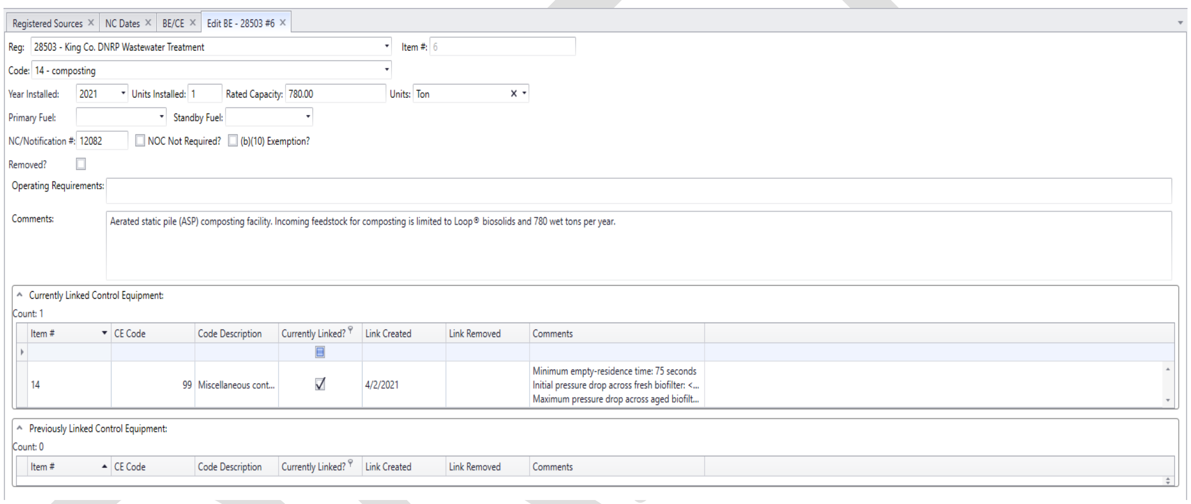
[1] Colon J. et al (2009) Performance of an industrial biofilter from a composting plant in the removal of ammonia and VOCs after material replacement. Journal of Chemical Technology and Biotechnology.

Order No. 14AQ-C191 (see the BACT section for more information). To control uncaptured emissions, King County will cover each ASP with at least 6 to 12-inch of biofilter material (biolayer).

Monitoring of pH levels, temperatures, water contents, oxygen levels, bed depth, bed residence time, and pressure drops will verify biofilter performance. In addition, King County will conduct emissions testing within 365 days after startup and every 60 months to verify that the biofilter meets the required removal efficiencies.

B. DATABASE INFORMATION

New NSPS due to this NOCOA?	**No**	**Applicable NSPS: None**	**Delegated? N/A**
New NESHAP due to this NOCOA?	**No**	**Applicable NESHAP: None**	**Delegated? N/A**
New Synthetic Minor due to this NOCOA?	**No**		



C. NOC FEES AND ANNUAL REGISTRATION FEES

NOC Fees:

Fees have been assessed in accordance with the fee schedule in Regulation I, Section 6.04. All fees must be paid prior to issuance of the final Order of Approval.

Fee Description	**Cost**	**Amount Received (Date)**
Filing Fee	$1,150	
Composting Facility	$10,000	
Public Notice	$700 (plus publication costs to be invoiced later)	
Filing received		$1,150 (12/15/2020)
Additional fee received		$10,700 (5/12/2022)
Total Remaining	**$ + publication costs**	

Registration Fees:
Registration fees are assessed to the facility on an annual basis. Fees are assessed in accordance with Regulation I, Section 5.07

Project related fees:

Applicability		
Regulation I	**Description**	**Note**
5.03(a)(5)	Facilities with gas or odor control equipment (>= 200 cfm)	
5.03(a)(8)(D)	Facilities with commercial composting operations	
Annual Registration Fee		
Regulation I	**Description**	**Fee**
5.07(c)(3)	Emission reporting	Varies
5.07(c)(5)	Facilities with composting operations (< 100,000 tons/yr)	$5,750
	Total =	$5,750+emission fees

Registration fees will increase by a minimum of $5,750.

Current registration fee schedule:

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D. STATE ENVIRONMENTAL POLICY ACT (SEPA) REVIEW

State Environmental Policy Act (SEPA) review was conducted in accordance with Regulation I, Article 2. The SEPA review is undertaken to identify and help government decision-makers, applicants, and the public to understand how a project will affect the environment. A review under SEPA is required for projects that are not categorically exempt in WAC 197-11-800 through WAC 197-11-890. A new source review action which requires a NOC application submittal to the Agency is not categorically exempt.

A new SEPA determination is not required because the potential impacts from this project were reviewed under SEPA by King County. A DNS was issued by King County on January 12, 2021. A copy of this DNS and SEPA checklist is included below and is being relied upon for this project.

210115_STP-Compost-Pilot-DNS-DocuSi

210115_STP-Compost-SEPA-Checklist-D

E. TRIBAL CONSULTATION

On November 21, 2019, the Agency’s Interim Tribal Consultation Policy was adopted by the Board. Criteria requiring tribal consultation are listed in Section II.A of the policy and include establishment of a new air operating permit source, establishment of a new emission reporting source, modification of an existing emission reporting source to increase production capacity, or establishment or modification of certain equipment or activities. In addition, if the Agency receives an NOC application that does not meet the criteria in Section II.A but may represent similar types and quantities of emissions, the Agency has the discretion to provide additional consultation opportunities.

This project meets the criteria for consultation listed in Section II.A of the Agency's Interim Tribal Consultation Policy. The Agency offered consultation and coordination on the review of King County's NOC application for the composting facility on March 25, 2021. This was offered to following tribes: Duwamish, Muckleshoot, Nisqually, Port Gamble S'Klallam, Puyallup, Suak-Suiattle, Snohomish, Snoqualmie, Steilacoom, Stillaguamish, Suquamish and Tulalip. Letters are embedded below.

12082 - Tulalip.pdf
12082 - Suquamish.pdf
12082 - Stillaguamish.pdf
12082 - Steilacoom.pdf
12082 - Snoqualmie.pdf
12082 - Snohomish.pdf
12082 - Sauk-Suiattle.pdf
12082 - Puyallup.pdf
12082 - Port Gamble S'Klallam.pd
12082 - Nisqually.pdf
12082 - Muckleshoot.pdf
12082 - Duwamish.pdf

F. BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Best Available Control Technology (BACT)

New stationary sources of air pollution are required to use BACT to control all pollutants not previously emitted, or those for which emissions would increase as a result of the new source or modification. BACT is defined in WAC 173-400-030 as, "an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under Chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each pollutant."

An emissions standard or emissions limitation means "a requirement established under the Federal Clean Air Act or Chapter 70.94 RCW which limits the quantity, rate, or concentration of emissions of air contaminants on a continuous basis, including any requirement relating to the operation or maintenance of a source to assure continuous emission reduction and any design, equipment, work practice, or operational standard adopted under the Federal Clean Air Act or Chapter 70.94 RCW."

<u>Best Available Control Technology for Toxics (tBACT)</u>
New or modified sources are required to use tBACT for emissions control for TAP. Best available control technology for toxics (tBACT) is defined in WAC 173-460-020 as, "the term defined in WAC 173-400-030, as applied to TAP."

<u>Relevant Regulation for Composting</u>
The Agency has issued recent determinations for composting facilities and their operations and equipment, these are summarized in Table 3. The intent of requiring BACT for King County's project is to ensure that all VOCs, ammonia (NH_3) and odorous compound emissions are limited to the lowest emissions limits that King County is capable of meeting by the application of control technology that is best available and has been implemented by composting facilities as a stationary source category. King County's capability of meeting BACT is compared to the capability of composting facilities meeting current permits and rules for composting operations within the State of Washington and California air districts SCAQMD and SJAQMD. The emissions limitations imposed by these permits and rules are currently being achieved in practice by implementing reasonable management practices and economically feasible emissions control technologies.

Table 4 summarizes each California air district's permitting by rule approach, including relevant BACT requirements. South Coast Air Quality Management District (SCAQMD) and San Joaquin Air Pollution Control District (SJAQMD) require air quality permits for some composting operations and have adopted composting facility-specific rules to complement the requirements of their NSR rules. While the other California air districts listed in Table 4 do not have composting facility-specific rules, other general permitting rules may be applicable to composting operations based on the size and emissions of the composting facility. Relevant information to this permitting action is also summarized in this section.

Table 3: Similar permits issued by the Agency

Origin	Description	Limitations
PSCAA Order No. 11935 (12/3/2020)	Commercial composting facility (maximum of 14,000 wet tons of feedstock per year) for recycling green yard waste, fish waste, pre-consumer food waste, and agricultural manure and bedding using Extended Aerated Static Pile composting technology. The compost operation consists of a tipping area, two Extended Aerated Static Pile composting bays with four zones each, concrete composting pad (100'x300'), curing piles, final product storage piles, and a leachate pond.	**VOC/Organic HAP** ▪ VOC removal efficiency of at least 75.0% across biofilter cover layer ▪ No detectable odor allowed at or beyond the facility's boundary **Ammonia** ▪ NH3 removal efficiency of at least 53.0% across biofilter cover layer ▪ No detectable odor allowed at or beyond the facility's boundary **Particulate Matter** ▪ Visible emissions from grinding and screening shall not exceed 5% opacity for any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour as measured by WDOE Method 9A.
PSCAA Order No. 10494 (4/1/2014)	Temporary Expansion of an existing Aerated Static Pile (ASP) and Mass Bed Composting Facility from 30,000 to 75,000 tons per year; of Agricultural Organics (Cow Manure, bedding, and Paunch), pre and post-consumer food waste, and yard waste.	**PM/Visible Emissions** ▪ Water mist system for wood grinder ▪ Shall not exceed 10% opacity for any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour **VOC/Odor** ▪ Biofilter for ASPs and tipping building. ▪ Daily odor inspections of the property. ▪ Material must be premixed for composting prior to leaving the tipping building. ▪ No storage of compost material at the end of each workday unless it is covered with a 6" biofilter media cap. ▪ Use of leachate collection and treatment system.

Continuation - Table 3: Similar permits issued by the Agency

Origin	Description	Limitations
PSCAA Order No. 10455 (8/21/2012)	Composting System rated at 228,521 tons per year of pre and post-consumer food waste, yard, clean wood and land clearing wastes; consisting of (4) four - 41,000 ton per year Gore Composting Systems with the first phase of composting reduced from 28 to 21 days; a Tipping Building (with additional 100 ft x 50 ft apron canopy) for receipt, grinding, and mixing of feedstocks with a 24,000 cfm rated biofilter; and a Grinding Building (625 square foot) for grinding and mixing feedstocks to be equipped with a 900 square foot biofilter rated at 2,100 cfm exhaust flow.	**PM/Visible Emissions** ▪ Shall not exceed 10% opacity for any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour ▪ Water mist system for wood grinder **VOC/Odor** ▪ Biofilter for tipping building. ▪ Composting material must be covered for the gore cover composting system. ▪ Daily odor inspections of the property. ▪ Material must be premixed for composting prior to leaving the tipping building. ▪ Use of leachate collection and treatment system.

South Coast Air Quality Management District (SCAQMD) and San Joaquin Air Pollution Control District (SJAQMD) require air quality permits for some composting operations and have adopted composting facility-specific rules to complement the requirements of their NSR rules. These rules are summarized in the table below.

