Technical Support Document for
Notice of Construction Approval Order No. 18AQ-Exxx
OB-3 Resources Management
Warden, WA

Prepared by: Ryan Vicente, PE

1.0 Project Summary

OB-3 Resources Management's Warden Industrial Wastewater Treatment Facility, herein referred to as 'the Permittee', is an existing source which was previously exempt from air regulation. This review is for a new anaerobic digester, and associated gas collection equipment, hydrogen sulfide scrubber tanks, and a biogas flare (the project). Based upon submitted data, a quantification of the Permittee's uncontrolled potential to emit suggests the source should be classified as a 'natural minor source' under the Clean Air Act.

2.0 Application Processing

2.1 Public Notice

Receipt of the application was posted on Ecology's Public Involvement Calendar from 1/5/17 through 1/20/17. A request for a public comment period was received via email on 1/19/17; therefore, a formal 30-day public notice is required.

2.2 Applicant Review

The applicant reviewed a draft of the Approval Order (herein referred to as a 'permit'), sent 4/3/18. Comments from consultant were received 4/23/18, and additional information was submitted 6/1/18, 6/13/18, 6/20/18, 6/28/18, and 7/19/18. The new data included new modeling for flare operation at a lower minimum temperature, as well revisions to potential to emit (PTE) quantifications for the project.

2.3 SEPA

The City of Warden issued a Mitigated Determination of Nonsignificance on 6/28/16.

3.0 Applicable Regulations

3.1 State Regulations

3.1.1 New Source Review Applicability

The uncontrolled PTE of the project, based on direct venting of biogas to the ambient air, exceeds the WAC 173-460-150 de minimis emission value for one toxic air pollutant (TAP), hydrogen sulfide (H_2S). Therefore, the project is subject to new source review per WAC 173-400-110(2) and WAC 173-460-040(1).

The proposed PTE of the project, after iron sponge capture of H_2S followed by flaring of the biogas, exceeds the WAC 173-400-110 Table 110(5) exemption levels for six pollutants and the de minimis emission values for four TAPs (see table below). Therefore, these pollutants are also subject to new source review per WAC 173-400-110(2) and WAC 173-460-040(1).

Criteria Air Pollutants	**Toxic Air Pollutants**
Carbon monoxide (CO)	7,12-Dimethylbenz[a]anthracene
Nitrogen oxides (NO_X)	Cadmium compounds
Particulate matter (TSP, PM_{10}, and $PM_{2.5}$)	Nitrogen dioxide (NO_2)
Sulfur dioxide (SO_2)	Sulfur dioxide

3.1.2 General Standards for Maximum Emissions

WAC 173-400-040(2) generally limits visible emissions from all sources to no more than three minutes of 20 percent opacity, in any one hour, of an air contaminant from any emissions unit. The flare controls emissions from the digester; therefore, the limit applies to that unit. However, this source category has routinely been limited to 5 percent opacity; therefore, the lower limit is specified in the permit.

3.1.3 Emission Standards for Combustion and Incineration Units

WAC 173-400-050(1) limits emissions of PM from combustion units to 0.1 grains per dry standard cubic foot (dscf) of exhaust gas. The flare is a combustion unit; therefore the standard applies to that unit. The Permittee modeled emissions using a flare manufacturer provided PM emission rate of 0.042 lb/MMBtu; that value is stated as a limit in the permit. The limit results in potential emissions at 0.024 gr/dscf; therefore, the higher limit was not included in the permit.

3.1.4 Emission Standards for General Process Units

WAC 173-400-060 limits emissions of particulate material from any general process unit to 0.23 grams per dry cubic meter at standard conditions (0.1 grain/dscf) of exhaust gas.

The digester qualifies as a ‘general process unit’[1] as it causes a change in material, organic and suspended solids, into biogas by chemical means; therefore the standard applies to that unit. The scrubbers absorb H_2S, but do not change the pollutant, and the general process unit definition excludes combustion; therefore, the standard does not apply to the scrubbers or the flare. In any case, see Section 3.1.3 for an explanation as to why this limit was not included in the permit.

[1] See WAC 173-400-030 for definition of ‘general process unit’.

3.1.5 Emission Standards for Sources Emitting Hazardous Air Pollutants

WAC 173-400-075(6)(b) and (c)(i) adopts certain federal regulations listed at 40 CFR Part 61 and Part 63 by reference. None of the adopted regulations were found to apply; therefore, the section does not apply to the project.

3.1.6 Standards of Performance for New Sources

WAC 173-400-115(1) adopts certain federal regulations listed at 40 CFR Part 60 by reference. None of the adopted regulations were found to apply; therefore, the section does not apply to the project.

3.2 Federal Regulations

3.2.1 National Emission Standards for Hazardous Air Pollutants (NESHAP)

None of the NESHAP regulations listed at 40 CFR Part 61 and Part 63 (for source categories) appear to apply to this project.

