Notice of Construction (NOC) Worksheet

PUGET SOUND
Clean Air Agency

Applicant: City of Edmonds Wastewater Treatment Plant	**NOC Number**: 12135
Project Location: 200 2nd Ave S, Edmonds WA 98020	**Registration Number**: 14063
Applicant Name and Phone: Pamela Randolph	**NAICS:** 22130 Sewage Treatment Facilities
Engineer: Madeline McFerran/Ralph Munoz	**Inspector**: Melissa McAfee

A. DESCRIPTION

For the Order of Approval:
Sewage sludge gasification and syngas oxidation system. Sludge rotary drum dryer. Exhaust from gasification/oxidation and sludge dryer controlled by product separator cyclone, venturi scrubber, granulated activated carbon adsorption. Dry sludge handling bins, conveyors, hoppers controlled by one baghouse.

Additional Information (if needed):

Facility

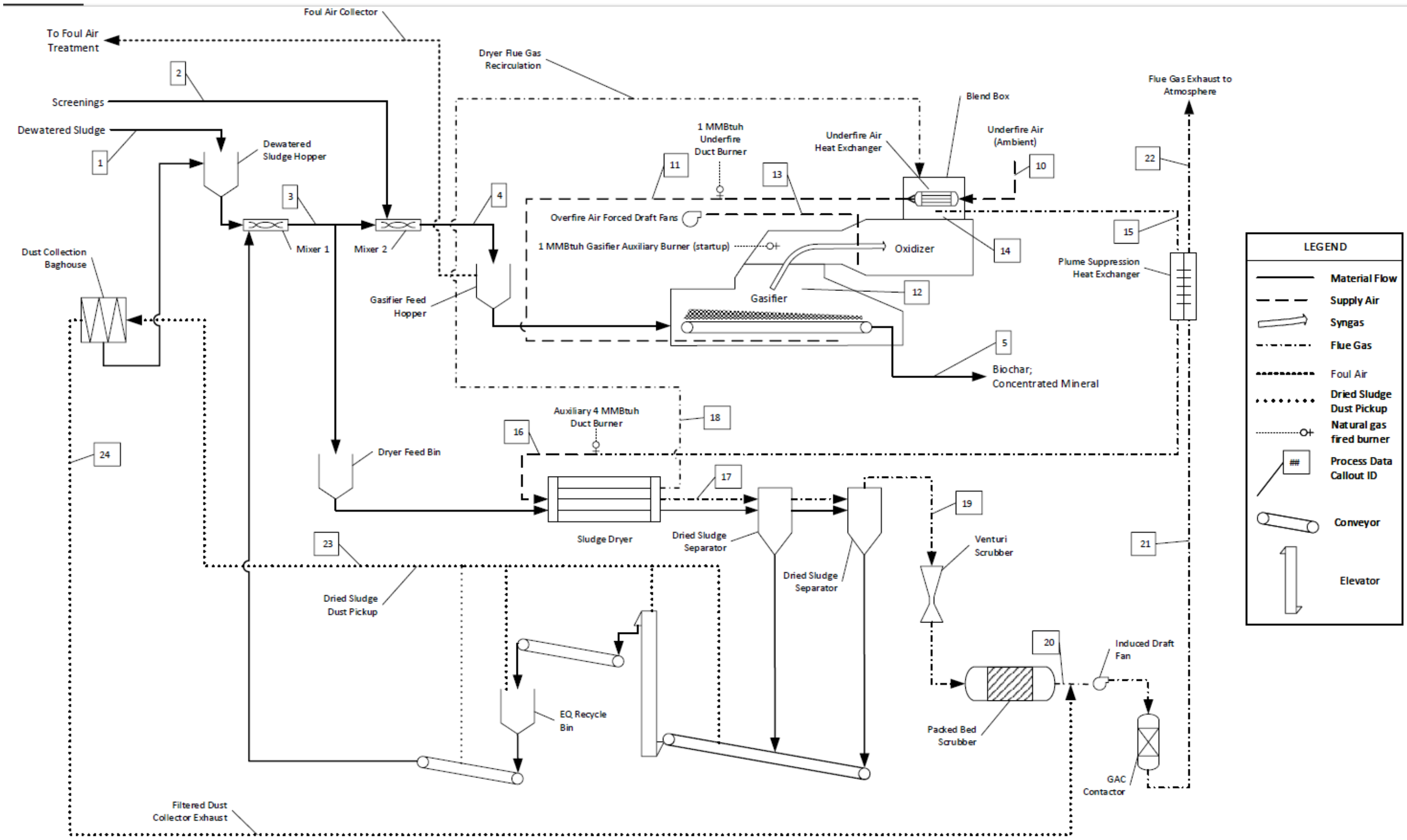
City of Edmonds Wastewater Treatment Plant is a primary and secondary treatment municipal wastewater treatment plant. Primary treatment consists of removal of suspended solids through mechanical settling, and secondary treatment utilizes activated sludge to oxidize carbonaceous waste. This Notice of Construction application reviews a proposed change to the waste sludge treatment: replacement of sewage sludge incineration with sewage sludge gasification and oxidation of the syngas produced by the gasification.

Proposed Equipment/Activities

The project is for replacement of the existing sewage sludge incinerator at the facility with a gasifier/oxidizer system to produce syngas and residual product. The sewage sludge incinerator was decommissioned July 1, 2021 as noted in the facility's semiannual 40 CFR 60 Subpart O report.

Gasification is a phased carbon conversion process conducted in an oxygen starved environment to convert solid organic materials into volatile gases and ash residuals. The proposed unit may be operated to produce residuals with variable carbon content; the applicant specifies that biochar is one end of the operating spectrum with highest carbon content and concentrated mineral (CM) is the other end of the operating spectrum with lowest carbon content. Production of CM generates more heat than production of biochar. The syngas produced by gasification is combusted in the oxidizer portion of the chamber and the resulting heated exhaust is used to dry sludge in a rotary drum dryer.

The proposed project flow diagram was supplied with the permit application:



A written summary of the project flow for the gasification/oxidizer system is described below:

Material Flow (dewatered sludge, concentrated mineral product, biochar, screenings)

Upstream of the portion of this facility under review for NOC 12135, the wastewater treatment plant generates primary sludge, which is the sludge that settles to the bottom of the primary clarifiers, and waste activated sludge (WAS), which is excess sludge produced by the activated sludge secondary treatment process. Activated sludge tanks contain microorganisms that consume carbonaceous waste and produce more sludge as the organisms grow and multiply. Primary sludge and WAS are commingled and then dewatered.

The activities that are part of this project will occur after the sludge is dewatered. The dewatered sludge will enter a sludge hopper and will be pumped to a mixer which will combine the dewatered sludge with solids collected from the dryer. The dewatered sludge mixture will then be split and routed as follows:

A) About 80% of the sludge mixture will go to the rotary drum dryer where flue gas from the gasifier/oxidizer unit will heat and dry the sludge. After the sludge is dried, the sludge will pass through a product separator where the dried product will be separated from the flue gas. A high efficiency cyclone will remove coarse PM particles from the flue gas stream. The dried sludge captured in the product separator and the cyclone will be returned to the sludge mixer to be mixed with the dewatered sludge.

B) About 20% of the sludge mixture will be routed to a mixer where screenings may be added to the dewatered sludge material. Screenings are coarse materials removed by the bar screens at the plant headworks, e.g. rags, rope, cardboard, and paper and wipes which are dewatered and ground for disposal. When the system is producing biochar the screenings will not be added and will be disposed off-site. When the system is producing CM the screenings will be added. The mixture will then be conveyed to the gasifier feedbin and into the gasifier unit to be converted into syngas and end product. The gasifier will operate between 1200°F - 1600°F in a reducing environment. The biochar or CM produced will pumped out of the gasifier unit and then conveyed to a dumpster for solid waste collection.

Exhaust Flow (foul air, syngas, dust/particulate from dry sludge handling)

Foul Air

The initial sludge handling will include emission points for foul air (the sludge itself will be a source of emissions). Potential emission points for volatile organic compounds (VOCs) and odor will include:

- The dewatered sludge hopper.
- Mixer 1 (where dewatered sludge and dried sludge will be mixed).
- Conveyor 005 which will split the mixture between the Dryer Feed bin or Mixer 2 (where the sludge mixture can be blended with screenings).
- The screenings conveyor in the gasifier room
- The Dryer Feed Bin.
- Mixer 2

These emission points will each be routed to the plant odor control system under review under NOC 12123.

Syngas

Syngas will be produced in the gasifier portion of the gasifier/oxidizer (1200°F – 1600°F reducing environment in the gasifier portion of the process unit) and then be oxidized in the oxidizer by adding ambient air to the syngas which will result in the spontaneous combustion of the syngas at temperatures of 2000°F-2300°F to produce process heat. The oxidized syngas will then flow to a blend box, where flue gas from the sludge dryer will be blended with the oxidized syngas. The blend box will also include a heat exchanger to preheat the gasifier underfire air supply.

The blend box is last stage in the oxidation process, and the blend box exhaust will be the process flue gas. After leaving the blend box, the flue gas will pass through a stack gas vapor plume suppression heat exchanger, which will heat stack gas above dewpoint to mitigate formation of a visible vapor plume when the stack gas is released into the atmosphere. The flue gas will then flow to the drum dryer, where the flue gas will provide direct heat for sludge drying.

A portion of the exhaust from the dryer will be returned to the blend box. The remainder of the dryer exhaust will be conveyed through the product separator and cyclone. The exhaust gas will then be treated by a Venturi scrubber to remove particulate, then a packed bed scrubber to remove acid gases, and then an activated carbon contactor to treat exhaust organics and mercury vapor. (See discussion in Section F). After this treatment train, the exhaust will pass through the vapor plume suppression heat exchanger (where heat from the blend box exhaust will be recovered and transferred to the exhaust stack gas). The flue gas leaving the heat exchanger will then be emitted into ambient air through a stack 20 foot high (measured above building grade) and 1.67 foot diameter.

<u>Dry Sludge Handling Dust</u>

Following the sludge dryer, the dried sludge will be transferred to dried sludge separators and the dry material will be transferred by two conveyors to an EQ Recycle Bin. The dried sludge will be recirculated back into mixer 1 where the dried sludge will be mixed with dewatered sludge to condition the dried sludge prior to gasification. The dried sludge dust pickup system will convey dust to an induced draft 3,000 cfm pulse jet dust collector with air to cloth ratio of 5.19:1.

System capacity (pasted from page 15 of application):

> The system is sized to process 14,500 wet tons per year of dewatered biosolids cake averaging 20% solid content, equivalent to 2,875 Dry TPY, and process 840 wet tons per year of screenings averaging 50% solid content, equivalent to 420 Dry TPY. The screenings provide a portion of fuel for the gasifier and are completely separated from the biosolids. The project will be installed within the confines of the existing incinerator building.

The gasifier technology is described as "quiescent fluidized bed" technology, P100EM1Q PDF describes in Table 1 two kinds of fluidized beds, both are high in particulate and are "bubbling" and "recirculating." Bubbling removes ash after the fluidized bed via cyclone and recirculating returns the ash to the fluidized bed. The process flow diagram for the application indicates that the residual product (biochar or CM) will not be recirculated. The manufacturer shows their process as what they call "fluid lift" where the feedstock itself is the fluidized bed rather than a separate medium as with conventional fluidized beds and may be closest approximated by the bubbling fluidized bed technology in P100EM1Q. The "fluid lift" is also similar to a traveling grate system supplied with underfire air. The system uses plenums to vary the flow rate, fluid type, temperature and pressure to dry, pyrolyze and gasify the feedstock. Given that there is not an additional medium added and the absence of full fluidization reduces interparticle contact and abrasion in the gasifier, particulate emissions are expected to be overall lower than for bubbling fluidized beds.