Table 4: California Permitting Rules for New and Existing Composting Operations

Air District	Relevant Rules	Emissions Limitations
SJVAPCD	Rule 4565 (animal manure, biosolids, poultry litter) & 4566 (organics); NSR Rule 2201	Mitigation measures based on wet-tons of material processed to achieve reductions of 19%, 60%, 80% VOCs.
SCAQMD	Rule 1133.2 (co-composting with biosolids and/or animal waste), Rule 1133.3 greenwaste only; NSR Regulation XIII, Rules 1304, 317	70% reduction by weight for existing operations, and 80% reduction by weight for new operations for VOCs and NH_3 (Rule 1133.2); 80% reduction by weight for VOC and NH_3 (Rule 1133.3)

SJVAPCD Composting Rules Summary

SJVAPCD Rule 4565 (Biosolids, Animal Manure, and Poultry Litter Operations) and SJVAPCD Rule 4566 (Organic Material Composting Operations) provide requirements for new and existing composting operations and related activities. Rule 4565 requires reductions of VOC emissions from biosolids (sewage sludge or wastewater), animal manure, and poultry litter composting and co-composting (biosolids/manure/litter mixed with other materials) operations. Rule 4566 requires VOC emission reductions from organic material (food, green, or a mixture thereof) composting operations. In addition to reducing VOC emissions, the measures and practices required by SJVAPCD

Rules 4565 and 4566 also reduce ammonia (NH_3) emissions. Per Rule 4565, mitigation measures, for both the active and curing composting stages, are aiming at reducing VOC emissions from biosolids, animal manure, or poultry litter composting operations. The number of mitigation measures required depends on the facility's annual feedstock throughput which related to the cost effectiveness of the controls. The proposed facility will compost 780 wet tons per year. A list of all mitigation measures can be found in Table 2 of District Rule 4565.

- Composting of up to 20,000 wet-tons per year are required to implement at least three Class One mitigation measures.
- Composting between 20,000 and 100,000 wet-tons per year are required to implement at least four total mitigation measures (either four Class One measures or three Class One measures and one Class Two measure).
- Composting of 100,000 wet-tons per year or greater are required to implement four or five mitigation measures (depending on the measures chosen).
- Composting of less than 200,000 wet-tons per year are required to implement two mitigation measures or an alternative measure that demonstrates at least 19% VOC reduction.
- Composting between 200,000 and 750,000 wet-tons per year are required to implement either three mitigation measures or an alternative measure that demonstrates at least 60% VOC reduction.
- Composting 750,000 wet-tons per year or greater are required to implement a mitigation measure that demonstrates at least 80% VOC reduction.

Per Rule 4566, mitigation measures are aiming at reducing VOC emissions from organic material composting during the active stage. The number of mitigation measures required depends on the facility's annual feedstock throughput. A list of all mitigation measures can be found in Table 1 of District Rule 4566.

- Composting of less than 200,000 wet-tons per year: for windrow composting only, implement at least 3 turns during the active-phase and one mitigation measure; or an Agency-approved alternative measure that demonstrates at least 19% VOC reduction.
- Composting between 200,000 and 750,000 wet-tons per year: for windrow composting only, implement at least 3 turns during the active-phase, one mitigation measure for watering systems, and the finished compost cover mitigation measure; or an Agency-approved alternative measure that demonstrates at least 60% VOC reduction.

Pursuant to SJVAPCD Rule 2201, add-on emission control devices may be required if a new or modified composting/co-composting operation triggers BACT. The SJVAPCD has established BACT guidelines relevant to the composting industry, which are summarized in the table below:

Table 5: SJVAPCD BACT Guideline Summary

Basis	Description	BACT/tBACT
SJVAPCD BACT Guideline 6.4.1 (4/3/1998)	Composted Materials – Screening, Transportable, Wood Waste Processing	**PM_{10}:** Use of a water sprinkler system or maintaining adequate moisture content of the process materials to prevent visible emissions in excess of 5% opacity.
SJVAPCD BACT Guideline 6.4.3 (7/16/2018)	Green Waste, Wood Waste, and Composted Material – Transfer & Screening	**PM_{10}:** Process materials with moisture content ≥25% and ≤30%; visible emissions not to exceed 5% opacity
SJVAPCD BACT Guideline 6.4.8 (12/19/2016)	Manure Composting Operations	**VOC:** Class One Mitigation Measures from District Rule 4565 (10% control) **NH_3:** Class One Mitigation Measures from District Rule 4565 (10% control)

SCAQMD Composting Rules Summary

SCAQMD 1133 series rules provide requirements for composting and related activities. SCAQMD Rule 1133.2 requires reductions of volatile organic compounds (VOC) and ammonia (NH3) emissions from co-composting, while Rule 1133.3 requires emission reductions from greenwaste composting. For co-composting process, biosolids (i.e., wastewater treatment plants sludge) and manure are mixed with bulking agents. For greenwaste composting, it includes three types of feedstock materials – greenwaste-only, greenwaste mixed with foodwaste, or greenwaste with up to 20% manure, by volume. New co-composting operations require all active co-composting to be conducted within an enclosure with inward face velocity and opening area limitations, and no increased VOC or NH3 emissions increases shall occur above background levels outside the enclosure as per Rule 1133.2. Add-on emission control devices are also required for new co-composting operations to reduce VOC and NH3 emissions as per Rule 1133.2. These add-on control devices are required to have an overall emission reduction of 80%, by weight, for VOC and NH3, respectively, from baseline emission factors. In lieu of complying with the requirements of paragraph (d)(1), operators of new co-composting operations may submit a compliance plan, for the approval of the Executive Officer, that demonstrates an overall emission reduction of 80 percent, by weight, for VOC emissions and 80 percent, by weight, for ammonia emissions from the baseline emission factors. Existing co-composting operations are required an overall emission reduction of 70%, by weight, for VOC and NH3, respectively, from baseline emission factors. The baseline emission factors are 1.78 pounds of VOC per ton of throughput and 2.93 pounds of NH3 per ton of throughput from the overall composting operation including both active and curing phases of composting. In lieu of complying with these requirements, operators of new co-composting operations may submit a compliance plan, for the approval of the Executive Officer, that demonstrates an overall emission reduction of 80 percent, by weight, for VOC emissions and 80 percent, by weight, for ammonia emissions from the baseline emission factors.

Either best management practices (BMPs) or add-on emission control devices are required to reduce VOC and NH_3 emissions from green waste composting windrows per Rule 1133.3, depending on the facility's feedstock throughput.

- Composting of green waste only, up to 20 volume % manure, or up to 5,000 tons per year (tpy) of food waste throughput:
  - Cover each active phase pile with finished compost (at least 6" thick) within 24 hours of formation.
  - Apply water within 6 hours before turning, such that the top of the pile is wet at a depth of at least 3".

    - Alternatively, implement a mitigation measure that demonstrates emission reductions of at least 40 wt.% for VOC and at least 20 wt.% for NH_3.
- Composting of greater than 5,000 tpy of food waste throughput:
    - Requires an add-on emission control device that has an overall system control efficiency of 80% or higher for VOC and NH_3 during the active phase (at least 22 days) of composting containing more than 10% food waste, determined by a source test.

Composting BMPs use the combination of at least 6 inches of finished compost cover and water application to the 3 inches depth from the pile surface or an alternative mitigation measure, which demonstrates via source test control efficiencies of 40% VOC and 20% NH3 emissions, by weight. Finished compost is a material that results from at least 62 days of combined active and curing phases of composting and can be either screened or unscreened. Compost overs (i.e., large pieces left after screening) are also acceptable as cover material.

Any relocation or any new or modified source which results in an emission increase of any non-attainment air contaminant, ozone depleting compound, or ammonia shall employ BACT. SCAQMD has interpreted the BACT provision as a 1.0 lb/day increase in emissions from all sources subject to NSR. Minor Source BACT requires compliance with SCAQMD Rule 1133.2 for composting. King County is in attainment for VOC. Based on the SJVAQMD emission factor and only 75 percent control on average, VOC emissions are 347 lb/year, less than 1 lb/day. ASP composting systems with an appropriate emission control device may be considered as BACT.

<u>Washington Department of Ecology</u>

Table 6: Similar Permits Issued by WDOE

Origin	Operational and Design Limitations
WDOE Order No. 14AQ-C191 (9/17/2019)	Compost facility accepting up to 62,700 wet tons per year feedstock from industrial, institutional, and residential, sources. **PM/Visible Emissions** ▪ Grinding, mixing, and turning conducted with adequate moisture to prevent visible emissions ▪ Vehicle routes covered with crushed stone or paved and controlled w/ water or chemical dust suppressants **VOC/Odor** ▪ Negative aeration system collecting at least 98% of Stage 1 emissions ▪ Biofilter with at least 75.0% destruction for all collected VOC emissions and 21.8% destruction for all collected NH_3 emissions ▪ Unscreened compost cover (at least 12”) applied to stockpiles at the end of each day ▪ Unscreened compost cover (at least 12”) applied to compost piles ▪ Carbon to nitrogen ratio of 25:1 to 30:1 for feedstock prior to placement in compost bed ▪ Compost bed moisture content 55-65%

BACT Analysis

A complete BACT analysis for a composting facility needs to look at the entire process and not just add-on control technologies. First, the technology needs to reduce the generation of odors, VOCs and TAPs. Second, the technology needs to capture the emissions that are generated by the composting process. Finally, the technology needs to be able to reduce the captured emissions before they are emitted to the air.

There are three primary commercial composting methods for biosolids. Biosolids can also be disposed of using incineration.

1. **Windrows:** Waste is piled into long rows called “windrows” and aerated periodically by turning the piles. The ideal pile height is between 4 and 8 feet with a width of 14 to 16 feet. This method is considered to be the base emissions case (i.e., uncontrolled) for BACT evaluation purposes.
2. **Aerated static pile (ASP):** Waste is mixed in a large pile, loosely layered with bulking agents like wood chips to allow air to pass through the pile. A network of pipes underneath the pile either blows air into piles (positive) or sucks the air out of the pile (negative) or a system that enables both positive and negative aeration interchangeably but not simultaneously (reversing aeration). The ASP category also includes ASPs with a biolayer and enclosed ASPs. ASPs with a layer are ASPs that have a 6 inch to 1-foot layer of finished compost or overs covering the surface of the ASP. ASPs can be located inside a building.
3. **In-vessel:** Waste is placed in a sealing drum, silo, or concrete-lined vessel where environmental conditions are mechanically controlled. In some vessels waste is physically turned or mixed.

There are multiple technologies within the windrow, ASP and in-vessel categories. The California Air Resource Board (ARB) published a summary of these technologies for the ARB Emission Inventory Methodology for Composting Facilities on March 2, 2015.

The San Joaquin Valley Technology Advancement Program evaluated a prototype extended Aerated Static Pile (eASP) composting process. The results are published in the report *Greenwaste Compost Site Emissions Reductions from Solar-powered Aeration and Biofilter Layer* (embedded below and dated May 14 ,2013). An eASP differs from an ASP only in that consecutive zones are laid alongside each other along the long axis. The prototype eASP utilized ambient air blown into the pile from the bottom. The eASP had a biolayer added to the surface as an air pollution control measure. The air emissions from the eASP were compared to the on-site measured air emissions of the current industry standard windrow composting method. VOC reductions of 98.8% were achieved when compared to the control windrows. Though, VOC reductions in this study also included reductions due to the use of solar power instead of fuel combustion for the process. Reductions in ammonia emissions were 83% using tubes in the field, and 53% from the laboratory, when the eASP was compared to the control windrows. Reductions in emissions of greenhouse gases ranged from 13% for methane up to nearly 89% for N_2O for the eASP system when compared to the controls.