3.2.2 Standards of Performance for New Stationary Sources

None of the New Source Performance Standards (NSPS) listed at 40 CFR Part 60 appear to apply to this project.

4.0 Emissions

4.1 Emission Factors

Biogas production estimates were based on hydraulic and organic loading rates to the digester, using a biological oxygen demand reduction rate of 85%. The assumed biogas composition is 75% methane, 25% carbon dioxide, and 0.25% H_2S. The digester is expected to produce up to 652 standard cubic feet per minute (scfm) of biogas.

The mass-balance based H_2S PTE was scaled down by 75% in recognition of the equivalent pollutant removal efficiency to be effected by the scrubbers. The emission factor for SO_2 was calculated assuming 98% conversion of remaining H_2S to SO_2 in the flare.

Emission factors for lead and TAPs (except for NO_2 and SO_2) were taken from EPA’s AP 42 (Fifth Edition, Volume I) Chapter 1.4 for natural gas combustion in boilers. The emission factors were scaled to reflect the 25% inert gas (and water vapor) composition of the biogas.

Flare manufacturer emission factors were used NO_X/NO_2, CO, PM, and VOC emissions estimates. The heat-rate based emission factors were scaled with the expected heat content of the biogas.

4.2 Best Available Control Technology

4.2.1 Best Available Control Technology (BACT) for Criteria Pollutants

The consultant cited 0.06 lb/MMBtu NO_X and 0.3 lb/MMBtu CO as BACT limits for a comparable facility in Quincy, Washington reviewed by Ecology in 2010 (NOC Approval Order 10AQ-E372). The application seeks approval for SO_2 emissions of up to 0.144 lb/MMBtu, after removal of H_2S (see Section 4.2.2).

Roosevelt Regional Landfill's landfill gas flare, permitted in 2008, shows an equivalent limit for NO_X; while the the limits for CO and SO_2 in that permit were each 0.08 lb/MMBtu. The landfill flare is operated ≥ 1,500°F with a retention time of ≥ 0.6 seconds; while this project specifies operations ≥ 1,400°F with a retention time of ≥ 0.3 seconds. The longer retention time likely results in the increased CO destruction efficiency. However, a larger flare would likely be cost prohibitive for this project. Similarly, the sulfur removal system employed at that facility is costly and complex. Therefore, I agree that each of these limits likely meet or exceed BACT.

While the application did not address BACT for particulate, control via baghouse, cyclone, electrostatic precipitator, or scrubber would likely be cost prohibitive for controlling flare emissions.

4.2.2 Best Available Control Technology for Toxics (tBACT)

For emissions of H_2S, the consultant considered multiple control technologies in their tBACT analysis: liquid redox (the 'LO-CAT' system), iron oxide ('iron sponge'), iron oxide with carbon ('SulfaTreat'), sulfur reducing bacteria, sodium hydroxide, and thermal destruction (flaring). The consultant demonstrated that substantially complete H_2S capture and destruction, via pretreatment with iron sponge followed by flaring of the biogas, likely meets or exceeds tBACT for the pollutant. The remaining technologies were discounted as either infeasible or cost prohibitive.

While the analysis did not address tBACT for 7,12-dimethylbenz[a]anthracene or cadmium compounds, I assume there will be a high level of thermal destruction efficiency for former (since organic) and that control of the latter would be cost prohibitive (see thoughts on particulate control in Section 4.2.2). In addition, I have a low confidence in these TAP estimates, as the emission factors are specific to the combustion of natural gas, not biogas generated from food process/rinse-water.

5.0 Ambient Air Quality Standards

5.1 Criteria Pollutants

Modeling was required for CO, NO_X, PM_{10}, $PM_{2.5}$, and SO_2, as those criteria pollutants will be emitted above their respective criteria pollutant WAC 173-400-110 Table 110(5) exemption levels. The modeling demonstrated that estimated concentrations of CO, NO_2 (annual average), PM_{10}, $PM_{2.5}$, and SO_2 (except 24-hr average) will remain below the WAC 173-400-113 Table 4a Cause or Contribute Threshold Values for Nonattainment Area Impacts. The ambient impacts for 24-hour SO_2 and the 1-hour NO_2 were compared to the NAAQS for those pollutants; the modeling verified that the project should not cause a violation of either standard.

5.2 Toxic Air Pollutants

Modeling was required for 7,12-dimethylbenz[a]anthracene, cadmium compounds, NO_2 (as a TAP), SO_2 (as a TAP) and H_2S, as those pollutants will emitted at levels exceeding their respective WAC 173-460-150 listed small quantity emission rate. The modeling was performed assuming 700 scfm of biogas production, which exceeds the 652 scfm expected for incoming feedstock at an average 2 MGD.

The modeling demonstrated that estimated concentrations of each pollutant will remain below the ASIL values listed at WAC 173-460-150. While modeling did not address the short term increases in emissions associated with the requested upper limit of 2.88 MGD of feedstock, the model results indicate an ample margin of safety for all pollutants.