**BRIDGEWATER GROUP**

JOHN BROWNING, P.E.
7100 SW HAMPTON STREET
COMMERCE PLAZA SUITE 235
DIRECT: (503) 212-2515
CELL: (503) 412-9842
jbrowning@bridgeh2o.com



**Department of Ecology**
Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

October 14, 2016

Subject: Notice of Construction Application
Pasco Sanitary Landfill RTO Replacement Project

To Whom It May Concern:

In July 2015 the Washington Department of Ecology conditionally approved the installation and operation of a Regenerative Thermal Oxidizer (RTO) to treat soil vapors extracted from the Pasco Sanitary Landfill (PSL) (Approval Order No. 14AQ-E571). The RTO was subsequently installed and currently operates at the facility. The existing RTO, a Gulf Coast Environmental (GCE) 2,300 SCFM 2-canister unit with thermal condensate treatment (GCE Model 20-92-RTO) is planned to be replaced with a new Anguil Environmental Systems, Inc., Model 25, 2,500 SCFM RTO. Replacing the existing RTO with a new one requires the submission of the attached Notice of Construction (NOC) application.

Included with this submission are the following:

- Ecology Notice of Construction Application Form ECY 070-410;
- A check in the amount of $1,500 for the basic project initial fee;
- Notice of Construction Application Supporting Information document.

If you have any questions related to the NOC application please contact myself at 503-212-2515 or Tina Blakley of PBS Engineering + Environmental at 509-375-7833.

Sincerely,

John Browning

John Browning, P.E.

**BRIDGEWATER GROUP, INC.**

c: Tina Blakely/PBS
Mark Leece/PBS
IWAG Technical Committee, c/o Will Ernst

Enclosures: NOC Application

PBS | Engineering + Environmental

4412 SW Corbett
Portland, OR 97239
503-248-1939

BANK OF THE WEST
SAN JOSE, CA 95113
90-78/1211

086499

CHECK DATE

October 12, 2016

PAY One Thousand Five Hundred and 00/100 Dollars

AMOUNT
VOID AFTER 90 DAYS 1,500.00

TO Washington Department of Ecology
Cashiering Section
PO Box 5128
Lacey, Washington 98509-5128

[redacted]

AUTHORIZED SIGNATURE

PBS | Engineering + Environmental

4412 SW Corbett
Portland, OR 97239
503-248-1939

086499

Check Date: 10/12/2016

| Invoice Number | Date | Voucher | Amount | Discounts | Previous Pay | Net Amount |
|---|---|---|---|---|---|---|
| Permit Fee | 10/12/2016 | 0224007 | 1,500.00 | | | 1,500.00 |
| Washington Department of Ecology | | TOTAL | 1,500.00 | | | 1,500.00 |
| Bank of the West Checking 1 | | 0000000023084 | | | | |

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

This application applies statewide for facilities under the Department of Ecology's jurisdiction. Submit this form for review of your project to construct a new or modified source of air emissions. Please refer to Ecology Forms ECY 070-410a-g, "Instructions for NOC Application," for general information about completing the application.

Ecology offers up to two hours of free pre-application assistance. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal, below. If you use up your two hours of free pre-application assistance, we will continue to assist you after you submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Upon completion of the application, please enclose a check for the initial fee and mail to:

**Department of Ecology**
**Cashiering Unit**
**P.O. Box 47611**
**Olympia, WA 98504-7611**

*For Fiscal Office Use Only:*
001-NSR-216-0299-000404

| **Check the box for the location of your proposal.** For assistance, call the contact listed below: | | |
|---|---|---|
| | **Ecology Permitting Office** | **Contact** |
| ☐ **CRO** | **Chelan, Douglas, Kittitas, Klickitat, or Okanogan County**<br>Ecology Central Regional Office – Air Quality Program | Lynnette Haller<br>(509) 457-7126<br>lynnette.haller@ecy.wa.gov |
| ☒ **ERO** | **Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla or Whitman County**<br>Ecology Eastern Regional Office – Air Quality Program | Greg Flibbert<br>(509) 329-3452<br>gregory.flibbert@ecy.wa.gov |
| ☐ **NWRO** | **San Juan County**<br>Ecology Northwest Regional Office – Air Quality Program | David Adler<br>(425) 649-7082<br>david.adler@ecy.wa.gov |
| ☐ **IND** | **For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters**<br>Ecology Industrial Section – Waste 2 Resources Program<br>Permit manager: _____ | Garin Schrieve<br>(360) 407-6916<br>garin.schrieve@ecy.wa.gov |
| ☐ **NWP** | **For actions taken on the US Department of Energy Hanford Reservation**<br>Ecology Nuclear Waste Program | Philip Gent<br>(509) 372-7983<br>philip.gent@ecy.wa.gov |

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

Check the box below for the fee that applies to your application.

**New project or equipment:**

| | |
|---|---|
| [X] | **$1,500: Basic project** initial fee covers up to 16 hours of review. |
| [ ] | **$10,000: Complex project** initial fee covers up to 106 hours of review. |

**Change to an existing permit or equipment:**

| | |
|---|---|
| [ ] | **$200: Administrative or simple change** initial fee covers up to 3 hours of review<br>Ecology may determine your change is complex during completeness review of your application. If your project is complex, you must pay the additional $675 before we will continue working on your application. |
| [ ] | **$875: Complex change** initial fee covers up to 10 hours of review |
| [ ] | **$350** flat fee: **Replace or alter control technology equipment under WAC 173-400-114**<br>Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application. |

| Read each statement, then check the box next to it to acknowledge that you agree. | |
|---|---|
| [X] | The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will bill you $95 per hour for the extra time. |
| [X] | You must include all information requested by this application. Ecology may not process your application if it does not include all the information requested. |
| [X] | Submittal of this application allows Ecology staff to visit and inspect your facility. |

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application
## Part 1: General Information

### I. Project, Facility, and Company Information

| |
|---|
| 1. Project Name: RTO Replacement Project |
| 2. Facility Name: Pasco Sanitary Landfill NPL Site |
| 3. Facility Street Address: 1.5 miles northeast of the City of Pasco, north of the intersection of Kahlotus Road with U.S. Highway 12 |
| 4. Facility Legal Description: Pasco Sanitary Landfill NPL Site, 1901 Dietrich Rd, Pasco, WA 99301. Parcel # 113580082.<br>Comment: The Site is located near the intersection of Kahlotus Road with U.S. Routes 12 and 395, at latitude 46 degrees, 15' 07" North and longitude 119 degrees, 03'13" West. |
| 5. Company Legal Name (if different from Facility Name):<br>Industrial Waste Area Generators Group (IWAG) III |
| 6. Company Mailing Address (street, city, state, zip):<br>c/o Will Ernst, Co-Chair, IWAG Technical Committee<br>PO Box 3707, MC 1W-12, Seattle WA 98124 |

### II. Contact Information and Certification

| | |
|---|---|
| 1. Facility Contact Name (who will be onsite)<br>Tina M. Blakley, P.E., PBS Engineering + Environmental | |
| 2. Facility Contact Mailing Address (if different than Company Mailing Address)<br>400 Bradley Blvd. #300, Richland, WA 99301 | |
| 3. Facility Contact Phone Number<br>(509) 375-7833 | 4. Facility Contact E-mail<br>tina.blakley@pbsenv.com |
| 5. Billing Contact Name (who should receive billing information):<br>PBS Engineering + Environmental | |
| 6. Billing Contact Mailing Address (if different than Company Mailing Address) Same | |
| 7. Billing Contact Phone Number Same | 8. Billing Contact E-mail Same |
| 9. Consultant Name (optional – if 3rd party hired to complete application elements)<br>John Browning, P.E. | |
| 10. Consultant Organization/Company Bridgewater Group, Inc. | |
| 11. Consultant Mailing Address (street, city, state, zip)<br>7100 SW Hampton Street, Tigard, OR 97223 | |
| 12. Consultant Phone Number<br>503-212-2515 | 13.Consultant E-mail<br>jbrowning@bridgeh2o.com |
| 14. Responsible Official Name and Title (who is responsible for project policy or decision-making)<br>Mark Leece, Vice President, PBS Engineering + Environmental | |
| 16. Responsible Official Phone<br>(503) 417-7583 | 17. Responsible Official E-mail<br>mark.leece@pbsenv.com |
| 18. Responsible Official Certification and Signature<br>I certify, based on information and belief formed after reasonable inquiry, the statements and information in this application are true, accurate and complete.<br>Signature _____ Date 10/11/2016 | |

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application
## Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form.

For all sections, check the box next to each item as you complete it.

### III. Project Description

Please attach the following to your application.

- [X] Written narrative describing your proposed project.
- [X] Projected construction start and completion dates.
- [X] Operating schedule and production rates.
- [X] List of all major process equipment with manufacturer and maximum rated capacity.
- [X] Process flow diagram with all emission points identified.
- [X] Plan view site map.

- [X] Manufacturer specification sheets for major process equipment components.
- [X] Manufacturer specification sheets for pollution control equipment.
- [X] Fuel specifications, including type, consumption (per hour & per year) and percent sulfur.

### IV. . State Environmental Policy Act (SEPA)

**Compliance Check the appropriate box below.**

- [ ] SEPA review is complete:
  Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, EIS) with your application.