PDF

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Table 6: Summary of available technologies used in the composting industry

Control type	Aeration	Control Technology	Cover Material
Windrow Technologies			
Static pile: no biofilter	Passive	None	None
Managed windrow: no biofilter	Passive	None	None
Water management requirements[a]	Passive	Watering	None
Static pile/passively aerated windrow covered 15 days with a biofilter[b]	Passive	At least 6 inches of Compost Cover	Finished Compost or Compost Overs
Static pile/passively aerated windrow covered 22 days with a biofilter[a]	Passive	At least 6 inches of Compost Cover	Finished Compost or Compost Overs
Aerated static pile (ASP) Technologies			
Negative ASP with biofilter (classic)	Forced, negative air	At least 6 inches of Compost Cover (optional), Biofilter Bed	Finished Compost or Compost Overs
Positive ASP with biocover	Forced, positive air	At least 6 inches of Compost Cover	Finished Compost or Compost Overs
Positive windrow style ASP with biocover (eASP)	Forced, positive air	At least 6 inches of Compost Cover	Finished Compost or Compost Overs
Enclosed aerated static pile technologies			
Enclosed negative ASP with biofilter (e.g., ECS)	Forced, negative air	Biofilter Bed	Engineered Cover Tarp
Negative ASP with biofilter (Indoor)	Forced, negative air	Biofilter Bed	Building
Enclosed positive ASP (e.g., GORE cover)	Forced, positive air	None	Engineered Cover Membranes
Ag bag	Forced, positive air	None	Thick Mill Plastic Bag
General enclosed pile vented through a biofilter	Forced	Vented through biofilter	Finished Compost or Compost Overs
In-Vessel	Forced	Aerobic fermentation	None

Source: https://ww3.arb.ca.gov/ei/areasrc/composting_emissions_inventory_methodology_final_combined.pdf
[a] Requires compliance with pile management and/or watering requirements in SJVAPCD's rule 4566.
[b] Requires compliance with pile management and/or watering requirements in SCAQMD's rule 1133.3.

The eASP method provides emission reductions in the same range as the enclosed systems. King County will use the same method for the secondary composting process during positive aeration. The San Joaquin Valley eASP project only provided information on a positive aeration ASP covered with a biolayer, but did not provide control efficiencies for an ASP with a biocover and biofilter under negative aeration. It is noted that additional emission reduction potential from ASP could not be quantified at the time. It is also noted that the layout and the addition of a biocover greatly increases the capture efficiency for ASP systems.

Biofilters and biolayers are generally the accepted odor reduction technologies for composting operations and are the only add-on technologies specified in the *ARB Emission Inventory Methodology for Composting Facilities* (embedded below and dated March 2 ,2015). Other odor control technologies include:

- Carbon Adsorption
- Photo Ionization
- Biotrickling Filter
- Chemical Scrubber
- Thermal Oxidizer

composting_emissions_inventory_meth

Table 7: Summary of effectiveness of technologies used in the composting industry

Control type	Aeration	VOC Control Efficiency	NH_3 Control Efficiency
Windrow			
Static pile: no biofilter	Passive	0%	0%
Managed windrow: no biofilter	Passive	0%	0%
Water management requirements[a]	Passive	19%	19%
Static pile/passively aerated windrow covered 15 days with a biofilter[b]	Passive	40%	20%
Static pile/passively aerated windrow covered 22 days with a biofilter[a]	Passive	60%	20%
Aerated static pile (ASP)			
Negative ASP with biofilter (classic)	Forced, negative air	26%	23%
Aerated static pile (ASP) with biocover			
Positive ASP with biofilter cover	Forced, positive air	80%–98%	53%
Positive ASP with biofilter cover (eASP)	Forced, positive air	98.8%	53%-84%
Enclosed aerated static pile			
Enclosed negative ASP with biofilter (e.g., ECS)	Forced, negative air	80%–98%	70%–78%
Negative ASP with biofilter (Indoor)	Forced, negative air	80%–98%	80%–99%
Enclosed positive ASP (e.g., GORE cover)	Forced, positive air	80%	70%
Ag bag	Forced, positive air	80%	70%
General enclosed pile vented through a biofilter	Forced	80%	70%

Source: https://ww3.arb.ca.gov/ei/areasrc/composting_emissions_inventory_methodology_final_combined.pdf

[a] Requires compliance with pile management and/or watering requirements in SJVAPCD's rule 4566.

[b] Requires compliance with pile management and/or watering requirements in SCAQMD's rule 1133.3.

Composting requires large volumes of air to maintain uniform temperatures and oxygen levels through the compost piles. When implementing technologies for high-volume of emissions, surface area of the media and residence times are the main drivers for the design of technologies. In determining whether technologies are BACT, the most common factors considered are cost, environmental impacts and effectiveness. For King County's case, however, the proposed composting operation is small and will not require large volumes of air.

Chemical scrubbers and biotrickling filters are effective and are designed to remove a wide range pollutants since they can operate in stages and at pH levels that effectively absorb acidic and basis pollutants. Thermal oxidizers are also effective; however, they produce secondary pollutants such as SO_2 that will require additional technologies to eliminate them leading to higher costs. When thermal oxidation is implemented for odorous pollutants, scrubbing follows with mist eliminators to reduce acid gases. Biofilters are not as effective as chemical scrubbers and biotrickling filters but are the least costly. Biofiltration is the most common technology because of its cost effectiveness, not necessarily for its effectiveness in reducing emissions. Carbon adsorption is only effective at removing light organic pollutants that and are not suitable at removing inorganic pollutants such as ammonia and sulfur compounds. Photo ionization is effective at scavenging a wide range of pollutants but at the expense of producing ozone. Ozone is a regulated pollutant with state and federal air quality standards.

All of the above technologies have been demonstrated effective in practice. However, for King County's small composting operation, many of the technologies are not feasible due to costs and secondary environmental impacts. As noted, thermal oxidation (which includes incineration) and photo ionization produces secondary pollutants that require additional controls. Implementing these additional controls makes thermal oxidization and photo ionization not feasible for a small operation. This also includes chemical scrubbing and biotrickling filtration. Scrubbers are designed to treat high-volumes of air required to overcome the large pressure drops created by the waterflows. Biotrickling filters on the other hand are designed to treat low-volumes of air. Their implementation are as costly as scrubbers, therefore, the cost of a biotrickling filter does not make them feasible for a small composting operation. Thermal oxidation is not cost effective for small-scale operations. Carbon adsorption is not effective for composting emissions so is not considered as BACT.

For King County's small composting operation, biofiltration is the most cost effective. In-vessel enclosed ASPs, where waste is placed in a sealing drum, silo, or concrete-lined vessel and environmental conditions are mechanically controlled, are not feasible for a short pilot project because of the nature of the site, and temporary status of the project, all of which will not allow any permanent structures. Large concrete vessels cannot be poured on site for a 5-year project. In-vessel technology will be re-evaluated for the future full-scale facility.

The effectiveness of the technologies listed in Table 6 at controlling VOCs and ammonia (NH_3) are provided in Table 7. Since VOCs and NH_3 contribute to odor, the data also indicates the technologies effectiveness at treating odor.
Composting processes using windrow technologies are the least efficient at reducing odors and VOCs. Emissions from passively aerated windrows with no biocover are considered to be uncontrolled. For this reason, windrows are not being considered for this permitting action.

ASPs have more uniform aeration and oxygen levels throughout the compost pile which results in less emissions generated than from a windrow and therefore higher control efficiencies. The low VOC and NH_3 control efficiencies for negative ASP with biofilter (classic) when compared to an ASP with a biocover are mainly due to the low capture efficiency for the process. The addition of a biocover greatly improves the capture and removal efficiency as indicted in Table 7. Therefore, ASPs without a biolayer are not being considered for this permitting action.

The remaining two technology categories, ASPs with a biocover and enclosed ASPs, have similar VOC control efficiencies of 80 percent or greater. The eASP method has a range of control efficiency for ammonia, 53 to 84 percent, compared to a positive ASP with biolayer, 53 percent and an enclosed ASP, 70 percent. Both technologies are considered for this permitting action.

CARB's document did not provide control efficiencies for an ASP with a biolayer under negative aeration with a biofilter. It was noted that additional emission reduction potential from ASP could not be quantified at this time. However, it is mentioned the addition of a biolayer greatly increases the capture efficiency for ASP systems. The addition of walls on either side of the piles also improves capture efficiency and distribution of airflow through the pile which reduce emissions. It is believed the control efficiency would be equal to or greater than an ASP with cover under positive aeration due to the additional control efficiency provided by the biofilter.

King County evaluated the cost of constructing an enclosed ASP by constructing a building over the active and curing composting processes and installing a ventilation system and biofilter to capture the emissions in the building. The cost for building and biofilter was estimated at 6.5 million dollars. Since the project has a 5-year limit, this would result in a cost of over 1 million dollars per year for an ammonia reduction of about 389 lbs per year. The detailed cost estimates are included in the NOC application. The current site footprint does not have space available for the biofilter large enough to control emissions from a building. Therefore, this type of enclosed ASP is not feasible and is not considered for this permitting action.

ASPs with a biolayer and enclosed ASPs have similar VOC control efficiencies of 80 percent or greater. The control efficiencies for ammonia range 53 to 84 percent for eASPs, 53 percent for positive ASPs with a biolayer, and 70 percent for enclosed ASPs.

King County's objective with this project is to operate a composting process in all aeration configurations, evaluate emissions, and make decisions for evaluating and planning a larger-scale composting process. The only way to pilot all three aeration programs (positive, negative, and combination positive and negative) is to construct and operate a reversing aeration system. An ASP with a biolayer is the technology best suited for this objective.

<u>BACT Determination</u>

King County is proposing active ASPs with reversing aeration (both positive and negative) with the compost placed in concrete block bunkers for active composting and secondary piles also with reversing aeration (both positive and negative) using an extended bed configuration for curing. The compost piles are covered with a biolayer of overs or finished compost or wood chips. During negative aeration, the extracted air from the piles is sent to a biofilter for treatment. The proposed layout of the ASPs with the use of reversing aeration, biolayers and a biofilter is BACT. The layout and technology will achieve similar control efficiencies of greater than 80 percent control of VOCs and greater than 53 percent control of ammonia when under either positive or negative air. The proposed system is cost-effective and alternating the airflow allows the process to mimic an in-vessel composting system.

The purpose of BACT is to limit or reduce all increases in emissions. For this permitting action, BACT will limit the composting operations' emissions of greenhouse gases, particulate matter (PM), ammonia (NH_3), amines, alcohols, aldehydes, reduced sulfur compounds, other volatile organic compounds (VOCs) and toxic air pollutants (TAPs).