Permit History

The facility's wastewater treatment plant (clarifiers, activated sludge and chlorine contact chambers) and fluidized bed sludge incinerator have been permitted since 1989 with four revisions made for changes to the controls on the incinerator and the sludge basins as detailed below. This NOC proposal would replace the sewage sludge incineration at the facility with gasification and production of biochar and mineral product. The permitting history for the facility is outlined below:

NOC 3097 issued 10/9/1989 (superseded by NOC 6466) for one fluidized bed sludge incinerator with a 2,600 cfm venturi/impingement tray scrubber and solids handling odor control using a packed tower scrubber at 20,000 cfm, 3 activated sludge diffused air aeration basins with 12,000 cfm air filter, two secondary clarifiers and chlorine contact chambers.

NOC 6466 issued 7/3/1996 (superseded by NOC 8959) modification of NOC 3097 to remove a requirement that the incinerator and its control system meet article 12 of regulation I.

NOC 8959 issued 6/10/2004 (superseded by NOC 11115) modification to remove pleated filters on activated sludge aeration basins.

NOC 11115 issued 4/11/2016 (superseded by NOC 11212) addition of four module fixed mercury sorption unit to the existing scrubber serving the sludge incinerator

NOC 11212 issued 7/26/2016 administrative update to NOC 11115, this NOC will be cancelled and superseded by NOC 12135.

NOC 12123 issued 12/17/2021 for replacement of the Foul Air (FA) control system: replace an existing 2-stage FA packed bed scrubber with a biotrickling filter odor control system. The application for NOC 12135 details 500 acfm air flow from the dewatered sludge hopper, Mixer 1, Conveyor 005, the dryer feed bin, Mixer 2, Screener 601 being routed to the Foul Air System. NOC 12123 describes a 20,000 cfm biofilter (the previous 2 stage biofilter covered under NOC 11115 also was for 20,000 cfm). From NOC 12123: "Existing equipment that feeds dewatered sludge and ground screenings to the SSI will be removed and replaced with new equipment to feed dewatered sludge to the gasifier and sludge dryer units in the CRP. This will require replacement of the existing FA collection system facilities associated with dewatered sludge handling".

As part of the permitting process and determination that 40 CFR 60 Subpart LLLL is not applicable to the project, the applicant made the following process modifications for supplemental natural gas firing during start-up and shutdown.

- A 1 MMBtu/h burner that provides supplemental heat to the gasifier during cold start-up has been relocated to the underfire air supply duct upstream of the gasifier.
- A 4 MMBtu/h NG finish burner has been added to the flue gas stream upstream of the sludge dryer. This burner will operate once during initial system charge and thereafter only to burn-off residual syngas in the system during shutdown.

All NG burners are less than 10 MMBtuh capacity, and accordingly are exempt from permit to construct review per PSCAA Regulation 1, Section 6.03(c). With these burners being used only during start-up and shutdown, the burners will not operate more than 50 hours per year. Once the system initial charge is complete, the finish burner will operate only during shutdown; the finish burner will not operate at the same time as the 1 MMBtu/h burners supporting start-up of the gasifier and oxidizer.

B. DATABASE INFORMATION

Reg: 14063 - Edmonds, City of, Wastewater Treatment Plant
Item #: 6
Code: 39 - miscellaneous
Year Installed:
Units Installed: 1
Rated Capacity: 768
Units: Lb/Hr
Primary Fuel: 7 - Other Fuel
Standby Fuel:
NC/Notification #: 12135
NOC Not Required? ☐
(b)(10) Exemption? ☐
Removed? ☐
Operating Requirements:
Comments: Ecoremedy gasification and oxidation unit for sewage sludge, gasifier (model ECR-542) generates syngas from sewage sludge which is then oxidized in oxidizer

Reg: 14063 - Edmonds, City of, Wastewater Treatment Plant
Item #: 7
Code: 22 - dryer (moisture removal only)
Year Installed:
Units Installed: 1
Rated Capacity: 7200
Units: Lb/Hr
Primary Fuel: 7 - Other Fuel
Standby Fuel:
NC/Notification #: 12135
NOC Not Required? ☐
(b)(10) Exemption? ☐
Removed? ☐
Operating Requirements:
Comments: sewage sludge direct rotary drum dryer utilizing syngas to dry sludge, 72,000 lb/hr at 65% solids input and 5,2000 lb/hr output at 90% solids, inlet temp 600-900 F, outlet temp 190-210 F 6,000 ACFM flow

Reg: 14063 - Edmonds, City of, Wastewater Treatment Plant
Item #: 11
Code: 75 - Single cyclone
Year Installed:
Units Installed: 1
Rated Capacity: 6557
Units: Acfm
Rated Exhaust Flowrate: 6557 CFM
NC/Notification #: 12135
NOC Not Required? ☐
Removed? ☐
Operating Requirements:
Comments:

Reg: 14063 - Edmonds, City of, Wastewater Treatment Plant
Item #: 12
Code: 53 - Venturi scrubber
Year Installed:
Units Installed: 1
Rated Capacity: 4557
Units: Acfm
Rated Exhaust Flowrate: 4557 CFM
NC/Notification #: 12135
NOC Not Required? ☐
Removed? ☐
Operating Requirements:
Comments: 99% particle removal of 5 micron and above particulate

Reg: 14063 - Edmonds, City of, Wastewater Treatment Plant
Item #: 13
Code: 141 - Wet scrubber
Year Installed:
Units Installed: 1
Rated Capacity: 3350
Units: Acfm
Rated Exhaust Flowrate: 3350 CFM
NC/Notification #:
NOC Not Required? ☐
Removed? ☐
Operating Requirements:
Comments: packed bed scrubber, NaOH and NaOCl scrubber estimated 95% SO2 and H2S removal efficiency

Reg: 14063 - Edmonds, City of, Wastewater Treatment Plant Item #: 14
Code: 48 - Activated carbon adsorption
Year Installed: Units Installed: 1 Rated Capacity: 450 Units: Cu Ft
Rated Exhaust Flowrate: 6350 CFM
NC/Notification #: 12135 ☐ NOC Not Required?
Removed? ☐
Operating Requirements:
Comments: carbon adsorber bed

New NSPS due to this NOCOA?	**No**	**Applicable NSPS: NA**	**Delegated? NA**
New NESHAP due to this NOCOA?	**No**	**Applicable NESHAP: NA**	**Delegated? NA**
New Synthetic Minor due to this NOCOA?	**No**		

Prior to this permitting action, the City of Edmonds Wastewater Treatment Plant has been subject to 40 CFR 60 Subpart O, 40 CFR 61 Subpart C and 40 CFR 61 Subpart E.

See federal rule applicability discussion in the “Federal Rule” section of this worksheet.

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	
Refuse burning equipment ≤12 ton/day (control equipment included)	$5,000	
Equipment: rotary drum dryer, sludge handling particulate control	$1,200	
Refined dispersion modeling review	$1,000	
NSPS or NESHAP Review (40 CFR 60 Subparts O, 40 CFR 61 E)	$2,000	
Public Notice*	$700	
Filing received		$ 1,150 (4/15/2021)
Additional fee received		$9,900 (to be invoiced)
Total		**$12,050**

*Publication fees to be invoiced following public comment period

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

This source was previously subject to PSCAA Regulation I Article 7, as the previous SSI was subject to 40 CFR 60 Subpart O. This new sludge treatment system is not subject to federal regulations affecting Title V applicability; the source is no longer a Title V source. The previous fees are listed below:

Invoice for Year 2021 Operating Permit Fees

Bill To:
Edmonds, City of, Wastewater Treatment Plant **200 2nd Ave S** **Edmonds, WA 98020** **Attention: Accounts Payable**

Invoice Date:	Invoice #:
November 20, 2020	20210026
Due Date:	**Terms:**
January 04, 2021	Net 45 Days
Facility ID (Permit #):	
14063	

Site Address: ***Edmonds, City of, Wastewater Treatment Plant***
200 2nd Ave S, Edmonds, WA 98020

The annual operating permit fee is required by Washington State law and Puget Sound Clean Air Agency's Regulation I.
Your fees are based on your NAICS code and your actual emissions during 2019.

Facility Fees and Applicable Regulations	Charges
Facility Fee for Operating Permit Sources. Reg I, 7.07(b)(1)(iii) NAICS 221320 -- Sewage Treatment Facilities	**$ 28,600.00**
Fee Totals	
Operating Permit Fee (After February 18, 2021, the fee is $35,100.00). *The Total Fee is due by January 04, 2021. If unpaid after February 18, 2021, an additional delinquent fee of $6,500.00 will be applied. The delinquent fee is equal to 25% of the Operating Permit Fee, not to exceed $6,500 (Reg I, 7.07(b)).*	**$ 28,600.00**
WA State Department of Ecology surcharge, Reg I, 7.07(d) *For further information regarding the WDOE surcharge, please call 1-360-407-7530.*	**$ 652.15**
TOTAL FEE	**$ 29,252.15**

Fees moving forward are summarized below:

Applicability		
Regulation I	Description	Note
5.03(a)(1)(B)	Source subject to federal emission standard under 40 CFR 61	40 CFR 61 Subpart E
5.03(a)(8)(L)	Sewage treatment with odor control	Biofilter system for odor control at wastewater treatment plant
5.03(a)(5)(A),(D)	Sources with gas/odor control equipment >200 cfm	Carbon adsorption, biofilter
5.03(a)(6)(A),(K)	Sources with particulate control equipment >200 cfm	Venturi scrubber, dust collector
Annual Registration Fee		
Regulation I	Description	Fee
5.07(c)	General registration fee	$1,150
5.07(c)(1)	Sources subject to federal emission standard	$2,100
	Total =	$3,250

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.

The City of Edmonds is the SEPA lead agency for this project and issued the associated DNS on March 15, 2019. A copy of this DNS is included in the NOC file. This NOC is being issued after the date that the DNS became final.

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.

The Agency identified that this NOC application meets one of the criteria in the Agency's Interim Tribal Consultation Policy, adopted by the Board on November 21, 2019. Criterion 5 of Resolution 1410 includes projects that modify an existing sewage treatment plant with odor control equipment to replace the primary production equipment for the existing sewage treatment plant. The gasifier/oxidizer and drum dryer under review for this NOC are replacing the sewage sludge incinerator. The gasifier/oxidizer produces syngas for drying of sludge and biochar and CM. The primary production equipment producing activated sludge (the activated sludge reactor units) are not being modified under this review. This application meets Criterion 5 because the gasifier/oxidizer unit produces syngas used for the gasification process and sludge drying as well as ash residuals which would constitute part of the plant's primary production equipment.

In accordance with the policy, the Agency notified each Tribe within the Agency's jurisdiction on May 17, 2021 of the intent to hold a consultation.

Based on no response, the Agency notified each tribe that the Agency would be proceeding with the final steps to issue the conditional approval of this Notice of Construction application.

F. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) REVIEW

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."

Best Available Control Technology for Toxics (tBACT)

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."

The system controls are designed as follows: (1) combustion controls for the oxidizer (2) auxiliary 4 MMBtuh duct burner (3) venturi scrubber for exhaust stream particulate removal (4) caustic packed bed scrubber for acid gas/inorganic gas removal (5) granulated activated carbon contactor for removal of residual metals, trace toxics (dioxins, furans, PAHs, PCBs). The dried sludge handling system controls proposed consist of a dust collector.

The equipment under review as well as the associated emissions subject to BACT and tBACT review are summarized below. The final column summarizes the applicant's proposed controls for BACT.