- [X] SEPA review has not been conducted:

  - [ ] If review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit.
    Agency Reviewing SEPA:
    City of Pasco, Washington

  - [ ] If the review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at www.ecy.wa.gov/programs/sea/sepa/docs/echecklist.doc

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

**V. Emissions Estimations of Criteria Pollutants**

**Does your project generate criteria air pollutant emissions?** [X] Yes [ ] No

If yes, please provide the following information regarding your criteria emissions in your application.

[X] The names of the criteria air pollutants emitted (i.e., $NO_x$, $SO_2$, CO, $PM_{2.5}$, $PM_{10}$, TSP, VOC, and Pb)

[X] Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)

[ ] If there will be any fugitive criteria pollutant emissions, clearly identify the pollutant and quantity

**VI. Emissions Estimations of Toxic Air Pollutants**

**Does your project generate toxic air pollutant emissions?** [X] Yes [ ] No

If yes, please provide the following information regarding your toxic air pollutant emissions in your application.

[X] The names of the toxic air pollutants emitted (specified in WAC 173-460-150[1])

[X] Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)

[ ] If there will be any fugitive toxic air pollutant emissions, clearly identify the pollutant and quantity

**VII. Emission Standard Compliance**

[X] Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under Chapter 70.94 RCW.
**Does your project comply with all applicable standards identified?** [X] Yes [ ] No

**VIII. Best Available Control Technology**

[X] Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

**IX. Ambient Air Impacts Analyses**

Please provide the following:

[X] Ambient air impacts analyses for Criteria Air Pollutants (including fugitive emissions)

[X] Ambient air impacts analyses for Toxic Air Pollutants (including fugitive emissions)

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

DEPARTMENT OF ECOLOGY
State of Washington

# Notice of Construction Application

[X] Discharge point data for each point included in air impacts analyses (include only if modeling is required)

- [X] Exhaust height
- [X] Exhaust inside dimensions (ex. diameter or length and width)
- [X] Exhaust gas velocity or volumetric flow rate
- [X] Exhaust gas exit temperature
- [X] The volumetric flow rate
- [X] Description of the discharges (i.e., vertically or horizontally) and whether there are any obstructions (ex., raincap)
- [X] Identification of the emission unit(s) discharging from the point
- [X] The distance from the stack to the nearest property line
- [X] Emission unit building height, width, and length
- [X] Height of tallest building on-site or in the vicinity and the nearest distance of that building to the exhaust
- [X] Whether the facility is in an urban or rural location

**Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level?** [ ] Yes [X] No

# Notice of Construction Application
# Supporting Information
# New Regenerative Thermal Oxidizer
# Pasco Sanitary Landfill
# Pasco, Washington

Submitted to:

**Washington Department of Ecology**
**Eastern Regional Office – Air Quality Program**

On Behalf of:

**Industrial Waste Area Generators Group III**
**c/o Will Ernst**
**Co-Chair, Technical Committee**
**P.O. Box 3707, MC 1W-12**
**Seattle, Washington 98124**

October 2016

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### TABLES



### APPENDICES

## 1.0 INTRODUCTION

In July 2015 the Washington Department of Ecology conditionally approved the installation and operation of a Regenerative Thermal Oxidizer (RTO) to treat soil vapors extracted from the Pasco Sanitary Landfill (PSL) (Approval Order No. 14AQ-E571). The RTO was subsequently installed and currently operates at the facility. The existing RTO, a Gulf Coast Environmental (GCE) 2,300 SCFM 2-canister unit with thermal condensate treatment (GCE Model 20-92-RTO) is planned to be replaced with a new Anguil Environmental Systems, Inc., Model 25, 2,500 SCFM RTO. Replacing the existing RTO with a new one requires the submission of a Notice of Construction (NOC) application.

Obtaining the approval order for the existing RTO required the submission of an NOC application including the following key technical information:

- Project description including the operating characteristics of the soil vapor extraction (SVE) system;
- State Environmental Policy Act (SEPA) compliance;
- Emission estimates for criteria pollutants and toxic air pollutants;
- Regulatory review;
- Best Available Control Technology (BACT) review;
- Ambient air impacts analysis including a first and second tier review for toxic air contaminant emissions.

The only operational change occurring at the PSL facility, and thus the only significant change in the key technical information associated with an NOC application, is the replacement of the existing RTO with a new one. As such, this NOC application relies on, and references, much of the key technical information contained in the permitting effort for the existing RTO. Where there are significant changes to the technical information that may impact Ecology's review and issuance of a new approval order, supplemental information is provided. For example, and as discussed with Ecology during pre-application meetings, a description of how the proposed new RTO will have better air dispersion characteristics is included in this application. Because the new RTO will have better air dispersion characteristics and the

basis for estimated emission rates has not changed, ambient air quality impacts will be lower and detailed air dispersion modeling and health impact assessments need not be repeated for this NOC application.

This NOC application follows Ecology's Form ECY 070-410 and each section provides a cross-reference to the sections in the form requesting technical information.

## 2.0 PROJECT DESCRIPTION (PART 2 SECTION III)

Written Narrative Describing the Proposed Project

The proposed project involves replacing the existing RTO used to control volatile organic compound (VOC) emissions generated from a soil vapor extraction (SVE) system from Zone A of the PSL facility with a new RTO. Technical specifications and details of the new RTO are provided in Appendix A.

Projected Construction Start and Completion Dates

Projected Construction Start Date: April 2017

Project Completion Date: April 2017

Operating Schedule and Production Rate

There are no changes to the operating schedule or production rate of the SVE system as a result of replacing the existing RTO.

List of all Major Process Equipment with Manufacturer and Rated Capacity

There are no significant changes proposed to the major SVE system process equipment.

Process Flow Diagram with All Emission Points Identified

There are no significant changes to the SVE system process flow. There will be a new emission point associated with the new RTO stack. The existing RTO unit will ultimately be dismantled and will not be a source of emissions.

Plan View Site Map

Figures 1, 2 and 3 in Appendix B provide a project location vicinity map, site map and plan view of the soil vapor extraction system. These figures are taken from the existing RTO's NOC application. The proposed location of the new RTO is adjacent to and just to the west of the existing RTO.

Manufacturer Specification Sheets for Major Process Equipment Components

There are no changes proposed to the SVE system process equipment.

Manufacturer Specification Sheets for Pollution Control Equipment

Manufacturer specifications for the proposed new RTO are provided in Appendix A.

As noted on the top of page 10 of Anguil proposal, dilution air into the RTO will be controlled automatically by the RTO PLC and will not be controlled by the operator, The PLC will adjust dilution air as needed to maintain combustion chamber temperature and provided additional LEL protection as needed. At the time of this application, only an example P&ID is available. When a final P&ID is completed, it can be provided to Ecology to more fully document the dilution air control.

## 3.0 SEPA COMPLIANCE (PART 2 SECTION IV)

A State Environmental Policy Act (SEPA) checklist for this project is provided in Appendix D.

The SEPA checklist has been drafted and reviewed by IWAG. The checklist was submitted to the City of Pasco, WA on October 10, 2016 to start the two week review process.

## 4.0 EMISSION ESTIMATES (PART SECTIONS V & VI)

Tables 1 through 4 of the NOC application for the existing RTO provided emission estimates for criteria pollutants and toxic air pollutants (TAPs) listed in WAC 173-460. The emission estimates included the following assumptions to produce conservative emission rates of regulated air pollutants.

- Emissions of VOCs and TAPs were based on the highest VOC mass loading rates observed to date from the SVE system.

- The most abundant sources of chlorinated and fluorinated compounds in the untreated SVE vapors were assumed to be 100% converted to hydrogen chloride and hydrogen fluoride.

- For the purposes of estimating maximum 1-hour emission rates of criteria pollutants from natural gas combustion it was conservatively assumed that the RTO would use 750 standard cubic feet per hour (scfh) of natural gas for one full hour during start-up conditions.

Tables 1 through 4 from the existing RTO NOC application are provided in Appendix B of this report for reference purposes.

While design considerations for the new RTO evaluated a slightly less conservative approach to estimating VOC loading, the basis for estimating emissions for this NOC application remains unchanged with the following exceptions.

- As discussed with Ecology during pre-application meetings the new RTO is being designed to achieve the following enhanced performance characteristics:

    - An overall removal efficiency of 98% or to a discharge concentration of 20 ppmv of total VOC as methane, whichever has the higher associated concentration and;

    - A speciated removal efficiency of 98% or to a discharge concentration the compound's practical quantification limit (PQL) or 3 ppmv for each of the following 12 compounds, whichever has the highest associated concentration

      Toluene
      2-butanone (MEK)
      Total o,m,p-Xylenes
      4-Methyl-2-pentanone (MIBK)
      Methylene chloride
      Ethanol
      Trichloroethene
      Ethylbenzene
      1,1,1-Trichloroethane
      1,2,4-Trimethylbenzene
      n-propylbenzene
      Isopropylbenzene

- The design natural gas flow rate for the new RTO is 1,000 scfh whereas the existing RTO fuel flow rate is 750 scfh. This increase in design natural gas flow rate represents a moderate potential increase in the relatively low criteria pollutant emissions resulting from natural gas combustion.

The existing RTO NOC application and Ecology's Technical Support Document (TSD) included an assessment of whether or not the RTO could be a source of dioxins or furans (PCDD/Fs). In general, the assessment concluded that there was no indication that PCDD/F formation would be a concern due to the high oxidation temperature present in the units combustion zone (≥1,600F) and the fact that the heat recovery beds rapidly quench the exhaust stream temperature to below PCDD/F forming favorable conditions. As described in the manufacturers (Anguil) specification provided in Appendix A, the new RTO oxidation temperatures will also be ≥1,600F and provide rapid quenching of the exhaust stream through the heat recovery beds. Based on these conditions and the previous assessment there is no indication that PCDD/F formation would be a concern for the proposed new RTO.