Emissions from King County's composting facility and its operations and equipment will primarily occur during the active and curing phases of composting process. Ammonia, amines, alcohols, aldehydes, reduced sulfur compounds are produced as by-products of the microbial decomposition of the organic carbon, nitrogen and sulfur compounds in biosolids. Information in King County's NOC application supports that 95 percent of the emissions from composting are from the active and curing phases of the process. According to the SCAQMD Rule 1133 final staff report, 80 percent of VOC emissions and 50 percent of NH_3 emissions occur during the first 22 days of composting or during the active composting phase (SCAQMD Rule 1133 Final Staff Report 2011). All other processes—material handling and storage, mixing, screening, and finished product storage—contribute to only 5 percent of the total VOC emissions. Therefore, for this permitting case, BACT will focus on the active and curing phases of the composting process.

Table 8: BACT for VOCs, inorganics and volatile TAPs from composting

Pollutant	BACT Limitation	BACT Implementation
Non-methane organic compounds	0.36 lbs per wet ton of biosolids composted (King County's baseline emissions rate)	▪ During negative aeration of ASPs, all air extracted from the ASPs must vent to a biofilter that meets an 80 percent removal rate for all collected VOC emissions and a 53 percent removal rate for all collected NH_3 emissions ▪ At all times during the active composting and curing phases, an unscreened biolayer (at least 6 -12") must be applied to the entire top surface area of all built ASPs
Ammonia (NH_3)	1.55 lbs per wet ton of biosolids composted (King County's baseline emissions rate)	
Hydrogen Sulfide (H_2S)	0.015 lbs per wet ton of biosolids composted (King County's baseline emissions rate)	
Methanol	0.002 lbs per wet ton of biosolids composted (King County's baseline emissions rate)	
Triethyl amine	0.001 lbs per wet ton of biosolids composted (King County's baseline emissions rate)	

Table 9: BACT for odor from composting

Pollutant	BACT Limitation	BACT Implementation
Odors	No detectable odor allowed at or beyond the facility's fence line	Periodic monitoring at the fence line using sensory observations and handheld device

Table 10: BACT for PM from composting

Pollutant	BACT Limitation	BACT Implementation
Particulate matter	Visible emissions from grinding and screening shall not exceed 5% opacity for any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour	Periodic opacity monitoring using WDOE Method 9A.

The Agency has not issued any recent BACT determinations for diesel-fired equipment. For this permitting action, BACT is based on King County's proposal to install a Tier 4 engine with limited operation.

Table 11: BACT for diesel-fired trommel screen

Pollutant	BACT Limitation
PM, VOCs, inorganics and volatile TAPs	▪ Limited to 208 hours of operation per year on a 12-month rolling average ▪ Maximum internal combustion engine power rate limited to 51 bhp ▪ Use of ultra-low sulfur containing fuel ▪ EPA Tier 4 emission standards compliant engine

G. EMISSION ESTIMATES

The purpose of this section is to identify each regulated air pollutant and present the amounts at which each regulated air pollutant will be emitted from the composting operation. For this permitting case, the Agency presents potential-to-emit (PTE) emissions. Potential emission sources at the composting operation consist of:

- Mixing areas: Loop® biosolids bunker, bulk material bunker, and mixer
- Bunkers: four primary compost bunkers with biocover operated as CASPs, aerated with reversing aeration (having the option for positive and negative aeration in each bunker)
- Curing area: a secondary compost pile of extended bed configuration, comprised of four piles with biocover, aerated with reversing aeration (having the option for positive or negative aeration in each zone)
- Biofilter: a biofilter serving to scrub emissions from the bunkers and curing area when operating in negative aeration direction
- Screening: trommel screen powered by a 38 kW (51 horsepower) diesel engine
- Bulk Material Bunker: storage area for bulk material and overs
- Finished compost: a finished compost storage area.

PTE is defined in WAC 173-400-030 as, "the maximum capacity of a source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design only if the limitation or the effect it would have on emissions is enforceable. Secondary emissions do not count in determining the potential to emit of a source." PTE emissions for this permitting action will be based on having all of the active and curing ASPs and the trommel screener in operation.

Emissions Factors Review

The California Air Resource Board (CARB) published facility-wide emissions factors (EFs) for VOCs from biosolids facilities and summarized in *ARB Emissions Inventory Methodology for Composting Facilities* (2015). The EFs are for uncontrolled facility-wide emissions in pounds per wet ton of biosolids processed. Composting using windrows, like in the ARB EF review, is considered to be uncontrolled compared to composting using aeration like the County proposes for this Facility.

Two sources, McGill[2] (2005) and Epstein[3] (2000), are used for estimating all HAP and TAP emissions, except for ammonia, naphthalene, and hydrogen sulfide which are discussed below. Many of the HAP and TAP compounds are included in both of these documents and had identical emission concentrations. If the concentrations were not identical in the two documents, then the highest emission concentration was used. The EFs are provided as emission concentrations in milligrams per cubic meter (mg/m3). The emission rate is calculated using the emission concentration and the airflow rate through the bunkers or zones. Emissions are calculated in pounds per hour (lb/hr), pounds per 24 hours (lb/24-hr), and lb/yr for comparison to the de minimis and SQER levels in WA State Toxics Rule.

For ammonia, the ARB has published facility-wide EFs from biosolids facilities. The EFs are for uncontrolled facility-wide emissions in pounds per wet ton of biosolids processed. Composting using windrows is considered to be uncontrolled.

Naphthalene emissions were provided by Table 10.11 in The Science of Composting Epstein[4] (1996). The naphthalene emission rate provided in McGill (2005) was the maximum naphthalene emissions rate observed at a municipal solid waste composting facility and did not reflect emissions from biosolids composting.

Emission concentrations of RSCs were taken from Tables 3 and 4 in Odors and Volatile Organic Compound Emissions from Composting Facilities Epstein (2000). The RSC, H_2S, is a TAP.

Composting is an aerobic process, and some fraction of the organic material is decomposed during composting to carbon dioxide (CO_2). The generation of nitrous oxide (N_2O) and methane (CH_4) can also occur. A standard set of EFs have been adopted by the Intergovernmental Panel on Climate Change (IPCC) from a review of the available literature and these values are used by the EPA. Emissions of these compounds depend on composting conditions. The 2006 IPCC Guideline reported CH_4 emissions ranging from less than 1 percent to a few percent of the initial carbon content of the compost and reported N_2O emissions have ranged from 0.5 to 5 percent of initial nitrogen in the material IPCC[5] (2006). The emissions of CH_4 and N_2O are converted into an equivalent CO_2 emission rate using the global warming potentials (GWPs) of these gases. The GWPs are recommended by the IPCC in its periodic assessment reports. These values account for differences in atmospheric lifetime

[2] Potential to Emit Analysis, McGill Environmental Systems of NC, Inc. April 2005
[3] Odors and Volatile Organic Compound Emissions from Composting Facilities, Eliot Epstein, Ph.D., 2000
[4] The Science of Composting, Eliot Epstein, Ph.D., 1996
[5] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

between CO_2 and the other GHGs and differences in their infrared absorption spectrum. These GWPs based on the 100-year time horizon are 25 for CH_4 and 298 for N_2O.

Emissions from material handling include fugitive emissions and emissions from the diesel engine powering the trommel screen. The screen is powered by a 38 kW (51 horsepower) diesel engine. Screening will be conducted a maximum a total of 208 hours per year as monitored by a twelve-month rolling average. Emissions were calculated assuming a Tier 4 engine and AP-42, Section 3.3, Table 3.3-2. The main source of potential fugitive dust emissions is from the movement of feedstock and compost around the Facility. Fugitive dust from vehicle traffic should be minimal because the Facility will follow current fugitive dust management procedures and maintain a clean site. However, the loading and unloading of materials in the different process areas may cause fugitive emissions. Therefore, fugitive emissions were calculated based on the number of drop points in the process. There are not generally accepted EFs for fugitive particulate emissions from composting. SJVAPCD recommends using the EF for crushed stone from AP-42 Table 11.19.2-2 as indicated in Area Source Emissions Inventory Methodology, 199 – Composting Waste Disposal (2006).

To allow for operational flexibility, emissions are calculated for three operating scenarios.

Scenario 1 (Positive Aeration): All four bunkers and four curing zones are in operation with the mixing area inactive. Emissions from the finished compost area are also included. The fifth curing zone will not be in operation because, as in all cases, a gap is left between the loading face and soon to be unloaded face of the extended bed. The mixing area would not be in operation when all four bunkers are already loaded with mixed material. Under this scenario, all active and curing composting bunkers and zones are aerated in the positive aeration direction. The biofilter is not in operation in this scenario because there is no negative aeration airflow through any bunkers or zones and thus no air flow pushed out the biofilter during this scenario. Operation under this scenario tends to be biased toward negative aeration for the beginning of the active composting where most emissions are generated. The likelihood of all being in positive aeration mode at the same time is unlikely (per King County's estimate). The potential exception is when the composting facility intentionally operates under this condition for the purpose of emission testing which would be a planned event resulting in actual emissions data.

Scenario 2 (Positive Aeration with Mixer): This scenario calculates emissions from three of the four bunkers in active composting, four of the five zones in the curing area, and the mixing area. Emissions from the finished compost area are also included. One active bunker would remain empty in order to receive the soon-to-be produced fresh mix of material. Under this scenario, positive aeration is considered as the only aeration direction used to control the compost process in the active bunkers and in the curing zones. The biofilter is not included because there is no airflow through the biofilter during this scenario (no negative aeration). This scenario represents worst-case for odors when a new batch of biosolids and bulking material are being prepared and are soon to be placed in one of the active bunkers. The odors from Scenario 2 are less than Scenario 1, but more than scenario 3.

Scenario 3 (Negative Aeration): This last scenario calculates emissions of all four bunkers and four curing piles in operation, with control by negative aeration. In this scenario the mixing area is inactive and not producing emissions as all four active bunkers are full and there is no space to place any fresh mixed material (thus not utilized). Under this scenario negative aeration is solely used to control the primary bunkers and curing zones, and all the process air is routed to the biofilter.

Table 12: Summary of intended operating scenarios

	Scenario 1	Scenario 2	Scenario 3
Mixing Areas (1-4)	Inactive	Active	Inactive
Compost Bunker (5)	↑ 4 Positive Aeration	↑ 3 Positive Aeration	↓ 4 Negative Aeration
Curing Area (6)	↑ 4 Positive Aeration	↑ 4 Positive Aeration	↓ 4 Negative Aeration
Screening Area (7)	-	-	-
Finished Product (8)	Active	Active	Active
Biofilter (▲)	Inactive	Inactive	Active
Emissions	Highest (0.2% of the time)		Lowest

<u>Emissions Calculations</u>

PTE emissions are calculated using Scenario 1.