Emission Unit	Associated Emissions	Proposed Control(s)
Gasifier and Oxidizer 6mmBtu/hr (combusting syngas)	NOx	Excess air control, upper temperature of 2300°F to minimize thermal NOx
	CO	Combustion controls
	PM	No discussion, design proposed utilizes cyclone and dust collector then venturi scrubber
	SO2	No discussion, design proposed utilizes packed bed scrubber acid gas removal
	VOC	No discussion, design proposed utilizes oxidizer Activated carbon for residuals
	HAP: arsenic, cadmium, mercury vapors	No discussion, design proposed utilizes activated carbon
	TAP: arsenic, cadmium, mercury vapors, PAHs, PCBs, dioxins furans,	No discussion, design proposed utilizes Oxidizer 2300°F combustion
Natural gas duct burners 2mmBtu/hr	NOx	Applicant proposes that the natural gas combustion in the duct burner is below thresholds for permitting i.e. not subject to BACT
Sludge dryer (about 200°F)	PM (including metallic HAP as particulate)	No discussion, design proposed utilizes cyclone and dust collector then venturi scrubber for PM, exhaust gas stream from dryer is the same as the exhaust gas stream from the oxidizer
	VOC	No discussion, design proposed utilizes Packed bed scrubber for acid gases, Activated Carbon adsorption for TAP and mercury removal
Sludge handling system	PM	No discussion, design proposed utilizes Dust collector with grain loading of 0.01 gr/dscf

Similar Permits

PSCAA has not permitted any sewage sludge gasification or pyrolysis projects prior to this review for NOC 12135. PSCAA has reviewed some projects utilizing acid gas control and metal controls. The PSCAA projects with some carryover to the pollutants under review are tabulated below:

NOC (date issued)	Description	Pollutant	BACT/tBACT
11075 (3/9/16)	Replacement venturi scrubber w/ mercury sorption module at existing WWTP SSI	Mercury, PM	(RACT) venturi scrubber with mercury modules (additional requirements of 40 CFR 60 Subpart MMMM monitoring)
11579	Replacement of chemical wet scrubber	Sulfur-containing emissions, NMOC	(RACT) packed bed caustic scrubber with 98% NMOC reduction

	at waste sorting and recycling facility		(or outlet 10 ppmv @ 3% O2, H_2S removal 99.7% or ≤1.0 ppmv H_2S at outlet

PSCAA has permitted dry material handling similar to the sludge handling system in several cases:

NOC (date issued)	Description	Pollutant	BACT/tBACT
11838 (2/13/2020)	Virgin abrasive blast media handling	PM & silica	0.002 gr/dscf, achieved with MERV 15 filtration
11650 (5/6/2020)	Lime dust collection system	PM	0.002 gr/dscf grain loading limit
11801 (2019)	Cocoa bean winnowing controlled by baghouse	PM	0.003 gr/dscf grain loading limit No visible emissions nor fallout from baghouse
11606 (2018)	Starch silo controlled by bin vent	PM	0.003 gr/dscf grain loading limit No visible emissions nor fallout from baghouse

<u>Other Regulatory Agencies BACT</u>

The applicant identified two operational facilities in the country utilizing similar technologies: (1) the Silicon Valley Clean Water Plant (permitted by BAAQMD Application No. 27704) and (2) an Ecoremedy location in Morrisville PA which was reviewed by PADEP.

Both facilities can provide information about what control devices have been achieved in practice for similar sources though neither facility was subject to BACT review (neither project triggered BACT thresholds for the state/local agencies reviewing the projects).

Three projects involving gasification of sewage sludge are also under review by New Jersey Department of Environmental Protection (one of the three projects under review, Aries Linden, has been permitted once already and the open review is for a modification to increase throughput). As there is an issued Aries Linden permit, that project is included along with the Silicon Valley Clean Water Plant and the Morrisville PA facility information below:

Project	Description	Limits, (Basis)	Summary of Technology to Achieve Limits, Conditions for Compliance
Silicon Valley Clean Water	Pyrolysis system processing 500	0.02 lb/hr POC (VOC) (cumulative increase)	Packed bed scrubber, activated carbon adsorption

Plant (BAAQMD)	lb/hr sludge, 2,000 ton annual sludge throughput	0.42 lb/hr CO (cumulative increase) 0.42 lb/hr NOx (cumulative increase) 0.02 lb/hr PM10 (cumulative increase) 0.02 lb/hr PM2.5 (cumulative increase) 0.11 lb/hr SO2 (cumulative increase) TAP/HAP emission limits post control device (air toxics requirements)	Measuring mercury from carbon beds to determine carbon change-out: monthly then once/3 months changeout required @ control efficiency below 90% and/or 0.0013 ppmv outlet mercury, limiting carbon bed temperature below 167°F, hourly parametric monitoring pH range (6-8) and temperature range (≤167°F) for removal of SO_2 materials, minimum flow for caustics in wet scrubber, hourly parametric monitoring Emission testing and associated operational limitations (one time testing)
Morrisville PA WWTP (PADEP)* (Determination issued 3/4/2021)	Wastewater gasification (~1100 lb/hr biosolids processed)	PADEP R&D limits: 20 TPY CO 10 TPY NOx 8 TPY SOx (SO2) 3 TPY PM10 8 TPY VOC 1 TPY single HAP 2.5 TPY total HAPs (basis for exemption)	Parameter monitoring once every 4 hours of: (1) fan amperage, (2) pressure drop across scrubber (3) temperatures at dropout box, dryer inlet, scrubber inlet, oxidizer (4) scrubber exhaust air flowrate (5) liquid flowrate to scrubber (6) scrubber liquid pH Parameter monitoring daily of: (1) total sludge processed (2) amount of sludge fed to gasifier Stack testing requirement for informational purposes
Aries Linden (NJDEP) (issued 10/16/2020, expires 2024)	Wastewater gasification and oxidation (gasifier capacity is 85 ton/day)	99.5% VOC removal efficiency (SOTA) 95% NOx removal (SOTA) 96% SO2 removal (SOTA) 99% total suspended particulate removal (SOTA)	Cyclone for large particulate and ash removal Tri-mer emission control system consisting of dry sorbent injection, ammonia injection and ceramic filter with embedded SCR catalyst unit to remove PM, spent sorbent and NOx Cyclone pressure drop monitoring on DAS continuously Oxidizer continuous monitoring of temperature (1500°F minimum)

		90% Cyclone particulate up to 5 micron removal	Tri-mer control system continuous monitoring of ammonia slip, pressure drop, lime injection rate, ammonia injection rate Initial stack testing (VOC, NOx, SO2, TSP)

*The Morrisville PA WWTP review indicated a "Plan Approval" was not required on 3/4/2021 but did require that the facility meet with PADEP after 1 year of operation to prepare a plan approval for the process.

The three current applications under review with NJDEP for similar processes to the Linden plant (one modification to increase production of the Linden plant, one new plant proposed for Newark, and one new plant proposed for Kearny, each by the same company) have a similarly designed fluidized bed gasification system and tri-mer emission control system. The NJEDP proposed projects are summarized below for informational purposes though the projects are still under review:

- Aries Linden New Jersey (application for increase in production from 430 ton/day to 450 ton/day)
    - Fluidized bed gasifier using quartz sand as inert bed material produces a syngas of typically 120-150 Btu/scf and solid biochar. Proposed monitoring parameters: bed temperature profile, average temperature at feed level, pressure drop across bed, gasifier outlet pressure, has capacity of 85 ton/day
    - Gasifier routed to thermal oxidizer (99.5% DRE for VOC) which would measure outlet exhaust gas VOC concentration, combustion chamber temperature, CO2 concentration and CO concentration
    - Emissions controlled with cyclone to remove most large particulate and ash (90% DRE up to 5 micron particulate), Tri-mer Emissions Control System for NOx SOx and PM removal (95% NOx removal, 96% SOx removal, 99% DRE for PM)
    - CEMS for NOx, CO2, O2 and NH3 monitoring
    - Parameter monitoring (injection of ammonia and of sorbent, pressure drop)
    - One-time testing of NOx, SO2, PM, CO, CO2, also to include toxic metals arsenic, cadmium, HCl, nickel

- Aries Kearny (450 tons/day wet)
    - Same design as the Linden facility with the gasifier, thermal oxidizer and tri-mer emission control system for NOx, SO2 and PM removal

- Aries Newark New Jersey (proposed 430 tons/day wet)
    - Same design as the Linden facility with the gasifier, thermal oxidizer and tri-mer emission control system for NOx, SO2 and PM removal

As discussed in Section B, 40 CFR 60 Subparts O and LLLL do not apply to this facility as the gasification unit does not meet the definition of a sewage sludge incinerator. While Subparts O and LLLL do not apply, the initial feedstock of sludge is common between an SSI unit and the proposed gasification system, and many of the same pollutants are anticipated from combustion of sewage sludge directly, as in an incinerator as the combustion of syngas. Due to the differing technology, the emissions from these two processes will likely have different emission factors as a result. The limits, testing and monitoring requirements of Subparts O and LLLL fluidized bed SSI are broadly summarized below for informational purposes only, they do not apply to the facility:

Subpart	Limits	Method of Compliance
O	1.30 lb/ton dry sludge PM limit 20% opacity limit	EPA Method 5 testing EPA Method 9 testing (one-time) Parameter monitoring specific to control device employed
LLLL	9.6 mg/dscm @ 7% O_2 PM limit (applies at all times during operation)	Method 5 performance test (initial and annual) , reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less)
	0.24 ppmv @ 7% O_2 HCl limit (applies at all times during operation)	Method 26A performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less))
	27 ppmv @ 7% O_2 CO limit (applies at all times during operation)	CEMs meeting PS 4B
	0.013 ng/dscm @ 7% O_2 dioxin/furan limit (mass basis) or 0.0044 @ 7% O_2 ng/dscm (toxic equivalency basis) (applies at all times during operation)	Method 23 performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less)
	30 ppmv @ 7% O_2 NOx limit (applies at all times during operation)	Method 7 or 7E performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less))
	5.3 ppmv @ 7% O_2 SO_2 limit (applies at all times during operation)	Method 6 or 6C performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less))
	0.0011 mg/dscm @ 7% O_2 Cd limit (applies at all times during operation)	Method 29 performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less))
	0.0010 @ 7% O_2 mg/dscm mercury limit (applies at all times during operation)	Method 29 performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less))
	0.00062 mg/dscm @ 7% O_2 lead limit (applies at all times during operation)	Method 29 performance test (initial and annual, reduced frequency to once per 3 yrs if results of two consecutive tests are 75% of emission limit or less))

	Operational limits for combustion chamber temperature, control device specific parameter monitoring, sludge feed rate	Operating limits established during initial performance testing/most recent performance test*: minimum pressure drop for wet scrubbers, scrubber liquid flow rate, scrubber pH, minimum combustion chamber operating temperature

*Selected control devices similar to those proposed for this application are listed from LLLL; list not exhaustive.

Analysis

The Silicon Valley Clean Water Plant permit and the Morrisville PA WWTP plants share some similarities with the proposed project: relative size of the operation, system design and the control technologies employed. NJDEP's Aries Linden review includes a State of the Art (SOTA) analysis, which, of the analyses completed is closest to PSCAA BACT analysis. The Aries Linden project is at a larger scale than the proposed Edmonds project (more than nine times the throughput of Edmonds) and utilizes different control technologies.

The Agency originally looked at each piece of equipment within the facility, but later realized the entire system is closed with only one exit point at the end of the process. This will make it easier to test for pollutants at one single stack.

NOx BACT

The NOx controls proposed across each of the facilities are ranked from most to least stringent. The control devices employed for projects voluntarily are also included given that the controls are technically feasible.

1. 95% removal (use of SCR)
2. Operational limits (limited throughput to keep NOx emissions below certain thresholds)

The applicant described available technologies for NOx control including flue gas recirculation and catalytic conversion. The applicant specified "Flue gas recirculation reduces NOx formation by suppressing combustion temperature. However, sufficient oxidizer temperature is needed to provide effective destruction of toxic organics in the syngas during oxidation." PSCAA concurs that flue gas recirculation would potentially decrease NOx emissions at the expense of potentially higher toxic air emissions from less effective destruction efficiency.