## 5.0 EMISSION STANDARD COMPLIANCE (PART 2 SECTION VII)

The existing RTO NOC application and Ecology's Technical Support Document assessed the applicability of Federal New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) and concluded none applied to the PSL operations. The project is subject to the requirements of WAC 173-400-110, New Source Review (NSR), WAC 173-400-113(2), Best Available Control Technology, and WAC 173-460, Controls for New Sources of Toxic Air Pollutants. These regulatory requirements are discussed in subsequent sections of this report.

## 6.0 BEST AVAILABLE CONTROL TECHNOLOGY (PART 2 SECTION VIII)

In general, Best Available Control Technology or BACT is an emission limitation based on the maximum degree of reduction for each regulated air from a new or modified stationary source that can be feasibly achieved while taking into account energy, environmental, and economic impacts and other costs. The existing RTO NOC application and Ecology's TSD evaluated this control technology requirement and concluded that the RTO resulted in 98%

control of the VOC removed from the vadose zone by the SVE system, and its exhaust contained a maximum of 3.3 pounds per hour VOC represents BACT and t-BACT. Because the performance characteristics for the new RTO are planned to be equal to or better than the proposed performance characteristics of the existing RTO, it is proposed that installation of the RTO described in Appendix A of this report is BACT for controlling emissions from the PSL soil vapor extraction system. T-BACT and compliance with toxic air pollutant new source review is further discussed in Section 7.0 of this report.

Additionally, the existing RTO NOC application evaluated t-BACT for acid gases because the oxidation of chlorinated and fluorinated compounds is a potential source of hydrogen chloride (HCl) and hydrogen fluoride (HF). The evaluation concluded that installation of a wet scrubber following the RTO was not economically feasible on a dollar per ton of acid gas removed basis. Owing to the following considerations it is reasonable to conclude that this project (replacing the existing RTO with a new one) also results in economic infeasibility to control acid gases with add-on controls:

- The conservative emission estimates for HCl and HF remain unchanged, i.e., the denominator in a cost per ton of pollutant removed calculation would not change.
- The previous t-BACT analysis for acid gases is relatively current and pollution control technology costs have not significantly changed, i.e., the numerator in a cost per ton of pollutant removed calculation would not significantly change.

## 7.0 AMBIENT AIR IMPACTS ANALYSES (PART 2 SECTION IX)

During pre-application meetings with Ecology information was presented to demonstrate that the estimated air pollutant emission rates and air dispersion characteristics of the new RTO would be equal to or better than those proposed by the existing RTO. Specifically, the following information in Table 1 below was provided to Ecology.

Table 1
**Comparison of Emission Rates & Source Parameters**

| Parameter | Original NOC* | New NOC** |
|---|---|---|
| Basis for VOC & TAP Emission Rates | Highest observed based on SVE vapor historical analytical. 100% of chlorinated and fluorinated compounds converted to HCl & HF. | No changes to basis for VOC or TAP emission rates. |
| Destruction Removal Efficiency (%) | 98% or 20 ppmv of total VOC | 98% or to a concentration of 20 ppmv of total VOC as methane, whichever has the higher associated concentration, 98% or the greater of PQL or 3 ppmv of 12 speciated compounds***. |
| Release Height (meters) | 6.1 | 9.14 |
| Exhaust flow rate (SCFM) | 2,300 | 2,500 |
| Stack Diameter (meters) | 0.305 | 0.356 |
| Exit Temperature (Kelvin) | 338.7 - 449.8 | 365 – 670 |
| Exit Velocity (meters/second) | 10.16 - 20.32 | 3.4 – 23.90 |
| Oxidation Temp. (Fahrenheit) | 1,600 - 1,800 | 1,650 - 1,800 |
| Stack Location | | Within 25m of existing stack |
| RTO Natural Gas Consumption | 750 SCFH | 1,000 SCFH |

* Revised Notice of Construction Application Supporting Information Report, Pasco Sanitary Landfill, Pasco, Washington, dated October 23, 2014.

**Proposed approach and information from RTO vendor (Anguil)

*** The 12 speciated compounds are:

Toluene
2-butanone (MEK)
Total o,m,p-Xylenes
4-Methyl-2-pentanone (MIBK)
Methylene chloride
Ethanol
Trichloroethene
Ethylbenzene
1,1,1-Trichloroethane
1,2,4-Trimethylbenzene
n-propylbenzene
Isopropylbenzene

Based on their review of this information Ecology requested that screening level air dispersion modeling be conducted to demonstrate that due to better

dispersion characteristics achieved by the RTO predicted air quality impacts will be lower than originally described in the existing RTO NOC thereby obviating the need to repeat detailed air dispersion modeling and assessments associated with a Tier 1 and Tier 2 toxic air pollutant review.

The results of the screening level air dispersion modeling analysis are shown in Table 2 below. A unit emission rate of 1 gram per second was modeled to determine comparative impacts. The existing and new RTO dispersion characteristics were evaluated under both low flow and high flow operating conditions and model-predicted impacts from the new RTO were lower. Please note that the values provided in the table are not predicted impacts of any air pollutant. They represent only a comparison of dispersion characteristics between the two units.

Table 2
**Screening Level Air Dispersion Modeling Results* to Compare Stack Characteristics**

| Operating Scenario | Existing RTO ($ug/m^3$) | New RTO ($ug/m^3$) |
|---|---|---|
| Low Flow | 538.6 | 460.4 |
| High Flow | 291.1 | 100.6 |

* Using an emission rate of 1 gram/second

A detailed description of the air dispersion modeling analysis is provided in Appendix C.

## 8.0 REFERENCES


Landau Associates. 2014. *Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco Washington*, dated October 23, 2014.

Landau Associates. 2014. *Report, Second-Tier Risk Analysis for Hydrogen Chloride Emissions, Pasco Sanitary Landfill, Pasco, Washington*, dated August 25, 2014.

Landau Associates. 2014. *Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco Washington*, dated October 23, 2014.

Landau Associates. 2014. *Revised Report, Second-Tier Risk Analysis for Hydrogen Chloride Emissions, Pasco Sanitary Landfill, Pasco, Washington*, dated October 23, 2014.

Landau Associates. 2015. *Technical Memorandum: Supplemental Exposure Assessment for Basin Disposal Inc., Second-Tier Health Impact Assessment, Pasco Sanitary Landfill, Pasco, Washington*, dated January 27, 2015.

PBS Engineering + Environmental. 2016. *Summary of Telephone Conference for September 21, 2016.*

# Appendix A

# RTO Manufacturer Technical Specification

# Anguil Environmental Systems, Inc. Regenerative Thermal Oxidizer

**Date:** September 9, 2016
**Proposal #:** AES-168058F

**Project:**

Pasco Sanitary Landfill Site
Pasco, WA

**Prepared for:**

Larry Adams
IWAG

Phone: (714) 963-7624 (office)
(714) 329-0543 (cell)

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**Submitted by:**

Scott Bayon
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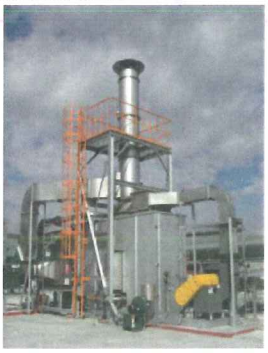
*"Our goal is to provide solutions today which help our customers remain profitable tomorrow"*
– Gene Anguil / Founder and CEO





***Background:***
- Founded in 1978
- Second generation family owned and operated
- Headquartered in Milwaukee, WI, USA with offices in Asia and Europe
- Over 1,750 oxidizers and countless heat recovery systems installed on six continents in a wide variety of industries

***Company Size and Make-up:***
- Annual sales in excess of $33 million
- In-house engineering staff consists of chemical, mechanical and electrical engineers
- Highly motivated employees who enjoy profit sharing and a rewarding work environment

***What Makes Anguil Unique?***
- Regulatory compliance is guaranteed
- Broad range of technology solutions that ensure an unbiased equipment selection
- Quality assurance program with complete factory acceptance testing prior to shipment
- An established safety program with continuous training for Anguil technicians
- Equipment is designed in Solidworks, ensuring accuracy and rapid completion

***Products:***

**Air pollution control systems…**
- Regenerative Thermal Oxidizers (RTO)
- Catalytic, Recuperative and Direct-Fired Thermal Oxidizers and Vapor Combustors.
- Concentrator systems
- Permanent Total Enclosures

**…for VOC, HAP and odor abatement**

**Heat and energy recovery systems…**
- Air-to-air heat exchangers
- Air-to-liquid heat exchangers
- Heat-to-power
- Energy Evaluations

**…for improved efficiency and reduced operating costs**

***Aftermarket:***

**Service and Maintenance…**
- 24/7 Emergency service response
- Operating cost reviews
- System upgrades and retrofits
- Spare parts and component packages
  - Preventive Maintenance Evaluations (PME)

**… on any make or model, regardless of original manufacturer**

***Partial List of Satisfied Customers:***

Boeing, Dow Chemical, Northrop Grumman, ExxonMobil, Johnson and Johnson, Peterbilt, Pfizer, Qualcomm, Rexam Beverage, Silgan Containers

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## Executive Summary

### 1. Equipment Description

The Industrial Waste Area Generators Group (IWAG) has requested a proposal for fabrication, delivery and installation of a vapor treatment system for a remediation project in Pasco, WA.