Table 13: HAP and TAP PTE emissions from the active and curing ASPs

HAP/TAP Emission Estimates			Uncontrolled			Controlled					
CAS	Pollutant	Emission Factor (mg/m3)	lb/hr (each bunker)	lb/hr (each zone)	lb/hr (total)	lb/hr (each bunker)	lb/hr (each zone)	lb/hr (total)	lb/24-hr (total)	lb/year (total)	Note
79-00-5	1,1,2-Trichloroethane	0.027	3.54E-05	4.04E-06	1.58E-04	7.08E-06	8.09E-07	3.15E-05	0.0008	0.28	1
120-82-1	1,2,4-Trichlorobenzene	0.0077	8.07E-06	1.15E-06	3.69E-05	1.61E-06	2.31E-07	7.38E-06	0.0002	0.06	1
106-46-7	1,4-Dichlorobenzene	0.009	9.44E-06	1.35E-06	4.31E-05	1.89E-06	2.70E-07	8.63E-06	0.0002	0.08	2
111-76-2	2-Butoxyethanol	0.009	9.44E-06	1.35E-06	4.31E-05	1.89E-06	2.70E-07	8.63E-06	0.0002	0.08	1
110-80-5	2-Ethoxyethanol	0.009	9.44E-06	1.35E-06	4.31E-05	1.89E-06	2.70E-07	8.63E-06	0.0002	0.08	2
75-07-0	Acetaldehyde	0.06	6.29E-05	8.99E-06	2.88E-04	1.26E-05	1.80E-06	5.75E-05	0.0014	0.50	1
107-05-1	Allyl chloride	0.07193	7.54E-05	1.08E-05	3.45E-04	1.51E-05	2.16E-06	6.90E-05	0.0017	0.60	1
7664-41-7	Ammonia				2.61E-01			1.38E-01	3.3185	1211.26	3
71-43-2	Benzene	0.104	1.36E-04	1.56E-05	6.08E-04	2.73E-05	3.12E-06	1.22E-04	0.0029	1.06	2
75-15-0	Carbon Disulfide	0.224	2.94E-04	3.36E-05	1.31E-03	5.87E-05	6.71E-06	2.62E-04	0.0063	2.29	2
56-23-5	Carbon tetrachloride	0.29	3.80E-04	4.34E-05	1.69E-03	7.60E-05	8.69E-06	3.39E-04	0.0081	2.97	1
108-90-7	Chlorobenzene	0.93	1.22E-03	1.39E-04	5.43E-03	2.44E-04	2.79E-05	1.09E-03	0.0261	9.52	1
67-66-3	Chloroform	0.054	7.08E-05	8.09E-06	3.15E-04	1.42E-05	1.62E-06	6.31E-05	0.0015	0.55	1
110-82-7	Cyclohexane	0.327	4.29E-04	4.90E-05	1.91E-03	8.57E-05	9.80E-06	3.82E-04	0.0092	3.35	2
100-41-4	Ethylbenzene	0.17	2.23E-04	2.55E-05	9.93E-04	4.46E-05	5.09E-06	1.99E-04	0.0048	1.74	1
50-00-0	Formaldehyde	0.013	1.70E-05	1.95E-06	7.59E-05	3.41E-06	3.89E-07	1.52E-05	0.0004	0.13	2
87-68-3	Hexachlorobutadiene	0.004	5.24E-06	5.99E-07	2.34E-05	1.05E-06	1.20E-07	4.67E-06	0.0001	0.04	1
110-54-3	Hexane	0.013	1.70E-05	1.95E-06	7.59E-05	3.41E-06	3.89E-07	1.52E-05	0.0004	0.13	1
6/4/7783	Hydrogen sulfide				6.61E-03			4.29E-03	0.1031	37.62	4
67-56-1	Methyl Alcohol	0.153	2.01E-04	2.29E-05	8.94E-04	4.01E-05	4.58E-06	1.79E-04	0.0043	1.57	2
74-87-3	Methyl Chloride	0.016	2.10E-05	2.40E-06	9.35E-05	4.19E-06	4.79E-07	1.87E-05	0.0004	0.16	1
78-93-3	Methyl ethyl ketone	15	1.97E-02	2.25E-03	8.76E-02	3.93E-03	4.49E-04	1.75E-02	0.4206	153.54	1
108-10-1	Methyl isobutyl ketone	0.32	4.19E-04	4.79E-05	1.87E-03	8.39E-05	9.59E-06	3.74E-04	0.0090	3.28	1
75-09-2	Methylene chloride	5.21	6.83E-03	7.80E-04	3.04E-02	1.37E-03	1.56E-04	6.09E-03	0.1461	53.33	1
106-36-3	m-Xlylene	0.024	3.15E-05	3.60E-06	1.40E-04	6.29E-06	7.19E-07	2.80E-05	0.0007	0.25	1
91-20-3	Naphthalene	0.044	5.77E-05	6.59E-06	2.57E-04	1.15E-05	1.32E-06	5.14E-05	0.0012	0.45	5
95-47-6	o-Xylene	0.024	3.15E-05	3.60E-06	1.40E-04	6.29E-06	7.19E-07	2.80E-05	0.0007	0.25	1
108-95-2	Phenol	0.029	3.80E-05	4.34E-06	1.69E-04	7.60E-06	8.69E-07	3.39E-05	0.0008	0.30	1
106-42-3	p-Xylene	0.024	3.15E-05	3.60E-06	1.40E-04	6.29E-06	7.19E-07	2.80E-05	0.0007	0.25	1
100-42-5	Styrene	0.19	2.49E-04	2.85E-05	1.11E-03	4.98E-05	5.69E-06	2.22E-04	0.0053	1.94	1
127-18-4	Tetrachloroethylene	0.01355	1.78E-05	2.03E-06	7.92E-05	3.55E-06	4.06E-07	1.58E-05	0.0004	0.14	1
108-88-3	Toluene	0.93	1.22E-03	1.39E-04	5.43E-03	2.44E-04	2.79E-05	1.09E-03	0.0261	9.52	1
79-01-6	Trichloroethylene	0.00644	8.44E-06	9.65E-07	3.76E-05	1.69E-06	1.93E-07	7.52E-06	0.0002	0.07	1
121-44-8	Triethylamine	9	1.18E-02	1.35E-03	5.26E-02	2.36E-03	2.70E-04	1.05E-02	0.2524	92.12	1
	Total TAPs									1406.16	
	Total HAPs									183.33	
	Total HAPs/TAPS									1589.49	

Note 1 - Appendix B, Potential to Emit Analysis, McGill Environmental Systems of NC, Inc. April 2005
Note 2 - Table 5, Odors and Volatile Organic Compound Emissions from Composting Facilities, Eliot Epstein, Ph.D., 2000
Note 3 - SJVAPCD emission factor
Note 4 - Tables 3 and 4, Odors and Volatile Organic Compound Emissions from Composting Facilities, Eliot Epstein, Ph.D., 2000
Note 5 - Table 10.11, The Science of Composting, Eliot Epstein, Ph.D., 1996

Table 14: HAP and TAP PTE emissions from the active and curing ASPs

Sulfur Compounds				
Name	Formula	lb/hr (total)	lb/24-hr (total)	lb/year (total)
Hydrogen sulfide	H2S	1.32E-03	3.17E-02	12
Dimethyl sulfide	(CH3)2S	8.77E-03	2.10E-01	77
Dimethyl disulfide	(CH3)2S2	2.27E-02	5.44E-01	198
Ethanethiol	CH3SH	1.25E-02	3.00E-01	110

Table 15: Criteria pollutant emissions from the diesel-fired trommel screen

Criteria Emissions					
Pollutant	Emission Factor (g/BHP-Hr)	Max (lb/hr)	Max Daily (lb/24-hr)	Annual (lb/year)	Annual (tpy)
NO_x Emissions	3.33	0.37	1.50	78	0.04
CO Emissions	3.70	0.42	1.66	87	0.04
PM_{10} Emissions	0.022	0.002	0.01	0.5	2.57E-04
$PM_{2.5}$ Emissions	0.022	0.002	0.01	0.5	2.57E-04
SO_x Emissions	0.0009	0.0001	0.00	0.02	1.09E-05
VOC Emissions	0.18	0.020	0.08	4	0.002

Table 16: HAP, TAP and organic compound emissions from the diesel-fired trommel screen

HAP Emissions				
Pollutant	**lb/MMBTU**	**lb/hr**	**lb/24-hr**	**lb/yr**
Benzene	9.33E-04	5.15E-04	2.06E-03	1.07E-01
Toluene	4.09E-04	2.26E-04	9.03E-04	4.70E-02
Xylenes	2.85E-04	1.57E-04	6.29E-04	3.27E-02
Formaldehyde	1.18E-03	6.51E-04	2.61E-03	1.35E-01
Acetaldehyde	7.67E-04	4.23E-04	1.69E-03	8.81E-02
Acrolein	9.25E-05	5.11E-05	2.04E-04	1.06E-02
Naphthalene	8.48E-05	4.68E-05	1.87E-04	9.74E-03
Total HAPS			8.28E-03	4.31E-01
Other Toxic Emissions				
Nitrogen dioxide		3.74E-01	1.50E+00	7.78E+01
Carbon monoxide		4.16E-01	1.66E+00	8.65E+01
Diesel Engine Exhaust, Particulate		2.47E-03	9.89E-03	5.14E-01
Sulfur Dioxide		1.05E-04	4.21E-04	2.19E-02
Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Polycyclic Aromatic Hydrocarbons				
Propylene	2.85E-04	1.57E-04	6.29E-04	3.27E-02
Acenaphthylene	5.06E-06	2.79E-06	1.12E-05	5.81E-04
Acenaphthene	1.42E-06	7.84E-07	3.14E-06	1.63E-04
Fluorene	2.92E-05	1.61E-05	6.45E-05	3.35E-03
Phenanthrene	2.94E-05	1.62E-05	6.49E-05	3.38E-03
Anthracene	1.87E-06	1.03E-06	4.13E-06	2.15E-04
Fluoranthene	7.61E-06	4.20E-06	1.68E-05	8.74E-04
Pyrene	4.78E-06	2.64E-06	1.06E-05	5.49E-04
Benz[a]anthracene	1.68E-06	9.27E-07	3.71E-06	1.93E-04
Chrysene	3.53E-07	1.95E-07	7.79E-07	4.05E-05
Benzo[b]fluoranthene	9.91E-08	5.47E-08	2.19E-07	1.14E-05
Benzo[k]fluoranthene	1.55E-07	8.56E-08	3.42E-07	1.78E-05
Benzo[a]pyrene	1.88E-07	1.04E-07	4.15E-07	2.16E-05
Indeno[1,2,3-cd]pyrene	3.75E-07	2.07E-07	8.28E-07	4.31E-05
Dibenz[a,h]anthracene	5.83E-07	3.22E-07	1.29E-06	6.69E-05
Benzo(g,h,l)perylene	4.89E-07	2.70E-07	1.08E-06	5.61E-05

Notes:
1. HAP and see Tier 4 Resources from AP-42, Section 3.3, Table 3.3-2.
2. N/A means that the Toxic is not a Washington State identified Toxic as according to WAC 173-460-150 (https://app.leg.wa.gov/wac/default.aspx?cite=173-460-150)
3. Yes means that the emissions exceeds the SQER limit and therefore modeling is required. Therefore, "No" means the SQER limit is not exceed and modeling is not required.