The applicant specified that "catalytic NOx reduction is economically unfeasible for a project of this size" but did not include any data to support this assertion. The NJDEP Linden facility utilizes a system including sorbent injection and a ceramic filter system with an SCR catalyst. The NJDEP Linden facility has an 85 ton sludge processing/day capacity in the gasifier with pre-control NOx emissions of 87.6 lb/hr. Linden's production corresponds to uncontrolled PTE of >300 ton/yr operating 8760 hours per year. In comparison, the Edmonds WWTP gasifier has design daily capacity of 9 ton sludge processed/day and pre-control NOx emissions calculated at 0.26 lb/hr (on CM mode) or 0.42 lb/hr (on Biochar mode) with NOx PTE annually below 2 tons/year for both modes of operation. Assuming a similar control efficiency to Linden (95%) the emission reduction associated with SCR for this project is expected to be about 1.9 tons of NOx per year while also introducing the potential for ammonia emissions associated the ammonia injection utilized for SCR. In this case, while an economic analysis is not presented, the additional environmental considerations associated with NOx reduction (including ammonia slip) and the magnitude of emission reduction support that BACT will be best management practices.

The applicant does discuss setting a maximum oxidizer temperature of 2500°F with the intention of limiting thermal NOx formation. The actual operating maximum temperature was reported to be around 2300°F but with capabilities up to 2500°F. Equilibrium constants for the formation of nitrogen oxide ($N_2 + O_2 \leftrightarrow 2NO$) increase from 2.7×10^{-18} at 440°F to 7.5×10^{-9} at 1340°F further increasing to 1.1×10^{-5} at 2240°F[1] (formation of NO is favored increasingly with temperature). Equilibrium constants for the formation of nitrogen dioxide ($NO + \frac{1}{2}O_2 \leftrightarrow NO_2$) favor nitrogen oxide formation over nitrogen dioxide formation as temperature increases above 1340°F[1]. The proposed upper limit of operation (2500°F) allows for complete combustion while minimizing NO formation.

Initial testing of NOx will be required for verification of emission factors utilized during permitting. Parametric monitoring of the oxidizer temperature will be used to demonstrate compliance with the oxidizer temperature limits associated with NOx BACT.

CO BACT
Across the different pyrolysis/gasification units permitted, CO emission limits were not set based on SOTA or BACT. CO emission limits were set based on the applicant's specification of CO emissions in the NJDEP permit.

The applicant does not explicitly discuss CO emission controls in the BACT discussion for the oxidizer flue gas at Edmonds although CO is discussed along with NO_x in the applicant's discussion of oxidizer operating temperature. The oxidizer minimum temperature of 1800°F is expected to allow for complete combustion needed to limit CO formation.

CO emission testing will be required for initial testing and parametric monitoring of the oxidizer temperature will be used to demonstrate compliance with the oxidizer temperature limits associated with CO BACT.

VOC BACT
Across the three permitted gasification/pyrolysis units outlined above, VOC control is achieved consistently through efficient syngas combustion/oxidation, as is proposed with the Edmonds gasifier and oxidizer combined unit. In addition, the heat generated by the combustion of syngas in the proposed system is routed directly to the sludge rotary drum dryer. The NJDEP SOTA determination for VOC destruction efficiency was 99.5% control. The oxidizer for the proposed system does not include any manufacturer specifications for control efficiency.

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[1] Cooper, David C. and Alley, F.C. Air Pollution Control a Design Approach. 4th ed. Table 16.3 Equilibrium Constants for the Formation of NO and NO_2 (page 527).

For the Edmonds oxidizer, the applicant reported an operating range from 1800°F – 2500°F with a destruction efficiency of 99.5% or an alternate outlet concentration limit of 13.9 ppmvd @ 3% O_2 as methane will constitute BACT for both biochar and CM modes. The basis for the alternate limit is from available test data from pyrolysis and gasification units tabulated below:

Test, Location, Date	VOC emissions (as methane)	Process Info
Chicken Litter Gasification Unit, Morrisville PA, May 2011	7.5 ppmvd*, 0.0029 lb/hr Measured w/ EPA Method 25 Run 1: 7.0 Run 2: 8.1	Not provided
Pyrolysis Unit, Redwood City CA, October 2017	10 ppmvd @ 3% O_2 Measured w/ EPA Method 25A Run 1: 8 @ 3% O_2 Run 2: 9 @ 3% O_2 Run 3: 12 @ 3% O_2	219 lb/hr sludge processing

*Morrisville PA VOC test data did not include oxygen correction factor nor did the test data included specify the O_2 concentration during the May 2011 testing.

As the Morrisville PA VOC test data utilized Method 25 rather than Method 25A and did not include process info and oxygen correction, each of the three runs from the October 2017 Redwood City test were utilized to calculate a standard deviation and the alternate limit for VOC at the outlet consists of the average plus two standard deviations: 10.8 ppmvd @ 7% O_2. Annual testing to be conducted utilizing EPA Method 25A.

Additional VOC control is provided by the scrubber system (which will provide removal of soluble organics) and the GAC contactor.

SO_2 and Sulfur Compound BACT, HCl tBACT

The gasification of the sludge releases sulfur in multiple compounds which are combusted in the oxidizer to primarily SO_2 although residual sulfur compounds including: hydrogen sulfide, dimethyl disulfide, methyl mercaptan, dimethyl sulfide, carbon disulfide, and carbonyl disulfide could be present in the exhaust stream. As with the Silicon Valley Clean Water Plant and the Morrisville PA facility, a packed bed scrubber and GAC contactor is proposed for inorganic gas removal.

The emission limits and control efficiencies specified for SO_2 or sulfur compound removal in similar permits sometimes applied to different subcategories of sulfur containing compounds and were often in different formats. An estimated ranking from most to least stringent is listed below:

1. 99.7% H_2S removal (NOC 11579 RACT)
2. 96% SO_2 removal (NJDEP Linden SOTA)
3. 5.3 ppmv @ 7% O_2 (40 CFR 60 Subpart LLLL limit)
4. 0.11 lb/hr SO_2 (33 ppmv @ 3% O_2/ 25.6 ppmv @7% O_2) (BAAQMD production limit)
5. 8 TPY SO_2 (PADEP research exemption annual emission threshold)

The applicant does not discuss sulfur compound or SO_2 BACT in the application but proposes use of a wet scrubber utilizing bleach and caustic soda (with wastewater from the system reintroduced into the WWTP processing).

The NJDEP SOTA analysis for the Linden plant required a 96% removal of SO_2 with the tri-mer control system (includes dry sorbent injection) as compared to the applicant's proposed 95% removal of inorganic gas using the packed bed scrubber (95% SO_2 and H_2S removal based on maximum inlet concentrations of 50 ppmv H_2S and 4 lb/hr SO_2). The 99.7% H_2S RACT removal from NOC 11579 was primarily focused on odor control at a facility with exhaust gas stream consisting primarily of H_2S and is not considered a required removal efficiency as BACT for this project. The Silicon Valley Clean Water Plant packed bed scrubber is more similar in design and sizing to the proposed system at Edmonds although the SO_2 limit from BAAQMD was not set based on BACT but as a cumulative increase limit and the BAAQMD limit would not be appropriate for this project. Test results from the 2017 Silicon Valley Clean Water Plant results indicated that outlet SO_2 emissions were 1.3 ppm @ 3% O_2 (1.03 ppmv @7% O_2). For the proposed packed bed scrubber, the manufacturer's 95% control, maximum emissions at the outlet of the scrubber would be expected to be 0.2 lb/hr SO_2 (estimated to be about 10.8 ppm @ 7% O_2 based on the design flows specified in the application for the scrubber exhaust and an assumption of 3% O_2 in the exhaust downstream of the oxidizer and 4 MMBtu/hr exempt duct burner). At high loading 95% SO_2 control will constitute BACT, with an alternate limit of 5.3 ppmv @ 7% O_2 based on the 40 CFR 60 Subpart LLLL limit for sulfur removal from sewage sludge incineration for low loading.

Compliance with the emission limits to be demonstrated through annual compliance testing using EPA method 6C. SO_2 removal efficiency will be utilized as a proxy for removal of all sulfur compounds.

The caustic scrubber is also anticipated to control hydrochloric acid that may form from the combustion of syngas halogens when combusted in the oxidizer. The manufacturer specifications do not address HCl control, but a limit from NSPS LLL was used as a BACT limit and required testing was placed into the permit.

PM BACT

The proposed system is anticipated to generate particulate during the gasification of the syngas with particulate carried in the exhaust stream through the oxidizer, with potential for generation of more particulate when the hot exhaust gas is used to directly heat sludge in the rotary drum dryer. The combined exhaust stream of the dryer and the gasifier/oxidizer is proposed to be controlled with a venturi scrubber. Particulate collected from the venturi scrubber will be routed to a dust collector.

Particulate controls and limits for similar gasification/pyrolysis systems have some variable formats and ranking is estimated from most to least stringent as follows, depending on inlet loading).

1. 99% TSP removal (NJ Linden SOTA)
2. 9.6 mg/dscm @ 7% O_2 (40 CFR 60 Subpart LLLL)
3. 0.02 lb/hr (BAAQMD production limit)
4. 3 tpy PM_{10} (PADEP research exemption threshold)
5. 1.3 lb/ton dry sludge (40 CFR 60 Subpart O)

6. 20% opacity (40 CFR 60 Subpart O)

For particulate, the Ecoremedy Morrisville facility processing chicken litter can provide an expectation of inlet loading for the proposed Edmonds facility. While the feedstock differs from the sludge under review for Edmonds, the design of the system where the feedstock is itself the transfer media for the fluidized bed is anticipated to be lower in particulate generation as compared to a traditional fluidized bed gasification system. The chicken litter facility is considered as the most representative particulate data for the proposed facility. The May 2011 Morrisville testing for PM found inlet particulate loading to be 1.95 lb/hr total (1,378 mg/dscm with unspecified dilution air). Anticipating similar inlet loading and the manufacturer's guaranteed 99% PM removal efficiency from the venturi scrubber would yield 13.78 mg/dscm at the anticipated O_2 dilution in the system.

The proposed system is closed between the oxidizer and the stack; no air is admitted to the system and all side streams (such as flue gas recirculation and dust pick-up streams) reconnect with the oxidizer flue gas. Thus, there is no oxygen dilution downstream of the oxidizer; and on a dry basis the oxygen content in the dryer exhaust is the same as the oxygen content in the flue gas from the oxidizer. The oxygen content of the oxidizer exhaust is proposed by the applicant to be about 13% on a dry basis, demonstrating that the oxidizer operates under significant lean-burn conditions. Note that the elevated levels of excess oxygen aid in providing complete combustion of the syngas.

The applicant proposes use of 99% PM removal efficiency from the venturi scrubber which is consistent with the 99% TSP removal found to the SOTA for NJ Linden. 99% PM removal will constitute BACT for PM generated from the dryer and the gasifier/oxidizer. An alternate limit for low loading of 9.6 mg/dscm @ 7% O_2 based on the limits of 40 CFR 60 Subpart LLLL for combustion of sewage sludge is also specified for BACT. Compliance with this limit will be using EPA method 5 instead of PSCAA method 5 since the 9.6 mg/dscm was taken from NSPS LLLL which calls for using EPA Method 5.

The sludge handling system (3,000 acfm) dust collector proposed would meet a grain loading of 0.01 gr/dscf which is higher than typically seen for material handling where there may be metallic TAP present. Similar permits issued for material handling for cement and spent abrasive blast media have been required to meet a grain loading of 0.002 gr/dscf and this grain loading is considered BACT in this case, to be demonstrated through manufacturer specifications or equivalent.