Vapors extracted by the soil vapor extraction process will be delivered to a new Anguil Model 25 (2,500 SCFM) Regenerative Thermal Oxidizer (RTO). The oxidizer is sized to allow for adequate dilution air due to high VOC loads generated by the Intermediate Wells. An electric heater is included to heat dilution air prior to combination with the SVE exhaust to prevent water from condensing when the dilution air and SVE exhaust combine. In this design, dilution air is only used during periods of high VOC loading.

Due to the presence of chlorinated compounds, upgraded materials of construction are included to prevent HCl corrosion. The base bid includes AL6XN, Hastelloy and vinyl ester coated carbon steel componentry.

In addition to the RTO, pricing is given to mechanically and electrically install the system.

### 2. Facility to be Controlled

Pasco Sanitary Landfill site in Pasco, WA

### 3. Processes Controlled

Soil Vapor Extraction (SVE)

### 4. RTO Energy Recovery

95% Nominal Thermal Energy to minimize gas usage

### 5. Proposed Equipment

Model 25 (2,500 SCFM) Regenerative Thermal Oxidizer (RTO)

### 6. Anguil Benefits

* Seamless integration with the current process
* Fully automated PLC based controls
* Modem for remote diagnostics
* Field Tested and proven technology
* Full equipment warranty
* Factory test prior to shipment
* 24 hour service support

**7. Results**

* Anguil guarantees the conversion efficiency of VOCs and HAPS of 98% or an outlet concentration of 20 ppmv as C1 (methane), whichever is less stringent per EPA Method 25A.

* Anguil guarantees 98% Speciated Destruction Efficiency of the following Compounds of Record or a stack concentration equal to the greater of either the compound's PQL or 3 ppmv (as compound):

1,1,1-Trichloroethane
1,2,4-Trimethylbenzene
2-Butanone (MEK)
4-Methyl-2-Pentanone (MIBK)
Ethanol
Ethylbenzene
Isopropylbenzene
Total Xylenes (o, m, p)
Methylene Chloride (dichloromethane)
n-Propylbenzene
Toluene
Trichloroethene

* Anguil guarantees the RTO opacity shall not exceed 5%, measured in accordance with EPA Method 9.

## Customer Process Specifications

- Process Flow: up to 1,000 SCFM
- Process Temperature: 100-225°F
- Process Data*:

| Compound | Max Mass (lbs/hr) |
|---|---|
| **Toluene** | 34.39 |
| **2-butanone (MEK)** | 9.88 |
| **Total o,m,p-Xylenes** | 4.94 |
| Acetone | 4.46 |
| **4-Methyl-2-pentanone (MIBK** | 2.89 |
| **Methylene chloride** | 2.31 |
| **Ethanol** | 2.07 |
| **Trichloroethene** | 1.68 |
| **Ethylbenzene** | 0.88 |
| Tetrachloroethene | 0.12 |
| **1,1,1-Trichloroethane** | 0.08 |
| 1,1-Dichloroethane | 0.09 |
| **1,2,4-Trimethylbenzene** | 0.12 |
| 1,2-Dichloroethane | 0.07 |
| 1,3,5-Trimethylbenzene | 0.10 |
| 2-Hexanone (MBK) | 0.04 |
| **n-propylbenzene** | 0.06 |
| Trichlorofluoromethane (CFC-1 | 0.03 |
| **Isopropylbenzene** | 0.03 |
| cis-1,2-Dichloroethene | 0.02 |
| Chloroethane | 0.02 |
| Benzene | 0.02 |
| Tertiary butyl alcohol | 0.01 |
| Chloromethane | 0.01 |
| Chloroform | 0.01 |
| 1,2-Dichlorobenzene | 0.01 |
| **TOTAL** | **64.32** |

***Notes:***

*1) Anguil assumes the maximum concentrations shown for Trichlorofluoromethane (CFC-11). The RTO materials of construction can withstand the levels shown, but higher levels (>1 ppmv HF post-oxidation) will require further materials of construction considerations as HF attacks the ceramic fiber refractory.*

*2) Anguil assumes there are no siloxanes present in the SVE vapor stream.*

*3) Anguil understands that the 64.32 lb/hr loading is without Tentatively Identified Compounds (TICs) present. It has been noted that TICs comprise approximately 40% of the VOC/HAP load to the RTO. As such, Anguil will base the RTO design on 107.3 lb/hr with a calorific value of 16,100 Btu/lb (derived from the mixture of compounds to the left).*

*4) Anguil understands that the SVE exhaust stream will be maintained to a maximum of 40% LEL by others upstream of the RTO*

*5) Anguil assumes there are no sulfur bearing compounds or siloxanes in the SVE vapor stream.*

*6) Anguil understands the IWAG is doing additional testing on the condensate to determine an accurate composition. If the composition is deemed acceptable, the condensate may undergo an evaporation process, with the resulting vapor stream sent to the oxidizer. Anguil reserves the right to evaluate the vapor stream prior to its introduction into the RTO.*

| Location | Well (scfm) | Dilution (scfm) | Flow (scfm) | lb/hr |
|---|---|---|---|---|
| 06S | 135 | 0 | 135 | 1.60 |
| 06D | 210 | 0 | 210 | 3.04 |
| 07S | 135 | 0 | 135 | 6.18 |
| 07D | 210 | 0 | 210 | 4.78 |
| | | | | |
| 06I | 30 | 60 | 30 | 42.16 |
| 07I | 30 | 90 | 30 | 49.51 |
| | | | | |
| Total System w/TICs Sum of above | 750 | 150 | 900 | 107.3 |
| Total System wo/TICs From Consolidated Tab | 750 | 150 | 900 | 64.4 |

- Facility Operating Schedule: 24 hr/day, 7 day/wk
- Facility Power: 460V / 60 Hz / 3 Ph
- Fuel Source: Natural Gas
- Process Water Content: Assumed saturated
- Process Oxygen Content: Assumed to be 13-16%
- Process Particulate: Assumed to be negligible
- Performance Requirements: 98% VOC Destruction Efficiency per EPA Method 25A

  98% Speciated Destruction Efficiency of the following Compounds of Record or a stack concentration equal to the greater of either the compound's PQL or 3 ppmv (as compound):

  1,1,1-Trichloroethane
  1,2,4-Trimethylbenzene
  2-Butanone (MEK)
  4-Methyl-2-Pentanone (MIBK)
  Ethanol
  Ethylbenzene
  Isopropylbenzene
  Total Xylenes (o, m, p)
  Methylene Chloride (dichloromethane)
  n-Propylbenzene
  Toluene
  Trichloroethene

  RTO opacity shall not exceed 5%, measured in accordance with EPA Method 9.
- RTO location on Site: Outdoors

**Note: Equipment has been designed and sized based on these customer parameters.**

## Process Analysis / Basis of Design

Below are the major design decisions that we have selected and proposed for your project. We have selected what we feel is the most cost efficient design that meets the project performance requirements while offering high reliability and minimizing maintenance.

- FAN LOCATION AND DESIGN
- RTO VALVE TYPE AND LOCATION
- RTO OXIDATION PHILOSOPHY
- RTO MATERIALS OF CONSTRUCTION
- RTO HEAT RECOVERY MEDIA

### FAN LOCATION AND DESIGN

We have proposed an ***induced draft*** arrangement with the RTO System Fan located downstream of the RTO. The RTO produces corrosive hydrochloric acid vapors as the chlorinated hydrocarbons are oxidized. With a forced draft arrangement, the RTO is under a positive pressure. The corrosive gases could tend to leak to atmosphere at the instrumentation (thermocouple) penetrations and other openings, such as access doors. The corrosive gases will condense at these interfaces, corroding the outer shell. An induced draft arrangement is preferred for chlorinated RTO applications as these areas will "leak" into the RTO. Thus, we have proposed an induced draft arrangement for this project.

The base bid includes an induced draft RTO System Fan with 316L stainless steel airstream components.

### RTO VALVE TYPE AND LOCATION

Many types of valves and valve locations have been used to control the process flow into Regenerative Thermal Oxidizers. Diverter valve types include rotary valves, three-way poppet valves, two-way poppet valves, and butterfly valves.

Poppet valves are supplied with the 2 Bed RTO and are faster acting than the butterfly valves, minimizing any leakage from the valves.

### RTO OXIDATION PHILOSOPHY

We have proposed a residence time of 0.8 seconds at 1,650 - 1700°F to achieve an average destruction efficiency of 98%.

The residence volumes are corrected for the actual airflow rate, which is dependent on the oxidation temperature.

## RTO MATERIALS OF CONSTRUCTION

Anguil has provided a couple of different options for upgraded materials of construction to protect against HCl and increase equipment lifetime and reliability.

*HEAT RECOVERY and PURIFICATION CHAMBER SHELL*: The heat recovery and purification chambers are constructed of **A36 Steel**. They are internally coated with a **vinyl ester coating** that provides resistance to HCl corrosion.

*SUPPORT STRUCTURE AND MEDIA SUPPORT GRID*: The ceramic media support grid proposed in the base price shall be constructed from **Hastelloy C-276**. This structure supports the ceramic media. This 'cold face' has the potential to see condensed acid gas. Cold face failure is a catastrophic event in an RTO.