Table 17: GHG emissions from the diesel-fired trommel screen

GHG Emissions					
Source Name	**CO_2 Emissions (tpy)**	**CH_4 Emissions (tpy)**		**N_2O Emissions (tpy)**	**CO_2^e Emissions (tpy)**
Diesel Emergency Generator	9.36	3.80E-04		7.59E-05	9.39

Diesel Fuel Emission Factors				Source
CO_2	73.96	kg/MMBtu		40 CFR 98.33 Table C-1
CH_4	3.00E-03	kg/MMBtu		40 CFR 98.33 Table C-2
N_2O	6.00E-04	kg/MMBtu		40 CFR 98.33 Table C-2
Default HHV	0.1380	MMBtu/gal		40 CFR 98.33 Table C-1
Conversion	1.1023	ton/tonne		
	0.0010	tonne/kg		

Global Warming Potentials		Source
GWP CO_2 =	1	40 CFR 98 Subpart A, Table A-1
GWP CH_4 =	25	41 CFR 98 Subpart A, Table A-1
GWP N_2O =	298	42 CFR 98 Subpart A, Table A-1

Table 18: Greenhouse Gas emissions from the active and curing ASPs

Description	Annual Throughput		Emission Factor[1] (Kg/wet Kg)			Emissions (Kg/year)			Emissions (lb/year)			
	wet tons per year	wet Kg per year	CO_2	N_2O	Methane	CO_2	N_2O	Methane	CO_2	N_2O	Methane	CO_2eq
Facility-Wide Emissions	780	707,616	0.44	0.004	0.0003	343	3	0.2	756.76	6.88	0.52	2820

Table 19: Particulate matter emissions from handling operations

Operation	Drop Points (no.)	Emissions (lbs PM10/wet ton)	
Material receiving, storage, mixing	4	0.0013	
ASP and curing	2	0.0007	
Finished compost storage and loadout	1	0.0003	
Facility Total	7	0.0023	
Total PM10 per year		3.12	lbs/yr
		0.002	tons/year

Embedded below is a spreadsheet showing all emissions calculations.

NOC12082_Emissions.xlsx

H. AMBIENT IMPACT ANALYSIS

Ambient Air Quality Standards

Establishment of the equipment associated with this project must comply with current National ambient air quality standards (NAAQS) and Washington State ambient air quality standards (WAAQS). As a surrogate means to assess impact from the project, the maximum predicted criteria pollutant emissions attributable to all the equipment are compared with the significance levels from WAC 173-400-810(27). For this permitting action, the analysis indicates that maximum predicted emissions are below the significance levels.

Table 20: NAAQS and WAAQS analysis

Pollutant	Emission Rate Threshold	Project Impact After BACT
Carbon monoxide	100 tons per year	0.04
Nitrogen oxides	40 tons per year	0.04
Sulfur dioxide	40 tons per year	1.09E-05
Ozone	40 tons per year of volatile organic compounds or nitrogen oxides	N/A
Lead	0.6 tons per year	N/A
PM-10	15 tons per year	0.002
PM-2.5	10 tons per year of direct PM-2.5 emissions	2.57E-04

Washington State Air Toxics Rule

To confirm compliance with Chapter 173-460 WAC (Washington Air Toxics Rule) and PSCAA Regulation 3, Section 2.07, the following is presented:

1. As required in WAC 173-460-060 and summarized in Section G of this worksheet, tBACT (best available control technology for toxics) will be used to control TAP emissions from this project.
2. As required in WAC 173-460-050 and summarized in Section H, TAP PTE after considering tBACT were quantified for this project.
3. Demonstration that the increase in emissions of TAP from the establishment of the equipment associated with this project is sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects. For this permitting case, the increases of emissions of TAPs are summarized in Table 21. As required in WAC 173-460-070, the following was confirmed:
    a. The calculated PTE emission rate for each TAP is less than the small quantity emission rate (SQER). The SQER is described in WAC 173-460-020(7) as a threshold below which emissions are sufficiently low to ensure compliance without modeling.
    b. For any TAP with an emission rate greater than the SQER, the predicted fence line concentrations of the TAP are less than the acceptable source impact level (ASIL).

Table 21: TAP emissions increases from the active and curing ASPs and diesel-fired trommel screen

Toxic Air Pollutant (TAP)	lbs/hr	lbs/24-hr	lbs/year	SQER Averaging Period	ASIL	SQER
1,1,2-Trichloroethane	3.15E-05	7.57E-04	2.76E-01	lb/year	0.063	10
1,4-Dichlorobenzene	8.63E-06	2.07E-04	7.56E-02	lb/year	0.091	15
2-Butoxyethanol	8.63E-06	2.07E-04	7.56E-02	lb/24-hr	82	6.1
2-Ethoxyethanol	8.63E-06	2.07E-04	7.56E-02	lb/24-hr	70	5.2
Acetaldehyde	4.81E-04	3.07E-03	5.92E-01	lb/year	0.37	60
Acrolein	5.11E-05	2.04E-04	1.06E-02	lb/24-hr	0.35	0.026
Allyl chloride	6.90E-05	1.66E-03	6.04E-01	lb/year	0.17	27
Ammonia	1.38E-01	3.32E+00	1.21E+03	lb/24-hr	500	37
Benz[a]anthracene	9.27E-07	3.71E-06	1.93E-04	lb/year	0.0055	0.89
Benzene	6.37E-04	4.98E-03	1.17E+00	lb/year	0.13	21
Benzo[a]pyrene	1.04E-07	4.15E-07	2.16E-05	lb/year	0.001	0.16
Benzo[b]fluoranthene	5.47E-08	2.19E-07	1.14E-05	lb/year	0.0055	0.89
Benzo[k]fluoranthene	8.56E-08	3.42E-07	1.78E-05	lb/year	0.0055	0.89
Carbon Disulfide	2.62E-04	6.28E-03	2.29E+00	lb/24-hr	800	59
Carbon monoxide	4.16E-01	1.66E+00	8.65E+01	lb/1-hr	23000	43
Carbon tetrachloride	3.39E-04	8.13E-03	2.97E+00	lb/year	0.17	27
Chlorobenzene	1.09E-03	2.61E-02	9.52E+00	lb/24-hr	1000	74
Chloroform	6.31E-05	1.51E-03	5.53E-01	lb/year	0.043	7.1
Chrysene	1.95E-07	7.79E-07	4.05E-05	lb/year	0.055	8.9

Continuation - Table 21: TAP emissions increases from the active and curing ASPs and diesel-fired trommel screen

Toxic Air Pollutant (TAP)	lbs/hr	lbs/24-hr	lbs/year	SQER Averaging Period	ASIL	SQER
Cyclohexane	3.82E-04	9.17E-03	3.35E+00	lb/24-hr	6000	440
Dibenz[a,h]anthracene	3.22E-07	1.29E-06	6.69E-05	lb/year	0.0005	0.082
Diesel Engine Exhaust, Particulate	2.47E-03	9.89E-03	5.14E-01	lb/year	0.0033	0.54
Ethylbenzene	1.99E-04	4.77E-03	1.74E+00	lb/year	0.4	65
Formaldehyde	6.67E-04	2.97E-03	2.69E-01	lb/year	0.17	27
Hexachlorobutadiene	4.67E-06	1.12E-04	4.09E-02	lb/year	0.045	7.4
Hexane	1.52E-05	3.65E-04	1.33E-01	lb/24-hr	700	52
Hydrogen sulfide	1.32E-03	3.17E-02	1.20E+01	lb/24-hr	2	0.15
Indeno[1,2,3-cd]pyrene	2.07E-07	8.28E-07	4.31E-05	lb/year	0.0055	0.89
Methyl Alcohol	1.79E-04	4.29E-03	1.57E+00	lb/24-hr	20000	1500
Methyl Chloride	1.87E-05	4.49E-04	1.64E-01	lb/24-hr	90	6.7
Methyl ethyl ketone	1.75E-02	4.21E-01	1.54E+02	lb/24-hr	5000	370
Methyl isobutyl ketone	3.74E-04	8.97E-03	3.28E+00	lb/24-hr	3000	220
Methylene chloride	6.09E-03	1.46E-01	5.33E+01	lb/year	60	9800
Naphthalene	9.82E-05	1.42E-03	4.60E-01	lb/year	0.029	4.8
Nitrogen dioxide	3.74E-01	1.50E+00	7.78E+01	lb/1-hr	470	0.87
Phenol	3.39E-05	8.13E-04	2.97E-01	lb/24-hr	200	15
Propylene	1.57E-04	6.29E-04	3.27E-02	lb/24-hr	3000	220
Styrene	2.22E-04	5.33E-03	1.94E+00	lb/24-hr	870	65
Sulfur Dioxide	1.05E-04	4.21E-04	2.19E-02	lb/1-hr	660	1.2
Tetrachloroethylene	1.58E-05	3.80E-04	1.39E-01	lb/year	0.16	27
Toluene	1.31E-03	2.70E-02	9.57E+00	lb/24-hr	5000	370
Trichloroethylene	7.52E-06	1.81E-04	6.59E-02	lb/year	0.21	34
Triethylamine	1.05E-02	2.52E-01	9.21E+01	lb/24-hr	200	15
Xylenes	2.41E-04	2.65E-03	7.70E-01	lb/24-hr	220	16

Washington State Air Toxics Rule Results

The emissions increases of all TAPs from this project are below their respective SQER. A refined dispersion modeling analysis was not necessary to demonstrate compliance with the rule.

I. AIR OPERATING & PSD PERMITTING

Pursuant to Article 7 of the Agency's Regulation I, major stationary sources are required to operate in compliance with an Air Operating Permit (AOP). Major stationary sources are those stationary sources with a potential to emit greater than: 100 tons per year of any criteria pollutant, 10 tons per year of any hazardous air pollutants (HAP), or 25 tons per year of any combination of HAP. This source is a natural minor and not AOP source.

A PSD permit is not required since King County's South WWTP (including proposed composting operation) potential to emit is minor with respect to the State's PSD program in WAC 173-400-141 and the increase in emissions from this permitting action is below PSD thresholds.

J. APPLICABLE REGULATIONS

1. PUGET SOUND CLEAN AIR AGENCY REGULATIONS

SECTION 5.05 (c): The owner or operator of a registered source shall develop and implement an operation and maintenance plan to ensure continuous compliance with Regulations I, II, and III. A copy of the plan shall be filed with the Control Officer upon request. The plan shall reflect good industrial practice and shall include, but not be limited to, the following:
(1) Periodic inspection of all equipment and control equipment;
(2) Monitoring and recording of equipment and control equipment performance;
(3) Prompt repair of any defective equipment or control equipment;
(4) Procedures for startup, shut down, and normal operation;
(5) The control measures to be employed to ensure compliance with Section 9.15 of this regulation; and
(6) A record of all actions required by the plan.
The plan shall be reviewed by the source owner or operator at least annually and updated to reflect any changes in good industrial practice.

SECTION 6.09: Within 30 days of completion of the installation or modification of a stationary source subject to the provisions of Article 6 of this regulation, the owner or operator or applicant shall file a Notice of Completion with the Agency. Each Notice of Completion shall be submitted on a form provided by the Agency, and shall specify the date upon which operation of the stationary source has commenced or will commence.

SECTION 9.03: (a) It shall be unlawful for any person to cause or allow the emission of any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour, which is:
(1) Darker in shade than that designated as No. 1 (20% density) on the Ringelmann Chart, as published by the United States Bureau of Mines; or
(2) Of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in Section 9.03(a)(1).
(b) The density or opacity of an air contaminant shall be measured at the point of its emission, except when the point of emission cannot be readily observed, it may be measured at an observable point of the plume nearest the point of emission.
(c) This section shall not apply when the presence of uncombined water is the only reason for the failure of the emission to meet the requirements of this section.

SECTION 9.09: General Particulate Matter (PM) Standard. It shall be unlawful for any person to cause or allow the emission of particulate matter in excess of the following concentrations:
Equipment Used in a Manufacturing Process: 0.05 gr/dscf

SECTION 9.11: It shall be unlawful for any person to cause or allow the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

SECTION 9.13: It shall be unlawful for any person to cause or allow the installation or use of any device or use of any means designed to mask the emission of an air contaminant which causes detriment to health, safety or welfare of any person.