Metallic TAPs tBACT
The gasification of the sewage sludge is anticipated to occur at high enough temperature to volatilize some metals present in the sludge such that the syngas being combusted in the oxidizer may contain metals. Design temperature of exhaust from the oxidizer will typically range from 1,930°F-1,969°F (actual operating temperatures may be somewhat higher or lower) dropping to 180°F-230°F between the dryer and the and the venturi scrubber. The drop in temperature is anticipated to condense many of the metals present in the oxidized syngas for removal as particulate as discussed in the PM BACT section. As discussed in the application, during gasification, temperatures will exceed the sublimation or boiling points of arsenic, cadmium, and mercury, but once the exhaust air is routed to the venturi scrubber the exhaust temperature will be below the

boiling points of arsenic (1,135°F), cadmium (1,412°F) and mercury (675°F). Thus the metal vapors will condense and may be collected as particulate from the venturi scrubber. Conditions will be added to the permit that ensure proper abatement of metals based on inlet gas temperatures.

In addition to the particulate removal from the venturi discussed in the PM BACT section, the system also includes an activated carbon adsorption bed intended to capture additional compounds including metals which may not be controlled by the venturi and packed-bed scrubbers. Similar technologies are utilized at Silicon Valley Clean Water Plant where the carbon system is monitored for mercury break-through to achieve an outlet mercury concentration at or below 0.0013 ppmv. The Silicon Valley Clean Water Plant permit also limits carbon bed temperature to at or below 167°F.

40 CFR 60 Subpart LLLL imposes limits on and requires testing for certain metallic toxics: lead, mercury, and cadmium utilizing EPA Method 29. Given the similar feedstocks and expectation of metals present in the exhaust system, initial and ongoing metals testing will be required to show compliance with our local TAP regulations along with tBACT. Due to the nature of the emerging technology, an initial performance test will be required to determine the presence and amount of TAPs and other criteria pollutants.

Volatile TAPs tBACT

Among the volatile and organic toxics anticipated to be generated in the gasification process are dioxins and furans, PCBs and PAHs which are expected to thermally decompose in the oxidizer, with the carbon adsorption bed as a secondary control for volatile TAPs that are not destroyed in the oxidizer. Testing for VOC destruction efficiency using Method 25A does provide the ability to determine destruction efficiency of specific compounds; however doing a method 25A on the gasifier and associated afterburner would be difficult as it is part of an entire process and does not directly vent to the atmosphere. Given the toxicity of dioxins and furans, and the basis of ongoing testing of dioxins and furans at SSI combustion facilities per 40 CFR 60 Subpart LLLL, The permittee will be required to test for dioxins and furans as part of the original testing. The testing limits will be compared to emission factors used during original permitting to ensure they were accurate. tBACT for these pollutants will be the use of the carbon adsorption bed.

Recommendations

Due to the emerging technology of the gasifier, and the way the system is set up with multiple control devices being used before finally being emitted to the atmosphere, BACT and tBACT will be a summary of control devices and monitoring. The permittee will be required to conduct an initial performance test where the results will be used to set emission limitations for pollutants and compare the results to emission factors used during this permitting action. There will be some restrictions on the amount of TAPs that can be emitted which will have to be set prior to permit issuance to protect the toxics program (SQERs/ASILs/etc).

Summary tBACT determination

Pollutant	Available Method That Meets BACT	Implementation of Method
Mercury	Venturi scrubber and carbon adsorption bed Compliance with initial performance test limit	Mercury break-through monitoring of carbon adsorption bed, Testing per EPA Method 29 or Method 30B,
Lead and Cadmium	Venturi scrubber and carbon adsorption bed: Compliance with initial performance test limit	Testing per EPA Method 29,
Dioxins, Furans	Compliance with initial performance test limit in ng/dscm	Oxidizer and activated carbon, testing per EPA Method 23,
HCl	Compliance with initial performance test limit	Packed bed scrubber, testing per EPA Method 26A, initial and annual testing with reduced frequency if emissions at or below 75% of emission limit

Summary BACT determination

Pollutant	Available Method That Meets BACT	Implementation of Method
NO_x	Good combustion practices, oxidizer temperature not to exceed 2500°F Compliance with initial performance test limit	Parameter monitoring Method 7E
SO_2	Packed bed Scrubber Compliance with initial performance test limit	Method 6C Continuous monitoring of packed bed scrubber parameters
CO	Good combustion practices, minimum oxidizer temperature of 1800°F Compliance with initial performance test limit	Parameter monitoring Method 10
Total VOCs	Compliance with initial performance test limit	EPA Test Method 25 or 25A

Pollutant	Available Method That Meets BACT	Implementation of Method
		EPA Test Method 18 to quantify exempt compounds.
PM	Compliance with initial performance test limit	EPA Test Method 5, Method 26A or Method 29

G. EMISSION ESTIMATES

Proposed Project Emissions

Emission units associated with the project include the gasifier/oxidizer, the drum dryer, and materials handling of dried product.

Emissions from this project are based on a maximum dewatered sludge feed rate of 768 lb/hr as dry solids for biochar production, and a maximum sludge and screenings mixture feed rate when operating

in concentrated mineral mode of 864 lb/hr (screenings feed adding 96 lb/hr as dry solids to the dewatered sludge feed rate) (see page 8 of application 12135 for full project details).

The applicant supplied emission calculations that were analyzed and verified by the Agency during this review. Table 1 provides emissions calculations for the biochar production scenario. Table 2 provides similar information for the concentrated minerals operating mode. Information in these tables includes basic operating data, development of emission factors, and emissions calculations. The format of both tables is identical; the only differences are changes in operating rates associated with each mode.

Parameter	Value	Units	Comments/Basis
Sytem Operating Parameters			
dewatered sludge feed	768	lb dry solids/hr	
dewatered screenings feed	0	lb dry solids/hr	
Total dry solids feed	768	lb dry solids/hr	
dryer operating rate	3,197	lb dry solids/hr	
Gasifier exhaust			
temperature	1993	° F	
moisture content	10.3%	weight percent	
	16.4%	volume percent	
gasifier flue gas rate, actual	6,974	wacfm	
Flue gas rate, standard wet	1500	wscfm	
Flue gas rate, standard dry	1,254	dscfm	
West Scrubber exhaust			
temperature	114	°F	
flow rate, actual	2,552	acfm	
Flow rate, standard	2,347	wscfm	
Exhaust stack			
flow rate, actual	7,122	acfm	
Flow rate, standard	5,740	wscfm	
stack temp	195	°F	
moisture content			
Stack diameter	1.67	feet	assumed - sized to attain ~ 50 fps stack gas velocity at standard conditions
stack velocity	54	fps	
Combustion gases			
CO			
Concentration	93	ppmvw	after wet scrubber
	6.76	lb/MMwscf	
Emission Rate	0.95	lb/hr	
NOx concentration actual			
Concentration	25	ppmvw	after wet scrubber
	2.99	lb/MMscf	
Emission Rate	0.42	lb/hr	
NO2			
Emission Rate	0.21	lb/hr	In-stack NO2:NOx ratio = 0.5 (EPA default)
VOC			
Concentration – gasifier exhaust	7.42	ppmvd	NMTHC as methane

Parameter	Value	Units	Comments/Basis
Concentration - gasifier exhaust	0.31	lb/MMscf as methane	
VOC emission rate	0.03	lb/hr	.
Process Emissions			
PM/PM10/PM2.5			
Gasifier PM			Based on results of PM measurements from stack testing of similar gasification/oxidation unit using chicken litter. PM data normalized to gasifier output in dscfm. Assume all PM is PM2.5
chicken litter gasifier PM			
air flow during stack test	387	lb/hr	average for five runs across two feed conditions
PM emission rate	1.95	lb/hr	average for five runs across two feed conditions
	83.95	lb/MMdscf	
Gasifier PM - biochar mode			
gasifier PM, bichar mode	6.32	lb PM/hr	
Dryer PM			
Emission factor	5.8	lb PM10/ton dry solids	
Dryer sludge feed rate - BC	3197	lb dry solids/hr	Process Flow Diagram (G-7) 10 Feb 2021
Dryer PM	9.27	lb PM/hr	uncontrolled emissions
Gasifier + Dryer PM			
Uncontrolled PM emissions	15.59	lb PM/hr	
Control efficiency	99%		
PM emissions, gasifier + dryer	0.156	lb/hr	controlled emissions. Measured downstream of packed bed scrubber.
Dust System PM			
Air flow rate	3000	acfm	
Temperature	120	°F	
Baghouse performance	0.01	gr/dscf	controlled emissions.
PM emission dust system	0.23	lb/hr	
Total controlled PM emissions	0.39		
SO2			
Concentration	0.5	ppmvw	controlled emissions. Measured downstream of packed bed scrubber.
	0.08	lb/MMscf	
Emission Rate	0.03	lb/hr	
DXF (mass)			
Emission Factor	5.27E-11	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.02E-11	lb/hr	calculation based on total solids loading to carbon recovery process
PCB			
Emission Factor	1.05E-09	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.

Parameter	Value	Units	Comments/Basis
Emission Rate	4.03E-10	lb/hr	
Total PCDD/PCDF			
Emission Factor	<5.3E-11	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.02E-11	lb/hr	
HCl			
Emission Factor	6.39E-04	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.45E-04	lb/hr	
HF			
Emission Factor	7.31E-04	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.81E-04	lb/hr	
Arsenic			
Emission Factor	2.90E-05	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in As content in sludge cake.
Emission Rate	1.11E-05	lb/hr	
Cadmium			
Emission Factor	6.33E-08	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Cd content in sludge cake.
Emission Rate	2.43E-08	lb/hr	
Chromium			
Emission Factor	1.18E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Cr content in sludge cake.
Emission Rate	4.54E-07	lb/hr	
Chromium VI)			
Emission Factor	7.50E-07	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Cr content in sludge cake.
Emission Rate	2.88E-07	lb/hr	
Lead			
Emission Factor	4.41E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Pb content in sludge cake.
Emission Rate	1.69E-06	lb/hr	
Manganese			
Emission Factor	5.42E-06	lb/ton dry solids	Based on source testing of similar pyrolysis unit.
Emission Rate	2.08E-06	lb/hr	
Mercury			
Emission Factor	9.54E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Hg content in sludge cake.
Emission Rate	3.66E-06	lb/hr	

Parameter	Value	Units	Comments/Basis
Nickel			
Emission Factor	5.65E-07	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Ni content in sludge cake.
Emission Rate	2.17E-07	lb/hr	
Vanadium			
Emission Factor	1.12E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in V content in sludge cake.
Emission Rate	4.29E-07	lb/hr	

The tables below are presented for Concentrated Minerals scenario:

Parameter	Value	Units	Comments/Basis
Sytem Operating Parameters			
dewatered sludge feed	768	lb dry solids/hr	
dewatered screenings feed	96	lb dry solids/hr	
Total dry solids feed	864	lb dry solids/hr	
dryer operating rate	2,911	lb dry solids/hr	
Gasifier exhaust			
temperature	1993	° F	
moisture content	10.3%	weight percent	
	16.4%	volume percent	
gasifier flue gas rate, actual	11,248	wacfm	
Flue gas rate, standard wet	2420	wscfm	
Flue gas rate, standard dry	2,023	dscfm	
West Scrubber exhaust			
temperature	120	°F	
flow rate, actual	1,572	acfm	
Flow rate, standard	1,431	wscfm	
Exhaust stack			
flow rate, actual	8,666	acfm	
Flow rate, standard	5,094	wscfm	
stack temp	438	°F	
moisture content			
Stack diameter	1.67	feet	assumed - sized to attain ~ 50 fps stack gas velocity at standard conditions
stack velocity	66.2	fps	
Combustion gases			
CO			
Concentration	93	ppmvw	after wet scrubber
	6.76	lb/MMwscf	
Emission Rate	0.58	lb/hr	
NOx concentration actual			
Concentration	25	ppmvw	after wet scrubber
	2.99	lb/MMscf	
Emission Rate	0.26	lb/hr	
NO2			
Emission Rate	0.13	lb/hr	In-stack NO2:NOx ratio = 0.5 (EPA default)
VOC			
Concentration – gasifier exhaust	7.42	ppmvd	NMTHC as methane