*DIVERTER VALVES*: The poppet valves proposed in the base price shall be constructed from **AL6XN.** The poppet valves see both the inlet and outlet conditions of the RTO. Thus, they will be exposed to acid gases. The poppet valves act as the "heartbeat" of the system. Failure of the poppet valves due to acid corrosion can lead to unexpected shut-down, as well as poppet valve replacement.

*EXHAUST STACK*: Without an acid gas scrubber, the exhaust stack will be metallic. The exhaust stack is constructed out of **316L stainless steel**.

## RTO HEAT RECOVERY MEDIA

The selected heat recovery media includes a 6" layer of ceramic saddles at the top of each heat recovery bed. This layer helps provide uniform flow distribution. Lantec MLM-180 is used as the main heat recovery media. This multilayer media provides high heat recovery with a low pressure drop.

## RTO Design Specifications

Size and Weight

- Maximum Airflow: 2,500 SCFM (Includes Dilution* and Process Flow)

  **NOTE: Dilution air is only used during periods of high VOC loading. Addition of dilution air is automatic, controlled by the PLC based on combustion chamber temperature and/or LEL.*

- Approximate Footprint: 31'-9" x 15'-9"
- Approximate Weight: 33,000 lb
- Stack Height: 30'
- Stack Diameter: 18"
- Oxidizer Control Panel Location: NEMA 3R control panel located on the oxidizer skid
- Suggested Foundation Size: 38' x 22'

Utilities Required

- Fuel Requirements: 5 psig (1,000 scfh)
- Electrical Power: 460V / 60 Hz / 3 Ph (174.8 FLA)
- Required Compressed Air: 80-100 psig (-40°F dewpoint) 5-10 SCFM
-

Operation Information

- VOC Destruction Efficiency: 98% or an outlet concentration of 20 ppmv as C1 (methane), whichever is less stringent per EPA Method 25A.

  98% Speciated Destruction Efficiency of the following Compounds of Record or a stack concentration equal to the greater of either the compound's PQL or 3 ppmv (as compound):

  1,1,1-Trichloroethane
  1,2,4-Trimethylbenzene
  2-Butanone (MEK)
  4-Methyl-2-Pentanone (MIBK)
  Ethanol
  Ethylbenzene
  Isopropylbenzene
  Total Xylenes (o, m, p)
  Methylene Chloride (dichloromethane)
  n-Propylbenzene
  Toluene
  Trichloroethene

- RTO Opacity: RTO opacity shall not exceed 5%, measured in accordance with EPA Method 9.

- Nominal Thermal Efficiency (TE): 95%
- RTO System Fan Draft Design: Induced
- System Process Fan HP: 50 HP
- Combustion Fan HP: 3 HP
- Burner Installed Maximum Capacity: 1.0 MM BTU/hr
- Operating Set Point: 1,650-1,800°F

*NOTE: Minimum operating set point temperature may be lowered if determined through source testing that required DRE is met with a lower temperature*

***Note: All weights, dimensions, horsepower ratings, burner sizing, and specific engineering details within the proposal are approximate and will be confirmed by Anguil Environmental following order placement.**

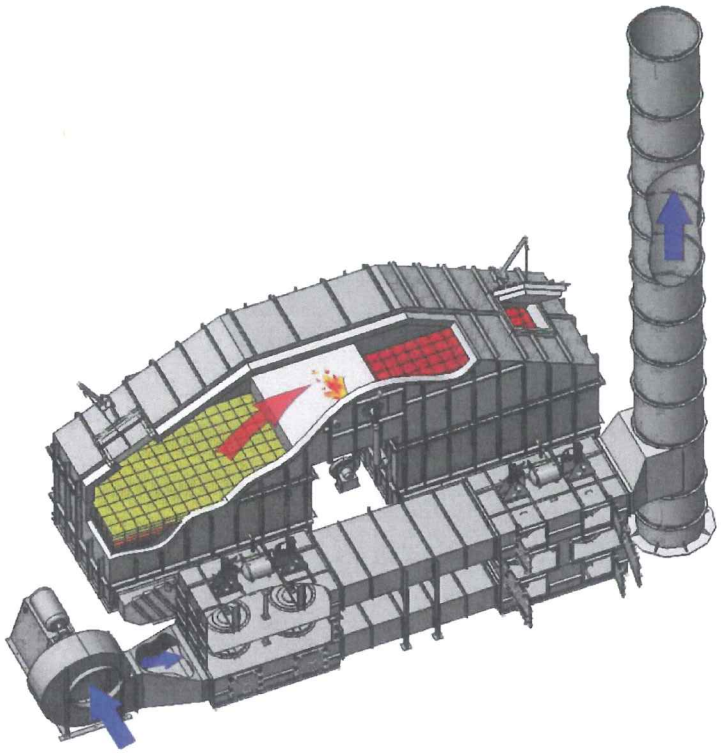
## RTO Equipment Specifications

The Anguil Regenerative Thermal Oxidizer (RTO) destroys Hazardous Air Pollutants (HAPs), Volatile Organic Compounds (VOCs) and odorous emissions that are discharged from industrial processes. Emission destruction is achieved through the process of high temperature thermal or catalytic oxidation, converting the pollutants to carbon dioxide and water vapor while reusing the thermal energy generated to reduce operating costs.

**How the RTO Works-**

VOC and HAP laden process gas enters the oxidizer through an inlet manifold to flow control, poppet valves that direct this gas into energy recovery chambers where it is preheated. The process gas and contaminants are progressively heated in the ceramic media beds as they move toward the combustion chamber.

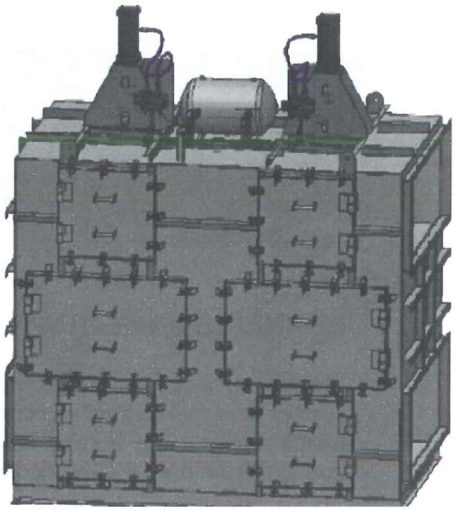
Once oxidized in the combustion chamber, the hot purified air releases thermal energy as it passes through the media bed in the outlet flow direction. The outlet bed is heated and the gas is cooled so that the outlet gas temperature is only slightly higher than the process inlet temperature. Poppet valves alternate the airflow direction into the media beds to maximize energy recovery within the oxidizer. The high energy recovery within these oxidizers reduces the auxiliary fuel requirement and saves operating cost. The Anguil oxidizer achieves high destruction efficiency and self-sustaining operation with no auxiliary fuel usage at concentrations as low as 3-4% LEL (Lower Explosive Limit).



## POPPET VALVES

Anguil's poppet valves are uniquely designed to divert high volume process air into and out of the oxidizer, properly balance VOC loading, maintain destruction efficiency and optimize heat recovery. We custom design, manufacture and install these vital components to ensure reliability and trouble free operation. Anguil has several poppet assemblies that have been operating continuously since 1993 and have required nothing but regular maintenance.

### SPECIFICATIONS



- **AL6XN Shaft, Disk & Seat**
- Poppet Box Body: **AL6XN**
- Cylinder Actuator Supports: 1/4" Plate Steel
- Parker Hannifin Heavy Duty Pneumatic Cylinder:
  90 psi, 10 CFM, -40°F
- Heavy Duty, High Flow, 4-way Versa Solenoid Valve
- Bolted Actuator Mountings with Shaft Guarding
- Connecting Duct Work to Fan and Exhaust Stack
- Compressed air Accumulator Tank Included
- End of Stroke Switches
- Solenoid Valve Exhaust Flow Control

### FEATURES

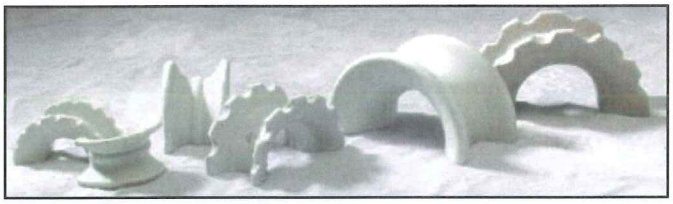
- Vertical Shaft
- Double Acting, Three-way Air Flow Design:
- Reliable Metal to Metal Seal:
  1MM+ cycles
- Removable Machined Seats:
  <0.25% leakage at 18" W.C.
- Valve Pressure Drop: Maximum of 2" W.C.
- Rectangular Ports for Inlet/Outlet Ducting
- Removable Actuator Mounting
- Hinged Access Doors
- Lockout Device with Padlock Provision
- Quiet Operation
- Over Temperature Protection
- Short valve switch distance

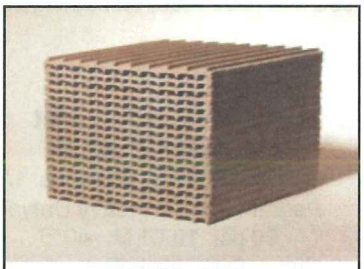
### ADVANTAGES

**Energy Efficient** – Compressed air consumption to switch solenoids from closed to open position is minimal
**Dependable** – Two-disc system minimizes valve switch distance and wear
**Ease of Maintenance** – Multiple hinged access doors make occasional cleaning and bearing maintenance easy

## HEAT TRANSFER MEDIA

- Two (2) beds of high temperature structured heat transfer media and ceramic saddles
- Both elements are chemically and thermally stable for rapid heat up and cool down
- Ceramic media designed to provide optimum heat transfer surface area
- Media bed for proper air distribution and optimum RTO performance
- Low system designed pressure drop





**MLM-180**
(US Patent No. 6,071,593)

## BURNER(S)/FUEL TRAIN

The burner installed capacity is higher than required during normal operation. This allows the system to respond rapidly to significant airflow increases, preventing loss of proper RTO operation temperatures. The burner capacity is also sufficient to maintain system operating temperature during full airflow, VOC free conditions.