SECTION 9.15: It shall be unlawful for any person to cause or allow visible emissions of fugitive dust unless reasonable precautions are employed to minimize the emissions. Reasonable precautions include, but are not limited to, the following:
(1) The use of control equipment, enclosures, and wet (or chemical) suppression techniques, as practical, and curtailment during high winds;
(2) Surfacing roadways and parking areas with asphalt, concrete, or gravel;
(3) Treating temporary, low-traffic areas (e.g., construction sites) with water or chemical stabilizers, reducing vehicle speeds, constructing pavement or rip rap exit aprons, and cleaning vehicle undercarriages before they exit to prevent the track-out of mud or dirt onto paved public roadways; or
(4) Covering or wetting truck loads or allowing adequate freeboard to prevent the escape of dust-bearing materials.

REGULATION I, SECTION 9.20(a): It shall be unlawful for any person to cause or allow the operation of any features, machines or devices constituting parts of or called for by plans, specifications, or other information submitted pursuant to Article 6 of Regulation I unless such features, machines or devices are maintained in good working order.

2. WASHINGTON STATE ADMINISTRATIVE CODE

WAC 173-400-040(3): Fallout. No person shall cause or allow the emission of particulate matter from any source to be deposited beyond the property under direct control of the owner or operator of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited.

WAC 173-400-040(4): Fugitive emissions. The owner or operator of any emissions unit engaging in materials handling, construction, demolition or other operation which is a source of fugitive emission:

(a) If located in an attainment area and not impacting any nonattainment area, shall take reasonable precautions to prevent the release of air contaminants from the operation.

WAC173-400-111(7): Construction limitations.
(a) Approval to construct or modify a stationary source becomes invalid if construction is not commenced within eighteen months after receipt of the approval, if construction is discontinued for a period of eighteen months or more, or if construction is not completed within a reasonable

time. The permitting authority may extend the eighteen-month period upon a satisfactory showing by the permittee that an extension is justified.

3. FEDERAL

Compression Ignition ICE NSPS – Title 40 CFR Part 60, Subpart IIII

The Compression Ignition ICE NSPS applies to certain manufacturers, owners, and operators of stationary compression ignition (CI) ICE. For owners and operators of engines that are not fire pump engines, the rule applies to stationary CI ICE that commenced construction (defined as the date the engine is ordered by the owner or operator) after July 11, 2005 and that were manufactured after April 1, 2006.

Applicable – The internal combustion engine powering the trommel screen is a stationary seasonal source; therefore, it meets the definition for a stationary internal combustion engine as defined per Title 40 CFR Part 60, Section 60.4216.

Reciprocating ICE (RICE) MACT Standard – Subpart ZZZZ

The RICE MACT standard establishes national emission and operating limitations, testing, recordkeeping, and reporting requirements for existing, new and reconstructed stationary RICE. The affected source includes RICE with a site rating less, equal or greater than 500 hp located at major and area sources of HAP emissions.

Applicable – The internal combustion engine powering the trommel screen is considered a seasonal stationary as defined per Title 40 CFR Section 1068.30, because the compost screening operations will remain at a single location on a permanent basis and will operate at that single location approximately three months (or more) per calendar year. Per 40 CFR 63.6590(c)(1), a new stationary RICE located at an area source of HAP complies with Subpart ZZZZ by complying with NSPS Subpart IIII.

K. PUBLIC NOTICE

The Agency has determined that there would be significant public interest in this project; therefore, the project meets the criteria for mandatory public notice under WAC 173-400-171(3)(n).

A 30-day public comment period was held from MONTH DAY, 2022 through MONTH DAY, 2022. Notices that the draft materials were open to comment were published in the Renton Reporter and the Daily Journal of Commerce on MONTH DAY, 2021. The Agency posted the application, the draft worksheet, and the draft Order of Approval and DNS on the Agency's website during the comment period. Discuss comments received.

L. RECOMMENDED APPROVAL CONDITIONS

Standard Conditions:

1. Approval is hereby granted as provided in Article 6 of Regulation I of the Puget Sound Clean Air Agency to the applicant to install or establish the equipment, device or process described hereon at the installation address in accordance with the plans and specifications on file in the Engineering Division of the Puget Sound Clean Air Agency.

2. This approval does not relieve the applicant or owner of any requirement of any other governmental agency.

Facility-Wide Requirements:

3. King County is only allowed to compost Class B biosolids generated by King County WWTP facilities. Any other feedstock shall not be allowed to be composted onsite. A feedstock is an organic material that undergoes decomposition with the aid of bulking material. King County shall only use bulking material with C:N ratios greater than 50 and woodchips for bulking material originating from trees, brush, branches, grass, logging residues, stumps, and clean untreated wood waste. Delivery of bulking material may be in the form of woodchips, or as trees, brush, branches, logging residues, stumps or clean untreated wood waste ready to be processed in the grinder. The County will conduct C:N ratio testing of bulking materials once per month during the period of May-October. Any batch of bulking material with a C:N ratio less than 50 will either not be used or will be modified to raise the ratio above 50.
    a. Sampling of feedstock materials shall be conducted according to TMECC 02.01 FIELD SAMPLING OF COMPOST MATERIALS.
    b. For each sample, determination of nitrogen content shall be determined using AOAC 990.03.
    c. For each sample, determination of carbon content shall be determined using AOAC 972.43.
    d. Feedstock material may be sampled either before or after delivery to the site.
    e. For each sample, records shall be maintained that show who collected the sample, the method of sampling, and the date/time of the sample, the test results for each sample taken at the facility. For analysis provided from a vendor maintain the record supplied by the vendor indicating the results and sampling method.
    f. For each batch of compost record the recipe followed and the load identification for each component (feedstock or bulking agent) and document how the C:N ratio was determined.

4. No more than 780 tons of Loop biosolids shall be composted onsite during any 12-consecutive-month period.

5. King County shall implement all the necessary odor control measures to sufficiently prevent odors from the composting operations. Odor associated with the composting operations shall not exceed

Level 0 (as defined in Agency Regulation I, Section 9.11(b)(1)) is allowed at or beyond King County's property line.

6. King County shall implement dust control measures to control dust emissions from all activities related to the composting operation to a reasonable minimum. Visible emissions in excess of 5% opacity in aggregate above the height of working equipment for more than three (3) minutes in any one hour as determined by The Washington Department of Ecology Method 9 A are prohibited.
7. King County shall develop an Operations and Maintenance (O&M) Plan consistent with the requirements of Regulation I, Section 5.05(c). The plan must address procedures for determining when the active composting and curing aerated static piles (ASPs), biolayers and biofilters are operating properly and the corrective actions that will be taken when they are not.
8. King County shall inspect the entire composting operation area for visible emissions of fugitive dust at least once per calendar week that composting occurs. The inspection must include an evaluation of whether dust control equipment (e.g., water suppression system(s) or water truck) is being used and operated in good working order. If visible emissions are observed, the owner or operator shall investigate the cause and take immediate corrective action to minimize emissions. King County shall record the date, time, and results of each inspection. If visible fugitive dust emissions were observed during any inspection, the owner or operator shall record the cause and what precautions were taken to minimize emissions.
9. King County shall conduct an inspection of its entire composting operation area at least once per calendar month and monitor along the WWTP's property line for detectable composting odors. If odors greater than level 0 (as defined by Agency Regulation I, Section 9.11(b)(1)) from the composting operations are detected at or outside the property line during the monitoring or at any other time, King County shall take immediate corrective action to eliminate the odors. The monthly inspection shall also include a visual inspection of each ASP, and each biofilter to evaluate whether these activities are being maintained and operated in good working order. The owner or operator shall record the date, time, and results of each inspection, including any corrective actions taken to eliminate odors or maintenance performed on the biofilter.

Composting Feedstock, Bulking Material and Mixing Requirements:

10. All incoming feedstock and bulking material shall be inspected to determine if unacceptable materials are present. Unacceptable materials will be re-loaded and/or transported off King County's premises by the feedstock or bulking material hauler.
11. For each load of feedstock and bulking material received, King County shall record the following information:
    a) Feedstock or bulking material type.
    b) Weight of load.
    c) Results from inspection of the load.
    d) Date and time of receipt of the load.
    e) Name(s) of employee(s) who performed the inspection.
    f) Trackable identification of the load.

12. All feedstock for composting shall be mixed with bulking material and placed in an aerated static pile the same day it is delivered.. All feedstock mixed with bulking material must be placed in an aerated static pile (ASP) within 12 hours of feedstock delivery. With the exception of bulking material or finished compost, no other material may be stored onsite without being placed into an ASP for active composting or curing.
13. To demonstrate compliance with Condition No. 12, King County must record the date and time feedstock is mixed with bulking material and placed in an ASP for active composting. The record must reference to identified load(s) of feedstock that comply with Condition Nos. 10 and 11.
14. King County shall calculate and record the total weight of feedstock received for composting on a monthly and 12-month rolling basis.

Active Composting and Curing Requirements:

15. Each ASP for active composting and curing must be built with a 6 to 12-inch biolayer. The biolayer must uniformly cover the entire surface area of the ASP exposed to ambient air and must be placed on top of each ASP immediately upon building the ASP. The biolayer must be built of finished compost and/or bulking material, or material used to build the biofilter.
16. To demonstrate compliance with Condition No. 15, King County must calculate and record the initial total height of each built biolayer. All data used in verifying compliance with this limit must be retained.
17. Bunker wall height for the ASPs shall not exceed six feet. Built ASPs for active composting (including biolayer) shall not exceed the height of the bunker walls. King County shall calculate and record the initial total height of each bunker wall built for active composting. All data used in verifying compliance with this limit must be retained.
18. Bunker wall height for the ASPs for curing shall not exceed six feet. Built ASPs for curing (including biolayer) must not exceed the height of the bunker walls. King County shall calculate and record the initial total height of each bunker wall built for curing. All data used in verifying compliance with this limit must be retained.
19. Starting from the moment each ASP for composting is built, each ASP for active composting shall operate within the following operational limits at all times:
    (a) The moisture content throughout the entire ASP shall be maintained above 40%.
    (b) The temperature throughout the entire ASP shall be maintained below 76.6°C (170°F), based on an hourly average.
    (c) After day 3 of composting, the average pH of the ASP shall be maintained above 6.0.
    (d) The concentration of oxygen dissolved in water throughout the entire ASP shall be maintained at or above 2 ppm, based on an hourly average. The concentration of oxygen dissolved in water is determined by both the ASP's temperature and oxygen levels.
20. To demonstrate compliance with Condition No. 19(a), the average moisture content of each ASP for active composting shall be measured and recorded upon construction of the pile and upon transition to curing as measured by squeeze test. Records shall be kept of squeeze test result. If squeeze fails to show expected moisture then a sample shall be taken and an oven test performed to document moisture percentage. Multiple measurements shall be made to obtain a value representative of the entire ASP.