PUGET SOUND
Clean Air Agency

Parameter	Value	Units	Comments/Basis
Concentration - gasifier exhaust	0.31	lb/MMscf as methane	
VOC emission rate	0.04	lb/hr	.
Process Emissions			
PM/PM10/PM2.5			
Gasifier PM			Based on results of PM measurements from stack testing of similar gasification/oxidation unit using chicken litter. PM data normalized to gasifier output in dscfm. Assume all PM is PM2.5
chicken litter gasifier PM			
air flow during stack test	387	lb/hr	average for five runs across two feed conditions
PM emission rate	1.95	lb/hr	average for five runs across two feed conditions
	83.95	lb/MMdscf	
Gasifier PM - CM mode			
gasifier PM, CM mode	10.19	lb PM/hr	
Dryer PM			
Emission factor	5.8	lb PM10/ton dry solids	
Dryer sludge feed rate - BC	2911	lb dry solids/hr	Process Flow Diagram (G-7) 10 Feb 2021
Dryer PM	8.44	lb PM/hr	uncontrolled emissions
Gasifier + Dryer PM			
Uncontrolled PM emissions	18.63	lb PM/hr	
Control efficiency	99%		
PM emissions, gasifier + dryer	0.186	lb/hr	controlled emissions. Measured downstream of packed bed scrubber.
Dust System PM			
Air flow rate	3000	acfm	
Temperature	120	°F	
Baghouse performance	0.01	gr/dscf	controlled emissions.
PM emission dust system	0.23	lb/hr	
Total controlled PM emissions	0.42		
SO2			
Concentration	0.5	ppmvw	controlled emissions. Measured downstream of packed bed scrubber.
	0.08	lb/MMscf	
Emission Rate	0.03	lb/hr	
DXF (mass)			
Emission Factor	5.27E-11	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.28E-11	lb/hr	calculation based on total solids loading to carbon recovery process
PCB			
Emission Factor	1.05E-09	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.

Parameter	Value	Units	Comments/Basis
Emission Rate	4.54E-10	lb/hr	
Total PCDD/PCDF			
Emission Factor	<5.3E-11	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.28E-11	lb/hr	
HCl			
Emission Factor	6.39E-04	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	2.76E-04	lb/hr	
HF			
Emission Factor	7.31E-04	lb/ton dry solids	Based on source tesing of similar pyrolysis unit.
Emission Rate	3.16E-04	lb/hr	
Arsenic			
Emission Factor	2.98E-05	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in As content in sludge cake.
Emission Rate	1.29E-05	lb/hr	
Cadmium			
Emission Factor	6.33E-08	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Cd content in sludge cake.
Emission Rate	2.73E-08	lb/hr	
Chromium			
Emission Factor	1.26E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Cr content in sludge cake.
Emission Rate	5.42E-07	lb/hr	
Chromium VI)			
Emission Factor	7.96E-07	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Cr content in sludge cake.
Emission Rate	3.44E-07	lb/hr	
Lead			
Emission Factor	4.87E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Pb content in sludge cake.
Emission Rate	2.10E-06	lb/hr	
Manganese			
Emission Factor	5.42E-06	lb/ton dry solids	Based on source testing of similar pyrolysis unit.
Emission Rate	2.34E-06	lb/hr	
Mercury			
Emission Factor	9.54E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Hg content in sludge cake.
Emission Rate	4.12E-06	lb/hr	

Parameter	Value	Units	Comments/Basis
Nickel			
Emission Factor	6.10E-07	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in Ni content in sludge cake.
Emission Rate	2.63E-07	lb/hr	
Vanadium			
Emission Factor	2.44E-06	lb/ton dry solids	Based on source tesing of similar pyrolysis unit. Emission factor adjusted based on differences in V content in sludge cake.
Emission Rate	1.05E-06	lb/hr	

The project emission summary total for criteria pollutants is outlined below:

Pollutant	Biochar		Emissions Summary Concentrated Mineral		Maximum Emissions		Comparison with Exemption Thresholds	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	Threshold, tpy	Percent of Threshold
PM2.5	0.39	1.71	0.39	1.71	0.39	1.71	0.5	342%
PM10	0.39	1.71	0.39	1.71	0.39	1.71	0.8	228%
Nitrogen Oxides	0.42	1.84	0.26	1.12	0.42	1.84	2.0	92%
Sulfur Dioxide	0.03	0.13	0.03	0.11	0.03	0.13	2.0	6%
Carbon Monoxide	0.95	4.17	0.58	2.54	0.95	4.17	5.0	83%
Volatile Organics	0.03	0.12	0.04	0.20	0.04	0.20	2.0	10%
Lead	1.69E-06	7.42E-06	2.10E-06	9.21E-06	2.10E-06	9.21E-06	5.00E-03	0%

Note: The emission limits were compared to WAC 173-400-110(5) which the Agency does not use for exemption thresholds, and was only presented here for informational purposes.

Toxic Air Pollution emissions are presented below and discussed in more detail in the toxics review section below:

Project Toxic Air Pollutant Emissions

Toxic Air Pollutant	CAS #	SQER Averaging Period	SQER, lb/averaging period	De Minimis (lb/averaging period)	Toxic Air Pollutant Emissions Summary* lb/hr	lb/day	lb/yr	lb/Averaging Period	% of SQER
Arsenic & Inorganic Arsenic Compounds	---	year	0.0581	0.00291	1.29E-05	3.09E-04	1.13E-01	1.13E-01	194%
Cadmium & Compounds	7440-43-9	year	0.0457	0.00228	2.73E-08	6.56E-07	2.39E-04	2.39E-04	1%
Chromium(III), insoluble particulates, NOS¥	---	24-hr	0.370	0.019	1.98E-07	4.76E-06	1.74E-03	4.76E-06	0%
Chromium(VI)¥	18540-29-9	year	0.00128	0.000064	3.44E-07	8.26E-06	3.01E-03	3.01E-03	235%
Lead and compounds (NOS)	——	year	16	10	2.10E-06	5.05E-05	1.84E-02	1.84E-02	0%
Manganese & Compounds	---	24-hr	0.00526	0.000263	2.34E-06	5.62E-05	2.05E-02	5.62E-05	1%
Mercury, Elemental	7439-97-6	24-hr	0.0118	0.000591	4.12E-06	9.89E-05	3.61E-02	9.89E-05	1%
Nitrogen dioxide†	10102-44-0	1-hr	1.03	0.457	2.28E-11	5.46E-10	1.99E-07	2.28E-11	0%
Polychlorinated Biphenyls, NOS	1336-36-3	year	0.336	0.0168	4.54E-10	1.09E-08	3.97E-06	3.97E-06	0%
2,3,7,8-Tetrachlorodibenzo-p-dioxin & Related Compounds, NOS	---	year	5.05E-06	2.52E-07	2.28E-11	5.46E-10	1.99E-07	1.99E-07	<4%
Vanadium	7440-62-2	24-hr	0.0263	0.00131	1.05E-06	2.53E-05	9.22E-03	2.53E-05	0%
Hydrogen chloride	7647-01-0	24-hr	1.18	0.0591	2.76E-04	6.63E-03	2.42E+00	6.63E-03	1%
Hydrogen Fluoride	7664-39-3	24-hr	1.84	0.092	3.16E-04	7.57E-03	2.76E+00	7.57E-03	0%
Sulfur dioxide‡	7446-09-05	1-hr	1.45	0.457	2.86E-02	6.87E-01	2.51E+02	2.86E-02	2%

Notes:
*Maximum emissions occur in concentrated mineral mode.
¥ All chromium that is not chromium(VI) assumed to be chromium(III).
† assume 50% of NOx (default EPA in-stack NO2:NOx ratio)
‡ Same as criteria pollutant emissions

A copy of the emission calculations spreadsheet submitted by the applicant can be found here:

120902.44 CRP NOC Applications calcs - DI

H. OPERATING PERMIT OR PSD

The Title V Air Operating Permit (AOP) program applicability for the entire source has been reviewed.

The facility is not a Title V air operating permit source because post project PTE remains below Title V applicability thresholds and criteria. The source is considered a "**natural minor**". The facility was previously a Title V facility due to presence of a sewage sludge incinerator on-site (subject to 40 CFR 62, Subpart LLL (see 40 CFR § 62.16035)). On-site inspection has confirmed removal of the SSI unit.

I. AMBIENT TOXICS IMPACT ANALYSIS

The estimated potential toxic air pollutant (TAP) emissions at 100% rated capacity and 8760 hour per year for each new or modified emission unit (*or based on limit in permit*). The table below includes estimated potential emissions of all TAP and compares those to the Small Quantity Emission Rates (SQER) in WAC 173-460-150.

Emission offsets may be considered during First Tier review per WAC 173-460-080(3). "The reductions in TAP emissions authorized by this subsection must be included in the approval order as enforceable emission limits and must meet all the requirements of WAC 173-460-071 [public comment requirements]"

The September 2010 WA Department of Ecology Guidance Document for First, Second and Third Tier Review of Toxic Air Pollution Sources specifies that the emission reductions must be actual reductions, the reductions must be modeled against all affected receptors and when the emission increase and reductions are modeled together at the receptor the modeling must demonstrate that the off-set proposal results in emission values lower than the ASIL.

Arsenic and hexavalent chromium emissions from the project exceeded the SQER even when using offset values from the existing equipment (SSI) being removed with this project. See Table 6 of the permit application for those initial offset emission values.

Arsenic and hexavalent chromium emissions were calculated based on source testing of a similar pyrolysis unit done in Redwood City, CA from October 2-6, 2017. The emission factors used for this emission calculations of Chromium and Arsenic will be placed into the permit for verification since they were above the SQER and relied upon emissions data from another pyrolysis unit. Cr(VI) emissions were based on 10% of the total Chrome emissions, this conversion was based on the chrome speciation measurements in the sewage sludge incinerator exhausts found in the document titled: "Emissions of Metals, Chromium and Nickel Species, and Organics from Municipal Wastewater Sludge Incinerators. Project Summary", EPA/600/SR-92/003. May 1992. DeWees, William G., Robin R. Segall, Laurie Cone, and F. Michael Lewis.

Modeling was conducted by the source using AERMOD version 21112 and was done subtracting the offset values from the emissions (presented in Table 6 of the application). The results were verified for accuracy and the parameters used were verified as most representative. These files are available for download with the agency by request.