- Maxon Kinemax burner
- Fuel Train fabricated to FM Global specifications
- Service platform and ladder
- 3" burner view port
- Fireye flame safety control with self-checking dynamic UV scanner

## COMBUSTION AIR FAN

- Twin City Fan, New York Blower or equal
- Pre-piped and pre-wired
- TEFC motor
- Inlet filter
- Independent controlled fuel and combustion air valves

## FRESH AIR/PURGE DAMPER

- Used during oxidizer start-up, shut down or purging during idle time
- Allows for safe start-up and shut-down on ambient air
- Fresh air/purge damper is also used if dilution air is required during periods of high VOC loading or low process flow
- The damper is controlled by a signal from the PLC
- **80 kW Electric heater to be provided to pre-heat fresh air prior to entering the RTO, minimizing condensation when dilution air and SVE exhaust mix**
- **Fresh air filter included**

*NOTE: Dilution air is only used during periods of high VOC loading. Addition of dilution air is automatic, controlled by the PLC based on combustion chamber temperature and/or LEL.*

## RTO SYSTEM FAN

The RTO System Fan is sized to induce flow through the RTO.

- Twin City Fan
  - Model: 421 MBR – Heavy Duty Pressure Blower, High Pressure Air Handling
  - Arrangement: 1
  - Access Door – Bolted
  - Drain w/ Plug
  - Flange – Inlet, Punched with Companion Flange
  - Flange – Outlet, Punched with Companion Flange
  - Guard – Belt, OSHA Type
  - Guard – Shaft & Bearing
  - Guard – Cooler
  - **High Temp Construction (601-800°F)**
  - **High Temp Grease Bearings**
  - **High Temp Pedestal per Standard E1-83**
  - **316L Stainless Steel Airstream Components including Shaft & Accessories**
  - Shaft Seal – Standard Type
  - Shaft Cooler
  - Extended Lube Lines to Drive Side
  - Motor Slide Base or Rails (Built In) For Fan Base
  - Base – Unitary (No Isolators)
  - Special Paint on all Guards – OSHA Yellow
  - High Temp Aluminum Paint (to 800F) – Entire Fan
  - Fixed Speed V-Belt Drive, 1.5 SF
- VFD rated, TEFC motor
- Flexible connection on inlet/outlet of fan

## SYSTEM CONTROLS

The system controls are located in a **heated and air conditioned NEMA 3R control panel enclosure mounted on the oxidizer skid**. In the event of a system shutdown, the touch screen will indicate the cause of the shutdown via a digital message in English.

- **Temperature controlled NEMA 3R control panel enclosure to be mounted on the oxidizer skid**
- Allen Bradley CompactLogix PLC (Programmable Logic Controller) controls
- Allen Bradley 10" Color Touchscreen HMI
- Digital chart recorder: monitors combustion chamber and exhaust stack temperatures
- Ethernet modem for remote diagnostics and service support
- **A Modbus card is included for TCP/IP communication with existing Campbell data logger**

## VARIABLE FREQUENCY DRIVE (VFD)

The variable frequency drives regulate the airflow through the system. The VFDs are mounted with the system controls in the control enclosure. They aid in minimizing operating cost by providing system fan turn-down during periods of low process flow.

- Mounted in an **Anguil supplied NEMA 3R enclosure with air conditioner**
- **VFDs will be supplied for the RTO System Fan and Combustion Air Fan**

## ENERGY RECOVERY CHAMBERS

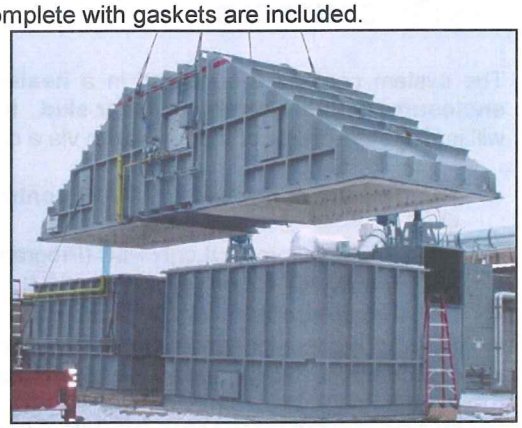
The RTO's energy recovery chambers are rectangular cross-sections constructed of **vinyl ester coated carbon steel**. They are reinforced to withstand the pressure requirement of the process air fan and all other applied loads. A carbon steel support structure is also provided to support the oxidizer chambers, media support grid and the ceramic heat recovery media itself. In order to allow for routine inspection of the heat recovery media, cold face and media support grid, two hinged access doors complete with gaskets are included.

- Two (2) **vinyl ester coated carbon steel** energy recovery chambers
  - Internally insulated: 6" thick, 8# density ceramic module insulation
  - Insulation rated for 2300°F
  - Insulation modules: shop installed with 310 stainless steel reinforcements and mounting hardware
- **Hastelloy C-276 Support Structure**
- **Hastelloy C-276 Media Support Grid**
- Two hinged access doors with gaskets

## COMBUSTION CHAMBER

The combustion chamber is a rectangular cross-section constructed of **vinyl ester coated carbon steel** and reinforced to withstand the pressure requirements of the process air fan and all other applied loads. The inverted "U" shape design provides the retention time to obtain the specified VOC destruction efficiency. In order to allow for routine inspection of the heat recovery media, insulation and burner, two hinged access doors complete with gaskets are included.

- Inverted "U" shaped oxidation chamber
  - Internally insulated: 8" thick, 8# density ceramic module insulation
  - Insulation rated for 2300°F
  - Insulation modules: shop installed with 310 stainless steel reinforcements and mounting hardware
- Hinged access doors with gaskets



## EXHAUST STACK

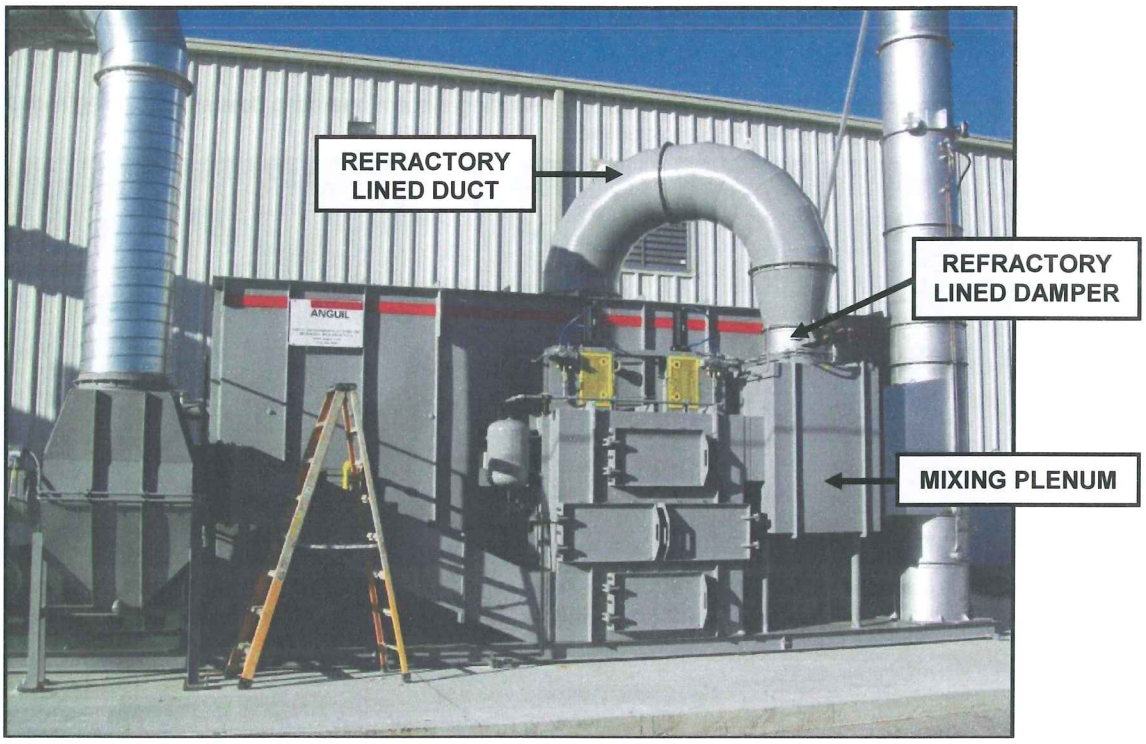
- **Constructed of 316L Stainless Steel**
- **Free standing construction**
- Two (2) EPA tests ports: 90° to each other

## HOT SIDE BYPASS

Due to the high internal heat recovery provided by RTO technology, the oxidizer will enter a self-sustaining mode, whereby no auxiliary fuel is required at VOC concentrations as low as 3-4% LEL. At higher VOC loadings, the unit can experience a high temperature shutdown if the RTO has no means of removing the additional energy from VOC oxidation.