21. To demonstrate compliance with Condition No. 19(b), the average temperature of each ASP for active composting shall be monitored and recorded sufficient to demonstrate compliance with WAC 173-308-170(3)(b). The components of the temperature monitoring system shall be calibrated and maintained in accordance with manufacturer instructions and operating manuals.
22. To demonstrate compliance with Condition No. 19(c), for each mix type the average pH level of each ASP for active composting shall be measured and recorded for the first five batches of a specific mix and then annually so long as the mix isn't changed.
23. To demonstrate compliance with Condition No. 19(d), the average oxygen level of each ASP for active composting shall be measured and recorded at least once each calendar week. Multiple measurements shall be made to obtain a value representative of the entire ASP. The concentration of oxygen dissolved in water must be calculated using the measured average oxygen level coupled with the average temperature of the ASP.
24. During negative aeration of the ASPs built for active composting and curing, all extracted air from the ASPs must vent to the biofilter.
25. The floor aeration systems of all the active composting bunkers and curing zones must be inspected and cleaned every four (4) calendar months. Each inspection must be conducted no less than 90 calendar days, and no more than 135 days, since the last inspection. Copies of the written inspection reports shall be retained for compliance demonstration. Each report must contain the date and time of the inspection and the criteria King County used to determine system integrity.

Biofilter and Biolayers Requirements:

26. The cumulative removal efficiency of the biofilter and biolayers must at all times achieve a minimum removal efficiency of 80 percent for volatile organic compounds and hydrogen sulfide.
27. The cumulative removal efficiency of the biofilter and biolayers must at all times achieve a minimum removal efficiency of 53 percent for ammonia.
28. The biofilter's media bed must have a depth of at least 3 feet and must be composed of clean, freshly shredded root/stump wood or trunk wood with up to 2 percent degradable organic material.
29. The biofilter and biolayers shall be operated within the following operational limits at all times:
    (a) The moisture content in the biofilter shall be maintained between 35% and 75% throughout the bed.
    (b) The temperature in the biofilter shall be maintained between 15^{o}C and 40^{o}C throughout the bed.
    (c) The pH level in the biofilter shall be maintained between 6.0 and 9.5 throughout the bed.

30. The biofilter shall be operated within the following operational limits at all times:
    (a) Maximum pressure drop across the biofilter bed must not exceed 0.8" w.c. per foot of depth.
    (b) The biofilter must meet a minimum operating bed residence time of 60 seconds.
    (c) Pressure drop across the biofilter shall be monitored according to the County's Biofilter Monitoring Plan. Per that Plan, an air pressure sensor will be included in the duct leading to the biofilter, monitored in realtime (with at least one reading per hour), that will notifty the

operator through the system operating software when an increase in back pressure is above 75% of the limit of the fan and needs to be addressed.

31. The biofilter and biolayers must be evaluated every six (6) calendar months. Each evaluation must be conducted no less than 150 calendar days, and no more than 210 calendar days, since the last evaluation. A copy of final valuation reports shall be submitted to the Agency no later than 30 days after the evaluation date.

32. Evaluation of the biofilter must determine the operational condition and integrity of the entire biofilter. At a minimum, the biofilter semiannual evaluation must meet the following:
    (a) Testing must occur during the negative aeration of at least three (3) active composting ASPs and three (3) curing ASPs (zones).
    (b) Testing of the media to ensure that the bed of the biofilter is adequately biodegrading the emissions from the active composting and curing ASPs. Testing of the media must test for the following parameters: moisture content, pH and temperature. Tests methods shall be specified in the facility Operations Plan. A biofilter evaluation plan with detailed sampling protocols to PSCAA shall be submitted to the Agency with the notification required per Regulation I, Section 3.07(b).
    (c) An assessment showing that the biofilter adequately drains to ensure that the bed isn't becoming waterlogged during precipitation events. Acceptable metrics shall be determined by King County or the manufacturer/designer of the biofilter. The evaluation must identify deviations from the acceptable metrics.
    (d) The evaluation must identify corrective actions needed to correct deviations identified in the primary biofilter evaluation.

33. The first biofilter evaluation must be conducted within 180 days from the first day of operating the biofilter. The date of the biofilter's first day of operation must be recorded in the first evaluation.

34. King County must submit a biofilter evaluation plans with detailed sampling protocols to PSCAA 45 days prior to the first evaluations. After the first evaluations, if the plan is revised in any manner, the revised plans must be submitted to PSCAA 21 days prior to the subsequent evaluation. The evaluation plan(s) shall include:
    (a) A diagram showing the sampling locations within the biofilter. The diagram must show the final depth of each sample core or location or measurement. Depth is measured from the top of the biofilter.
    (b) A description and diagram of the equipment that will be deployed to collect the core samples.
    (c) The procedures that will be used to collect the core samples.
    (d) A description of each test method that will be used to measure and analyze moisture contents, pH levels and temperature.
    (e) The procedures that will be used to calculate the operating bed residence time of the biofilter. This must include procedures for collecting any necessary data for the calculation.
    (f) The procedures that will be used to measure or calculate the pressure drops per foot of depth of the biofilter. This must include procedures for collecting and analyzing any necessary data for the calculation.
    (g) The procedures that will be used to determine adequate drainage of the biofilter and a description of the method of analysis and calculations.

35. King County must correct all deviations identified in biofilter evaluations prior to initiating any subsequent evaluations.

Emissions Performance Requirements:

36. Emissions must not exceed 0.36 pounds of **non-methane organic compounds** per ton of feedstock introduced for composting averaged over the entire composting cycle.
37. Emissions must not exceed 1.55 pounds of **ammonia** per ton of feedstock introduced for composting averaged over the entire composting cycle.
38. Emissions testing of the biofilter and ASPs with biolayers must demonstrate compliance with Condition Nos. 36 and 37. The inlet and the outlet of the biofilter shall be tested for VOCs, ammonia and odors.
    (a) Initial emissions testing must be conducted within 365 days from initially operating the biofilter. Initial compliance must be conducted in accordance with Section 3.07 of Puget Sound Clean Air Agency (PSCAA) and the test plan submitted to PSCAA as required by Condition No. 41.
    (b) Ongoing emissions testing must be conducted every sixty (60) months. Ongoing emissions testing begins from the first date of initial emissions testing. Ongoing compliance must be conducted in accordance with Section 3.07 of PSCAA Regulation I and the test plan submitted to PSCAA as required by Condition No. 41.
39. King County must conduct sampling and analysis of the sampling data per the following:
    (a) Sampling of the biofilter must occur during the negative aeration of at least one active composting ASP and one curing ASP.
    (b) Sampling of the ASPs must occur during the positive aeration of at least one active composting ASP and one curing ASP.
    (c) The total amount of material in each of the active composting bunkers and curing zones must be calculated and recorded each of day of sampling. Amounts must be recorded in tons or cubic yards. Initial construction date of each ASP shall also be recorded.

40. King County shall have emissions tested for compliance with removal efficiency requirements in Condition Nos. 26 and 27. The testing shall be performed in accordance with the following:
    (a) To demonstrate biofilter removal efficiency:
        (1) The concentrations of non-methane organic compounds and ammonia shall be measured as close to the inlet of the header to the biofilter while maintaining good sampling technique to obtain a representative sample.
        (2) Non-methane organic compounds and ammonia concentrations shall be measured at the surface of the biofilter. Sampling can be performed using colorimetric tubes, handheld vapor analyzers, evacuated canisters, or other methods approved by the Agency. The resulting measurements must be representative of the concentrations being emitted by the biofilter. Sample locations shall be distributed to provide measurements that are representative of the removal efficiency of the entirety of the biofilter. The location and method of the sampling must be in the test plan required by Condition 41.
        (3) Sampling at the inlet of the biofilter shall be conducted within four hours of the sampling at the subsurface of the biofilter.

(4) The average concentrations of non-methane organic compounds and ammonia at the biofilter's inlet (uncontrolled) and surface (controlled) shall be used to determine the cumulative removal efficiencies.

(b) To demonstrate biolayer removal efficiency:

(1) The concentrations of non-methane organic compounds, ammonia and hydrogen sulfide, shall be measured at the subsurface of at least one biolayer (2 inches to 4 inches). Sampling can be performed using colorimetric tubes, handheld vapor analyzers, evacuated canisters, or other methods approved by the Agency. The resulting measurements must be representative of the concentrations being emitted by the biofilter. Sample locations shall be distributed to provide measurements that are representative of the removal efficiency of the entirety of the biofilter. The location and method of the sampling must be in the test plan required by Condition 41.

(2) Sampling at the biolayer shall be conducted within four hours of sampling the corresponding ASP.

(3) The average concentrations of non-methane organic compounds and ammonia at the biolayer's surface (controlled) and ASP (uncontrolled) shall be used to determine the cumulative removal efficiencies.

(c) The cumulative efficiency per pollutant is calculated using the following formula:

1 – ((controlled biolayers average pollutant concentrations + controlled biofilter average pollutant concentration) / (uncontrolled biolayers average pollutant concentrations + uncontrolled biofilter average pollutant concentration))

(d) The total amount of material in each of the active composting bunkers and curing zones must be calculated and recorded each day of sampling. Amounts must be recorded in tons or cubic yards. Initial construction date of each ASP shall also be recorded.

41. At least 60 days prior to each emissions performance test, King County must submit a test plan. The test plan must address the following:

(a) A diagram showing the sampling locations of the biofilter and biolayer(s). The diagram must also show the final depth of each sample. Depth is measured from the top of the biofilter bed or biolayer.

(b) A description and diagram of the equipment that will be deployed to collect all samples.

(c) Procedures to collect all samples.

(d) Description of all the analytical methods and how they will be used to determine concentrations.

(e) Isoflux dynamic-chamber monitoring of times, sweep flow rates, inside and outside air temperatures, exit flow rates and residence times.

(f) Procedures to monitor the amount of material in active composting bunker and curing zone.

42. A testing notification must be submitted to the PSCAA in accordance with Section 3.07 of Regulation I, at least twenty-one (21) days before any emissions test required by this Order of Approval is conducted.

Complaints:

43. King County shall establish a complaint response program for complaints received regarding air quality, including but not limited to odors and/or fugitive dust, as part of an O&M Plan. The program shall include a complaint phone line, criteria and methods for establishing whether the King County composting operation may be the source of the air emissions related to the complaint, and a format for communicating results of investigation and advising complainants of King County's corrective actions.
    (a) The owner or operator shall record and investigate complaints received regarding air quality as soon as possible, but no later than one working day after receipt.
    (b) King County shall correct any problems identified by these complaint investigations within 24 hours of identification or cease operation of the equipment until the problem is resolved;
    (c) Records of all complaints received regarding air quality issues shall include information regarding date and time of complaint; name and address of complainant (if known); nature of the complaint; investigation efforts completed and basis for conclusion reached; and date, time, and nature of any corrective action taken.

Diesel-Fired Trommel Screen Requirements:

44. The 51 hp diesel-fired trommel screen shall not exceed 208 hours per year based on a 12-month rolling average. Records showing the screen's operation shall be used to demonstrate compliance with the operational limitation.

Recordkeeping:

45. All records of observations and supporting documentation required by this Order of Approval shall be completed contemporaneously and no later than the end of each day. Each inspection and observation required on a routine basis by this Order shall be completed for each operational day for the site. An operational day is defined as any day that feedstock, actively composting material, or finished compost is located onsite.

46. The owner or operator shall maintain records required by this Order of Approval for two years and make them available to Puget Sound Clean Air Agency personnel upon request.

M. CORRESPONDENCE AND SUPPORTING DOCUMENTS

Spreadsheet with applicant comments and Agency Responses.

3.LoopCompost_PSCAA_ResponseWorksh

Background Ecology Permit

14AQ-C191.pdf

N. REVIEWS

Reviews	Name	Date
Engineer:	Brian Renninger	
Inspector:	Nina Lawonn	
Second Review:	John Dawson	5/20/2021 2/16/2022
Applicant Name:	Christopher Dew	