Project Toxic Air Pollutant Emissions

Toxic Air Pollutant	CAS #	SQER Averaging Period	SQER, lb/averaging period	De Minimis (lb/averaging period)	Toxic Air Pollutant Emissions Summary* lb/hr	lb/day	lb/yr	lb/Averaging Period	% of SQER
Arsenic & Inorganic Arsenic Compounds	---	year	0.0581	0.00291	1.29E-05	3.09E-04	1.13E-01	1.13E-01	194%
Cadmium & Compounds	7440-43-9	year	0.0457	0.00228	2.73E-08	6.56E-07	2.39E-04	2.39E-04	1%
Chromium(III), insoluble particulates, NOS¥	---	24-hr	0.370	0.019	1.98E-07	4.76E-06	1.74E-03	4.76E-06	0%
Chromium(VI)¥	18540-29-9	year	0.00128	0.000064	3.44E-07	8.26E-06	3.01E-03	3.01E-03	235%
Lead and compounds (NOS)	——	year	16	10	2.10E-06	5.05E-05	1.84E-02	1.84E-02	0%
Manganese & Compounds	---	24-hr	0.00526	0.000263	2.34E-06	5.62E-05	2.05E-02	5.62E-05	1%
Mercury, Elemental	7439-97-6	24-hr	0.0118	0.000591	4.12E-06	9.89E-05	3.61E-02	9.89E-05	1%
Nitrogen dioxide†	10102-44-0	1-hr	1.03	0.457	2.28E-11	5.46E-10	1.99E-07	2.28E-11	0%
Polychlorinated Biphenyls, NOS	1336-36-3	year	0.336	0.0168	4.54E-10	1.09E-08	3.97E-06	3.97E-06	0%
2,3,7,8-Tetrachlorodibenzo-p-dioxin & Related Compounds, NOS	---	year	5.05E-06	2.52E-07	2.28E-11	5.46E-10	1.99E-07	1.99E-07	<4%
Vanadium	7440-62-2	24-hr	0.0263	0.00131	1.05E-06	2.53E-05	9.22E-03	2.53E-05	0%
Hydrogen chloride	7647-01-0	24-hr	1.18	0.0591	2.76E-04	6.63E-03	2.42E+00	6.63E-03	1%
Hydrogen Fluoride	7664-39-3	24-hr	1.84	0.092	3.16E-04	7.57E-03	2.76E+00	7.57E-03	0%
Sulfur dioxide‡	7446-09-05	1-hr	1.45	0.457	2.86E-02	6.87E-01	2.51E+02	2.86E-02	2%

Notes:
*Maximum emissions occur in concentrated mineral mode.
¥ All chromium that is not chromium(VI) assumed to be chromium(III).
† assume 50% of NOx (default EPA in-stack NO2:NOx ratio)
‡ Same as criteria pollutant emissions

Modeling parameters:

Table F-1
Emission Source Parameters

Source Description	Stack ID	Stack Release Type	UTM Easting (m)	UTM Northing (m)	Base Elevation (m)	Stack Height (ft)	Temperature (°F)	Exit Velocity (fps)	Stack Diameter (ft)
Carbon Recovery Project – Biochar Mode	GOX_BC	DEFAULT	546210.2	5295212	5.54	20	195	54.4	1.67
Carbon Recovery Project – Biochar Mode	GOX_CM	DEFAULT	546210.2	5295212	5.54	20	438	66.2	1.67
Existing Sewage Sludge Incinerator	SSI	DEFAULT	546210.2	5295212	5.54	20	90	24.0	1.58

Table F-2
Stack Emission Rates for Arsenic and Cr(VI)

Air Pollutant	Stack Emission Rates, lb/hr GOX_BC	GOX_CM	SSI
Arsenic	1.11E-05	1.29E-05	-1.88E-05
Cr(VI)	2.88E-07	3.44E-07	-2.67E-07

Table F-4
Comparison of Modeled Impact for Arsenic and CR(VI) with ASILs

Air Pollutant	Averaging Time	ASIL µg/m³	Modeled Impact µg/m³	Modeled Impact % of Threshold
Arsenic	Annual	3.03E-04‡	0.00	0%
Cr(VI)	Annual	6.67E-06‡	0.00	0%

Notes:
- * Cause or Contribute Threshold Value (WAC 173-400-113, Table 4a) for criteria air pollutants.
- † US EPA Significant Impact Level for 1-hour NO2
- ‡ Acceptable Source Impact Level" (WAC 173-460)

ASILs were found to be below the thresholds found in WAC 173-460. No further analysis was conducted. As can be seen in the table above, modeled impacts are 0.00 due to the fact that offset modeling values were used from taking the SSI offline which is allowed under the Toxics review regulation.

J. APPLICABLE RULES & REGULATIONS

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 9.07: Sulfur Dioxide Emission Standard. It shall be unlawful for any person to cause or allow the emission of sulfur dioxide from any source in excess of 1,000 parts per million by volume on a dry basis, 1- hour average (corrected to 7% oxygen for fuel burning equipment and refuse burning equipment).

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:
Refuse Burning Equipment: Rated at 12 tons per day or less with heat recovery 0.02 gr/dscf @7% O_2

SECTION 9.10: Emission of Hydrochloric Acid. (a) It shall be unlawful for any person to cause or allow the emission of hydrochloric acid from any equipment in excess of 100 ppm on a dry basis, 1-hour average corrected to 7% oxygen for combustion sources.

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.

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.

Federal

Prior to this permitting action, the City of Edmonds Wastewater Treatment Plant was already subject to the requirements found in 40 CFR 60 Subpart O, 40 CFR 61 Subpart C and 40 CFR 61 Subpart E.

Section 129 of the Clean Air Act ("Solid Waste Combustion") requires EPA to develop regulations under Section 111 of the Clean Air Act ("Standards of Performance for New Stationary Sources") for each category of solid waste incineration unit. EPA has developed the following New Source Performance Standards (NSPS) and emission guidelines (EG) for solid waste incineration units as required by Section 129 for sewage sludge incinerators:

- Sewage Sludge Incinerators - Subparts LLLL/MMMM

Section 129 states that the term "solid waste" shall have the meaning established by the Administrator pursuant to the Solid Waste Disposal Act [42 U.S.C. 6901 et seq.]. Solid waste is defined in 40 CFR 258.2 as "any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. 1342, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923)."

The feedstock first entering the gasifier is solid waste per 40 CFR 258.2 as the material is sludge from a wastewater treatment plant. When the sludge was incinerated, 40 CFR 60 Subpart O and 40 CFR 61

Subpart C and 40 CFR 61 Subpart E applied. As the treatment of the wastewater sludge is proposed to be modified under this NOC, the federal rule applicability for gasification of wastewater sludge and oxidation of syngas is reviewed below:

40 CFR 60 Subpart O – Standards of Performance for Sewage Treatment Plants

40 CFR 60 Subpart O applies to facilities with an incinerator that combusts wastes containing 10% or more sewage sludge on a dry basis, or charges more than 2205 lb/day constructed after June 11, 1973. 40 CFR 60 Subpart O and 40 CFR 60 Subpart A do not define *incinerator* or *sewage sludge incinerator*, although Applicability Determination O006 specified "In the June 11, 1973, Federal Register sewage sludge is defined… Sewage is defined in the same Federal Register… While these definitions were removed when the regulations were promulgated, it is our feeling that these definitions supply the intent of the final promulgation."
EPA cites Applicability Determination (AD) O006 in AD 9900008 and adds "Although Subpart O specific definitions were not contained in the promulgated rule, this was not characterized as a major, substantive or substantial change from what had been proposed." Based on the EPA determinations from the Applicability Determination Index, the sewage sludge incinerator definition from the proposed rule is used in evaluation of 40 CFR 60 Subpart O applicability for this application.

Federal Register 38:111 (Monday June 11, 1973) published the proposed rule for 40 CFR 60 Subpart O and included the following definition for sewage sludge incinerator which was not included in the final rule:
"Sewage Sludge Incinerator" means any combustion device used in the processes of burning sewage sludge for the primary purpose of solids sterilization and to reduce the volume of waste by removing combustible matter, but does not include portable facilities or facilities used solely for burning scum or other floatable materials, recalcining lime, or regenerating activated carbon.

Utilizing the sewage sludge incinerator definition from the Federal Register for determination of 40 CFR 60 Subpart O applicability, indicates that for 40 CFR 60 Subpart O to apply the unit must be a combustion device used to burn sewage sludge.

PSCAA reviewed published applicability determinations for 40 CFR 60 Subpart O in the EPA Applicability Determination Index, as well as the materials provided by the applicant. PSCAA review did not yield any applicability determinations for specifically gasifier/oxidizer units and 40 CFR 60 Subpart O, however several applicability determinations (both for 40 CFR 60 Subpart LLLL and for the SSI Emission Guideline rule 40 CFR 60 Subpart MMMM) provide a framework for review of applicability which was utilized to determine that 40 CFR 60 Subpart O does not apply.

EPA Region 4 worked with OAQPS in the 40 CFR 60 Subpart MMMM determination made December 19, 2013 for a fixed bed downdraft gasifer processing biosolids, and EPA Region 9 made the 40 CFR 60 Subpart LLLL determination discussed below on July 25, 2016. In both letters, systems with pyrolysis/gasification to produce syngas from sewage sludge were found to not meet the definition of a sewage sludge incinerator. Both determinations considered the sewage sludge incinerator definitions of the federal rule under review. Both the SSI unit defined in 40 CFR 60.520 and 40 CFR 60.4930 specify that that the SSI is a combustion unit combusting sewage sludge. As discussed above, the SSI definition from Federal Register 38:111 (Monday June 11, 1973) published the proposed rule for 40 CFR 60

Subpart O is also a combustion device for burning sewage sludge. Sewage sludge is also defined in both 40 CFR 60.5250 and 40 CFR 60.4930 as “a solid, semi-solid, or liquid residue generated during the treatment of domestic sewage”, and the Subpart O proposed rule published in the Federal Register 38:111 (Monday June 11, 1973) as “the solid waste byproduct of municipal sewage treatment processes…”.

Given that the SSI and sewage sludge definitions are similar between 40 CFR 60 Subparts O, MMMM, and LLLL, the 40 CFR 60 Subpart O applicability determination is based on the same criteria as the 40 CFR 60 Subpart MMMM and LLLL determinations. For 40 CFR 60 Subpart O to apply, the unit proposed would need to meet the SSI definition and the material combusted would need to meet the definition of sewage sludge. The proposed unit’s gasification unit does not combust sewage sludge; no flame is applied and oxygen levels in the gasifier are limited to below the combustion threshold. The proposed unit’s oxidizer system is where combustion occurs, however the fuel combusted is syngas which is a gas and not solid, which does not meet the definition of sewage sludge. Given that neither the gasifier nor the oxidizer components of the proposed units are SSIs, 40 CFR 60 Subpart O does not apply.

40 CFR 60 Subpart LLLL – Standards of Performance for New Sewage Sludge Incineration Units

The manufacturer of the gasifier/oxidizer system proposed under this NOC 12135 requested an applicability determination from EPA. EPA issued an applicability determination September 9, 2021 finding that 40 CFR 63 Subpart LLLL does not apply. The applicability determination is embedded below:

Signed 9-9-21 Final
Clean Ecoremedy Re

40 CFR 61 Subpart E- National Emission Standard for Mercury

40 CFR 61 Subpart E applies to “stationary sources which… incinerate or dry wastewater treatment plant sludge.” The rotary drum dryer for sludge in this case is directly dried by the flow of combusted syngas through the dryer such that the dryer proposed meets the requirements of a sludge dryer per 40 CFR 61.51(m): “Sludge dryer means a device used to reduce the moisture content of sludge by heating to temperatures above 65°C (ca. 150°F) directly with combustion gases.” 40 CFR 61 Subpart E applies in this case as the facility dries wastewater treatment plant sludge.

40 CFR 61 Subpart C – National Emission Standard for Beryllium

In contrast to 40 CFR 60 Subparts O and LLLL, the 40 CFR 61 Subpart C defines incinerator as “any furnace used in the process of burning waste for the primary purpose of reducing the volume of the waste by removing combustible matter” such that for the purposes of 40 CFR 61 Subpart C, the gasification and oxidation unit, which removes combustible material as syngas would meet the definition of an incinerator under 40 CFR 61 Subpart C.

40 CFR 61 Subpart C applicability includes incinerators processing beryllium containing waste, defined in 40 CFR 61.31(g) as "material contaminated with beryllium and/or beryllium compounds used or generated during any process or operation performed by a source subject to this subpart." The sources subject to Subpart C from 40 CFR 61.30 are "(a) Extraction plants, ceramic plants, foundries, incinerators, and propellant plants which process beryllium ore, beryllium, beryllium oxide, beryllium alloys, or beryllium-containing waste" and "(b) Machine shops which process beryllium, beryllium oxides, or any alloy when such alloy contains more than 5 percent beryllium by weight."