The hot side bypass, during periods of high solvent loading, provides a means of removing energy from the RTO combustion chamber to prevent high temperature shutdowns. It diverts combustion chamber flow to the RTO exhaust, reducing the amount of heat that gets stored in the outlet media bed. When the flow direction switches, there is less heat stored in the new inlet bed, which prevents the combustion chamber temperature from exceeding the high temperature limit.

- 330 stainless steel shaft and blade
- Hot Bypass Damper internally lined with hard refractory
- Damper position controlled by PLC and driven with pneumatic actuator with positioner
- Refractory-lined bypass duct to mixing plenum on grade provides necessary residence time to achieve required destruction efficiency
- **Carbon steel bypass duct internally coated with vinyl ester coating to prevent corrosion**
- Duct and valve sized based on maximum temperature of 1800°F



## SUPPLEMENTAL FUEL INJECTION SYSTEM (SFI)

The Anguil Supplemental Fuel Injection (SFI) system is designed as a high efficiency means of controlling the RTO reaction chamber temperature. During system operation, when appropriate safeties have been satisfied, the burner and combustion air systems are turned off and the RTO combustion chamber temperature is maintained by injecting natural gas directly into the VOC laden airstream – typically at the inlet of the RTO system. The benefits of SFI are:

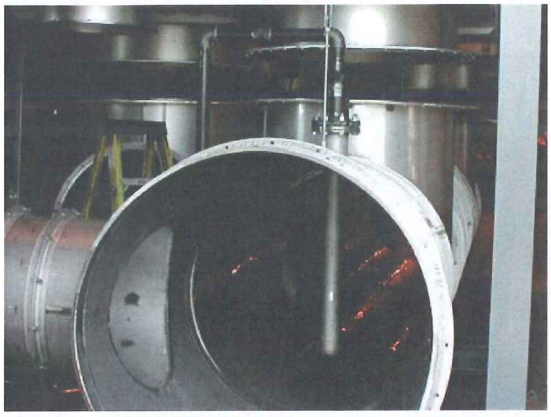
- **Provides high fuel efficiency by reducing combustion air**
- **Provides ultralow NOx emissions with flameless operation**
- **Provides a more uniform temperature profile throughout the RTO**

All natural gas injection systems enjoy these benefits, but not all systems are created equally. To date, Anguil's level of safety and controls for natural gas injection have been unmatched by our competitors.

A few of the highlights are:

- Some gas injection systems are designed as solenoid-type full-on or full-off systems. Anguil uses a modulating injection valve for more precise control.
- Some gas injection systems are not designed for proper mixing of the natural gas with the VOC laden airstream. Anguil's SFI system is designed with multiple levels of safeties and a custom designed injection quill to ensure a well mixed airstream is delivered to the RTO chamber.

Natural gas injection is an excellent means of reducing system operating cost and providing a cleaner "burn" when properly designed and applied.



**Supplemental Fuel Injection (SFI)**
**Custom Designed Injection Quill**

**Supplemental Fuel Injection (SFI)**
**Additional Fuel Train Piping**

## HIGH TEMPERATURE INSULATION & CLADDING

Due to the high moisture content of the SVE Vapor process steram and the presence of hydrochloric acid, Anguil shall provide external insulation and cladding to critical, uninsulated areas of the oxidizer. The insulation and cladding will help to keep the metal temperature above the dewpoint. Additionally, it will provide personnel protection, especially during high VOC loadings or a high temperature bake out. The following components should be externally insulated and clad:

- Poppet Valves
- RTO System Fan
- Lower Cold Face
- Lower 10' of Exhaust Stack

## LEL MONITOR

**PrevEx Model SNR672** drawn sample heated (250°F) sensor assembly

- Duct-mountable
- Integrated monitor with 5 relays
- 4-20mA output and RS-485 serial port (Modbus)
- Auto-calibration solenoids
- NEMA 4X housing
- Concentric sample/exhaust probe assembly
- Calibration Kit with regulator and span gas cylinder
- Hydrogen fuel delivery system (hydrogen tanks by others)
- Compressed air filter
- Stainless sintered end-of-line sample filter
- **Includes LEL Commissioning**

*NOTE: LEL Monitor shall be shipped loose for mechanical/electrical installation by others*

## BAKE OUT

The oxidizer can be operated off-line from the process in a bake-out mode to allow for the removal of organic build-up on the cold face of the heat exchange media. At a reduced airflow, the outlet temperature is allowed to reach an elevated temperature before the flow direction is switched. This hot air vaporizes organic particulate that may have collected on the cold face of the heat exchange media. The flow direction is then switched and the opposite cold face is cleaned. The area below the media support grid will be insulated to prevent the temperature of the outer skin from increasing during bake-out.

## PAINTING

All exposed surfaces of the oxidizer shall be primed coated with a high solids epoxy coating. The finish coat shall be a gloss high solids polyurethane multi-function weather resistant coating. The natural gas and compressed air piping will be primed and painted with one (1) coat of Anguil's standard coating. All other equipment will be the manufacturer's standard paint and color. Prior to painting, all welds will be caulked.

- UV resistant polyurethane paint
- Paint color can be specified by the customer

## START-UP AND TRAINING SERVICES

- Service technician will be provided for up to **six (6), eight-hour consecutive days** to start-up and balance the oxidizer
- 1 day of operator training will be conducted during start-up. Training to include ½ day classroom sessions and on unit training.
- In the event start-up is not completed due to the fault of Anguil, Anguil will remain on site at our cost.
- In the event that customer process is not available during start-up, a return trip may be required to start the unit on process air.

## OPERATION & MAINTENANCE MANUALS

- Anguil to provide a link to the Operation and Maintenance manual, available for electronic download. Paper hard copies available by request only.
- USB flash drive of all vendor bulletins

## FINAL ASSEMBLY AND SHOP TEST

We pre-assemble and pre-test modular components in our factory to provide significant savings of time and money during installation and start-up. Units are prewired and pre-piped at the factory for improved quality control and trouble-free start-up.

- Temporary assembly of system
- Inspection of the unit for manufacturing quality
- Check fuel and electrical connections
- Starting of burner and fuel train
- Warning labels are installed
- Test ports are installed
- Run electrical rigid conduit
- Fans and motors installed, cleared of debris and checked for quality
- Temporary wiring of components that are shipped loose from the RTO skid
- Valves to be cycled and set
- Customer is invited to witness shop testing

## RTO Outdoor Installation Specifications

Regenerative Thermal Oxidizer shall be installed outdoors on a concrete pad. Installation is based on free and clear access to the site.

**INSTALLATION SUPERVISION**

- An Anguil approved Project Installation Manager shall manage and supervise the oxidizer installation work
- Travel and living expenses included

**GENERAL SCOPE AND ASSUMPTIONS**

- Any required landscaping will be completed by the owner
- Access will be available to the work area for installation of the RTO and scrubber
- Access will be available to owner's sanitary facilities
- Water is available on site
- All utility runs and connections by others (natural gas, compressed air, water, power)
- Process piping/ductwork to Anguil equipment by others
- All permit fees by others
- Anguil shall provide cranes, lifts and equipment necessary for the installation of all Anguil provided equipment
- Anguil shall provide dumpsters as necessary during installation
- All work based on straight time, no overtime included
- Existing base is assumed adequate to support the foundation and RTO – no soil testing has been performed or is included

**CONCRETE SCOPE (quoted as a line item)**

- Engineering for concrete design

**EQUIPMENT INSTALLATION SCOPE**

- Equipment and labor to unload and install one 2,500 SCFM RTO with scrubber consisting of the following:
    - One (1) RTO Skid Assembly with media-preloaded
    - One (1) RTO Combustion Chamber
    - One (1) Burner Access Platform
    - Hot Gas Bypass Ductwork and Damper
    - One (1) Electric Dilution Air Heater
    - One (1) Exhaust Stack
- Reassemble listed pieces
- Furnish and install anchor bolts for the RTO and fans
- Shim and grout as required
- Finish/touch-up painting as required after installation is complete

**ELECTRICAL SCOPE**

- Reconnect wires that were disconnected for shipping.