The applicant identified ADI Z980002 for 40 CFR 61 Subpart C applicability which reviewed waste sludge from a pulp and paper mill. EPA Region 4 determined that since the waste containing beryllium was not generated from any of the sources subject to 40 CFR 61 Subpart C, the waste was not "beryllium containing waste" as defined in Subpart C and therefore Subpart C did not apply. Based on ADI Z980002, the applicant noted that Subpart C applicability would be dependent on whether "the Edmonds Wastewater Treatment receives discharges from wastes generated from a foundry, extraction plant, ceramic plant, propellant plant or machine shop which is subject to Subpart C. Given the previous determinations and the 40 CFR 61 definition of "beryllium containing waste" PSCAA concurs that 40 CFR 61 applicability is determined by whether the waste at Edmonds Wastewater Treatment plant meets the definition of beryllium containing waste. The applicant identified the City's industrial waste discharge control program as a mechanism of ensuring there are no discharges from 40 CFR 61 Subpart C facilities to the wastewater treatment plant. Therefore, 40 CFR 61 Subpart C is not an applicable federal regulation.

K. PUBLIC NOTICE

A notice of application was posted on the Agency's website for 15 days. No requests or responses were received. A copy of the website posting is below:

New Construction Projects

Company	Address	Project Description	Date Posted	Contact Engineer
Edmonds, City of, Wastewater Treatment Plant	200 2nd Ave S, Edmonds, WA 98020	Application for a carbon recovery unit to replace a sewage sludge incinerator at an existing municipal wastewater treatment plant. The carbon recovery unit puts sewage sludge in contact with air or oxygen at high temperature and pressure to convert the sewage sludge into two products: fuel called syngas and an ash product (either high carbon biochar or low carbon concentrated mineral products). The syngas is burned in the oxidizer portion of the unit to heat the process. Oxidized syngas is proposed to be controlled with a cyclone, a venturi scrubber, packed bed scrubber, and a carbon filter.	5/3/21	Madeline McFerran

This project meets the criteria for mandatory public notice under WAC 173-400-171(3). This project included emission offsets from the replacement of the SSI unit with the gasification unit under WAC 173-460-080(3) which requires mandatory public notice under WAC 173-400-171(3).

A 30-day public comment period will be held from October 27, 2022 through November 28, 2022.

[Placeholder for Public hearing comment period]

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.

Specific Conditions:

Emissions Limitations and Standards:

3. The owner and/or operator under this order must comply with all applicable requirements established in 40 CFR Part 61 Subparts A and E.
4. The owner and/or operator shall not process more than 864 pounds of dry solids per hour in the sludge handling processes covered under this order of approval. Compliance with this condition can be done using monthly processing records or daily processing records.
5. The owner and/or operator shall ensure that the dewatered sludge is not processed in the gasifier into syngas unless the oxidizer is properly functioning as part of the system.
6. The owner and/or operator shall not operate the sludge dryer unless emissions are routed through a three-stage emissions control system: the Venturi scrubber, followed by a packed bed scrubber, and then an activated carbon contactor.
7. All emissions associated with sludge drying and dried sludge handling shall be routed to either the three-stage emissions control system or the fabric filter dust collection system described above.
8. The gasifier/oxidizer operating temperature shall not exceed a temperature of 2500 degrees F. Compliance with this condition shall be determined using a block one-hour average, determined in accordance with 40 CFR 60.13(h)(2).
9. The flue gas exhaust stack coming from the sludge dryer, after being processed in the three-stage emissions control system, shall be 20 feet above the elevation of the bottom floor of the solids buildings.
10. The owner and/or operator shall not process waste from:
    - Extraction plants, ceramic plants, foundries, incinerators, and propellant plants which process beryllium ore, beryllium, beryllium oxide, beryllium alloys, or beryllium-containing waste.

- Machine shops which process beryllium, beryllium oxides, or any alloy when such alloy contains more than 5 percent beryllium by weight.

This condition can be verified according to the facilities waste discharge control program and shall be made available upon request from the agency.

11. The facility shall meet emission limits as described below.

Upon startup, emissions from the final exhaust stack shall not exceed the following limits.

Pollutant	**Emissions Limit**	**Compliance Demonstration Method**
SO2	1000 ppmv @ 7% O_2 dry	EPA Test Method 6C, or an alternative method approved by the Agency
HCl	100 ppmv @ 7% O_2 dry	EPA Test Method 26A, or an alternative method approved by the Agency
Arsenic	0.0000129 lbs/hr	EPA Test Method 29 Or an alternative method approved by the Agency.
Chrome (VI)	0.000000344 lbs/hr	EPA Test Method 29 Or an alternative method approved by the Agency.
PM	0.05 gr/dscf	EPA Test Method 5, Method 26A or Method 29 or an alternative method approved by the Agency.

Within 120 days after completing initial performance testing in accordance with permit condition 12, the owner and/or operator shall submit an engineering report to the agency proposing emission limits for the following constituents based on results of the initial performance test. Emission limits may include a 30% adjustment to allow for operational flexibility as long as this increase does not violate any other regulation. Upon approval by the Agency, the proposed emission limits will become enforceable operating limits and the owner and/or operator shall keep a copy of the table with all current enforceable limits on site and readily available for review.

If the results of the performance test show that using the updated testing emission factors would put the facility above any small quantity emission rates (SQERs) or any National Ambient Air Quality standards (NAAQS) that were previously below based on initial similar equipment estimates, the facility shall submit a permit modification to address these pollutants.

Pollutant	**Emission Limit Units[a]**	**Compliance Demonstration Method[b]**
PM	mg/dscm	EPA Test Method 5, Method 26A or Method 29

Pollutant	Emission Limit Units[a]	Compliance Demonstration Method[b]
NOx	ppmv	EPA Test Method 7E
SO_2	ppmv	EPA Test Method 6C
CO	ppmv	EPA Test Method 10
VOC	ppmv	EPA Test Method 25 or 25A EPA Test Method 18 to quantify exempt compounds.
As	lb/ton of dry solids feed OR % removal from dry solids feed	Air: EPA Test Method 29 Solids: SW-846
Cd	lb/ton of dry solids feed OR % removal from dry solids feed	Air: EPA Test Method 29 Solids: SW-846
Hg	lb/ton of dry solids feed OR % removal from dry solids feed	Air: EPA Test Method 29 or 30B Solids: SW-846
Pb	lb/ton of dry solids feed OR % removal from dry solids feed	Air: EPA Test Method 29 Solids: SW-846
Hg	lb/ton of dry solids feed OR % removal from dry solids feed	Air: EPA Test Method 29 Solids: SW-846
Total dioxins and furans	ng/dscm	EPA Test Method 23

Notes:

[a] Gas phase concentrations shall be corrected to 7% oxygen dry.

[b] Or other method approved by the Agency.

[c] Permittee may include methods to address potential ammonium chloride interferences in Method 26

All equipment covered under this order of approval shall not be required to commence initial startup for the sole purpose of conducting a performance test. The owner and/or operator may wait until the unit is needed to commence initial startup and testing.

12. Within 90 days of completing initial startup of the carbon recovery project (Gasifier/Oxidizer system with dry sludge material handling), the owner and/or operator shall conduct a performance test to establish emissions limits in accordance with permit condition 11.

    At least 60 days prior to conducting performance testing, the owner and/or operator shall submit a performance test plan for the sampling that includes the following elements:

    - The data that is to be collected during the testing.
    - The test methods to be used for stack gas measurements.
    - Sample collection procedures and test methods for any other proposed testing (such as sludge or dry solids).
    - The procedures and methods that will be used to develop emissions limits from the results of the source test.

    The owner and/or operator shall conduct all testing in accordance with Section 3.07 of Puget Sound Clean Air Agency (PSCAA) Regulation I, including:

- Sampling sites and velocity traverse points shall be selected in accordance with EPA Test Method 1 or 1A.
- The gas volumetric flow rate shall be measured in accordance with EPA Test Method 2, 2A, 2C, 2D, 2F, 2G or 19.
- The dry molecular weight shall be determined in accordance with EPA Test Method 3, 3A or 3B.
- The stack gas moisture shall be determined in accordance with EPA Test Method.
- The permittee shall use GFAAS or ICP/MS as needed for the analytical finish on the metals when using EPA Method 29 (Lead, Cadmium, Chrome, Arsenic and Mercury)

The equipment identified in this section is not required to commence initial startup for the sole purpose of conducting a performance test. The owner and/or operator may wait until the unit is needed to commence initial startup and testing.

13. The owner and/or operator shall not exhaust the dried sludge separators unless they are connected to a properly functioning dust collection baghouse. The dust collection baghouse shall have an outlet grain loading standard of 0.002 gr/dscf @ 13% O_2 dry. Compliance with this condition can be met by supplying manufacturers specifications showing the dust collection baghouse is capable of meeting the grain loading standard. The owner and/or operator shall make the document available to the agency upon request.

14. The owner and/or operator shall ensure that the flue gas entering the venturi scrubber unit does not exceed 230 degrees F (one-hour block average). The owner and/or operator must monitor the temperature of the influent gas coming into the venturi scrubber to ensure compliance with this condition.

15. The owner and/or operator shall ensure that the flue gas entering the packed bed carbon adsorption unit does not exceed 200 Degrees F (one-hour block average). The owner and/or operator must monitor the temperature of the influent gas coming into the packed bed carbon adsorption unit to ensure compliance with this condition.

16. The owner/or operator shall develop and maintain an Operation and Maintenance (O&M) plans for the three-stage emission control (the Venturi scrubber, followed by a packed bed scrubber, and then an activated carbon contactor). The O&M plan shall be developed and implemented per Agency's Regulation I.

17. Odor Compliance
    The owner and/or operator shall develop an odor response plan and odor complaint log with the following elements:

a. Instances where the odor is detected and any corrective action taken.
b. Initiate an investigation of all odor complaints received from the public as soon as possible, but no later than 12 hours after receipt of the complaint.
c. Take corrective action to eliminate odors beyond the property line as soon as possible, but within 24 hours after receipt of the complaint. If the odors cannot be eliminated within 24 hours after receipt of the complaint, the owner and/or operator shall explain the reasoning in the odor compliant log and the date that it was corrected.
d. Develop a report for every odor complaint and investigation. The odor complaint and investigation report must include the following:
    i. The date and time of when the complaint was received.
    ii. The date and time of when the investigation was initiated.
    iii. Location of complaint and investigation.
    iv. Weather conditions during the complaint and investigation.
    v. Description of complaint and investigation.
    vi. Actions taken in response to the complaint.
    vii. The date and time odors are no longer detected.

18. The following records shall be kept onsite and up-to-date, and be made readily available to Agency personnel upon request at all times:
    a. Compliance test reports.
    b. Amount of sludge handling processed on a monthly or daily basis to verify compliance with Permit Condition 4.
    c. A copy of the odor complaint log and odor response plan.
    d. A written log showing any instance where sludge handling gasses bypass the oxidizer or the three-stage control system and are released to the atmosphere unabated. Each log entry must include date, time, duration and the estimated amount of sludge handling gasses released to the atmosphere.
    e. The Operation and Maintenance (O&M) plan.
    f. All records required by 40 CFR 61 Subpart E.

19. Records required by this order must be kept by the owner and/or operator for at least 2 years, and made available upon request by the agency.

20. This order of approval hereby cancels and supersedes order of approval 11212 (issued 7/26/2016) upon the installation of the new equipment outlined in this order of approval.

M. REVIEWS

Reviews	Name	Date
Engineer:		
Inspector:		
Second Review:	John Dawson	5/31/2022
Applicant Name:		