## Items Not Included

- Concrete Pad
- Supply of calibration gas or hydrogen tanks for LEL monitor
- Soil testing for concrete pad
- Concrete pad (quoted as a line item)
- HAZOP participation (quoted as a daily rate)
- Interconnecting wiring between control panel and process equipment / tee dampers
- All natural gas piping to RTO fuel train
- All compressed air piping to RTO air train (-40F dewpoint requirement) and tee dampers
- Power source to RTO control panel
- Ductwork/dampers from process to oxidizer inlet
- Oxidizer recirculation fan, system fan and combustion air fan disconnects not included
- Personnel protection, security fencing and lighting
- Moving of oxidizer obstructions, fencing, landscaping, etc.
- Multiple installation trips if delays beyond Anguil's control
- All roof and building penetrations
- All fire suppression piping and controls
- All required sound abatement equipment
- Compliance testing
- Phone line to modem
- Taxes, permits
- Overtime, holiday or weekend work

## Pricing and Delivery

One (1) Anguil Model 25 Regenerative Thermal Oxidizer will process up to 2,500 SCFM of VOC laden air, providing 98% destruction efficiency.

| | |
|---|---|
| **EQUIPMENT PRICE**<br>F.O.B. (Origin), Freight Prepaid & Add to the invoice | **$ 720,900.00** |
| **INSTALLATION PRICE** | **$ 79,600.00** |
| **HAZOP/LOPA PARTICIPATION** | **$1,400/day + travel and living** |
| **ON-SITE COMPLIANCE TESTING** | **$1,200/day + travel and living** |
| **PACKAGING AND FREIGHT** | Billed at Cost +10% handling fee<br>*(Estimated at $13,500)* |

**OPTIONAL ADDERS**

| | |
|---|---|
| **CONCRETE PAD DESIGN** | **$ 4,400.00** |

**SHIPMENT:** 20-24 Weeks after approval of drawings (General Arrangement and Process and Instrumentation Diagram)

****Due to the rapidly changing market price of metals, Anguil reserves the right to adjust the final price of the equipment accordingly to account for market price.**

**TERMS:**
30% down payment due upon order placement
30% due 8 weeks after receipt of purchase order, net 30
30% due prior to shipment or notification of readiness to ship
10% due upon start-up, not to exceed 60 days from shipment, net 30

ALL PRICES HAVE BEEN QUOTED IN US DOLLARS
ALL PRICES WILL REMAIN FIRM FOR 60 DAYS;
THEREAFTER, A RE-QUOTE MAY BE REQUIRED

## Field Service Rates 2016

**Field Service Engineer and Installation Supervision**

| | |
|---|---|
| Straight Time (weekdays, 8 hours/day; min. of 8 hours) | $1,200/day |
| Overtime (more than 8 hours/day and Saturdays) | $200/hour |
| Sundays and Holidays | $220/hour |
| Emergency Service Rate (site visit within 48 hours of call) | $200/hour |
| Controls Field Service Engineer | $210/hour |
| Travel Time | $100/hour |
| Trip Preparation | $100/visit |
| Report Writing | $100/visit |
| International Labor Rate | $1,325/day |
| Technical Phone Support | $100/hour |

**Project Engineer**

| | |
|---|---|
| Principal Engineer (weekdays, 8 hours/day; min. of 8 hours) | $1,400/day |
| Project Engineer (weekdays, 8 hours/day; min. of 8 hours) | $1,200/day |
| Electrical Engineer / Programming | $175/hour |

**Travel and Living Expenses**

| | |
|---|---|
| Airline ticket | Cost + 15% Administrative fee |
| Hotel | Cost + 15% Administrative fee |
| Car rental | Cost + 15% Administrative fee |
| Meal allowance | $45/day |
| Meal allowance – International | $65/day |
| Airport parking | $20/day |
| Extra Luggage (tools, etc.), roundtrip | $100/trip |
| Mileage | $0.80/mile |

| | |
|---|---|
| **Start-Up and Training Services** | **$1,200/day plus travel and living exp.** |
| **International Start-Up and Training Services** | **$1,325/day plus travel and living exp.** |

Equipment will be checked mechanically and electrically and all operational data will be verified

- Field service engineers will be provided to start-up and balance the oxidizer
- Operator training conducted during start-up. Training includes classroom sessions and on unit training.

**Terms**
Net 30 days
Terms subject to change upon credit review

**2016 Holiday Schedule (premium rates apply)**
New Years Day
Good Friday
Memorial Day
Independence Day
Labor Day
Thanksgiving (2 days)
Christmas (3 days)
New Years Eve

## Terms and Conditions

**1. General**

Anguil's prices are based on these terms and conditions of sale. These terms and conditions may not be modified unless prior written agreement is reached between both Anguil and Purchaser and signed by an authorized representative of Anguil.

**2. Warranty**

Any contract resulting from this proposal will require start-up assistance to validate our warranty. This will require a technical service representative to be present at the time of initial start-up and must give release of operation of the equipment in accordance with the Seller's operating and maintenance manual.

Anguil Environmental Systems, Inc. (ANGUIL) warrants to the buyer that the products delivered will (a) be free from defects in material and manufacturing workmanship (b) conform to manufacturer's applicable product descriptions attached to Seller's quotation. If no product descriptions or specifications are attached to the quotation, manufacturer's specification in effect on the date of shipment will apply.

The product warranties are for a period of 12 months from the date of start-up, if start-up is within thirty (30) days of shipment or 15 months from date of shipment, whichever shall occur first. The product warranties will apply provided the following conditions:

- The equipment is operated and maintained as described in the Anguil operating manual provided with the equipment
- Recommended routine maintenance must be performed and documented per Anguil instructions at recommended intervals.
- This warranty does not apply to heat damage that may occur due to improper use of the RTO, or due to fires that may occur due to excessive buildup of organic matter in the process ductwork.

**Warranty Exclusions**

Warranty coverage does not include: (a) freight, labor, travel, and living expenses associated with parts replacement, (b) normal maintenance items such as fan belts, fuses, light bulbs, spark igniters, bearings, seals, gasket, lubrication and cleaning of the equipment, (c) abrasion, corrosion or negligence in operating the equipment on the part of Buyer or Buyer's subcontractor(s).

In the event the customer, or any installation contractor employed by the customer, contracts outside ANGUIL for installation work or erection of quoted equipment, the customer will assume full responsibility for workmanship resulting from said contract.

**3. Performance Guarantee**

**Anguil guarantees the conversion efficiency and low concentration stoppers as stated in the proposal.**

- **The test methods to be used to show compliance are:**
  - **US EPA Method 25A for Bulk VOC Destruction Efficiency**
  - **SW-846 Test Method 8260 for Speciated VOC Destruction Efficiency**
  - **US EPA Method 9 for Opacity**
- Anguil requires seven (7) days notice of the official testing to meet DRE guarantee. Anguil reserves the right to review of the test protocol prior to official testing to and to have personnel present at the official compliance test.
- Equipment is operating in accordance with Seller's written operating and maintenance instructions.
- Anguil shall rely on process and chemical information provided by Purchaser or its agents and not be liable for undisclosed or unknown process or chemical materials.

**4. Prices / Taxes**

Prices are quoted in U.S. dollars and may be accepted only within 60 days from date of quotation by Anguil. Anguil reserves the right to adjust the final price of the equipment according to the market price of metals. Any sales, use or other taxes and duties imposed on this sale are not included in the quoted price. If this order is placed from one of the following states; AZ, CA, GA, IL, KY, LA, MA, MI, NJ, NY, PA, TX, WI; and is taxable, sales tax can be added and will be billed separately to the Purchaser. Anguil will accept a valid exemption certificate from the Purchaser for those orders not taxable. If this order is placed from a state not listed, the Purchaser must provide one of the following; 1) Tax exempt certificate; 2) Pollution control exclusion certificate or 3) Self assessment letter to Anguil.

**5. Cancellations**
Orders canceled by Purchaser must be in writing and will be subject to a cancellation fee on the following basis: On any orders canceled prior to the procurement of material and the commencement of fabrication the Purchaser will be subject to a cancellation fee of 15% of Contract value to cover costs incurred for Engineering services plus overhead and reasonable expenses including rep commission made or incurred by Anguil in the initial processing of the order. On orders cancelled after the initiation of production, payment shall be made on the basis of actual cost of labor, materials, components (cancellation fees if applicable) and work in progress plus overhead expenses. Upon written receipt of cancellation, Anguil will immediately stop all work except that necessary to effect termination.

**6. Engineering Submittals**
Anguil will provide layout drawings to the Purchaser for approval and the Purchaser will be asked to comment on these drawings in regards to scope of work, dimensions, site interferences or specifications agreed upon at the time of sale. Approval of Purchaser does not relieve Anguil of obligations to perform to all other specifications of the contract. Final layout drawings will be used to prepare the fabrication drawings after they are returned with the Purchaser's approval.

Anguil will provide Process and Instrumentation Diagrams (P&ID) for approval and the Purchaser will be asked to comment on these drawings in regards to process verification, scope of supply, system features and instrumentation. Approval of Purchaser does not relieve Anguil of obligations to perform to all other specifications of the contract. Final P&ID drawings will be used to prepare the electrical schematics and controls after they are returned with the Purchaser's approval.

All additional Engineering and or drafting costs associated with revising the layout drawings or P&ID as a result of changes requested by Purchaser after initial approval will be considered a Change Order and quoted to the Purchaser at Anguil's prevailing per hour rates. If any such changes cause an increase in the cost or time required for performance, a Change Order will be submitted for Purchase approval. Upon receipt of written approval, Anguil will be granted the authority to proceed with agreed upon changes.

**7. Shipping Schedules**
Anguil will use its best efforts to meet delivery dates agreed to pursuant to the order of which these terms are a part. Anguil shall not be liable for any delay in delivery when such a delay is, directly or indirectly, caused by fires, floods, terrorism, accidents, riots, government interference, strikes, shortage of labor, materials or supplies, delays in transportation or any other causes beyond the reasonable control of Anguil. In the event of delay in performance due to any such cause, the date of delivery or time for completion will be adjusted to reflect the length of time lost by reason of such delay.

If a delay in shipping is requested less than 6 weeks prior to shipment, Anguil will complete the system and invoice any "prior to shipment" payment milestone which will be due at the time of the original scheduled ship date. Upon completion of the system, Anguil at its option may place the equipment in storage facilities and the Purchaser will pay the cost of storage, special handling fees and insurance. Equipment held for the Purchaser shall be at the risk of the Purchaser.

**8. Acceptance and Testing of Equipment**
Purchaser will upon delivery inspect and test the equipment and notify Anguil in writing within 30 days of installation or 90 days of shipment, whichever comes first, of all defects discovered including failure of the equipment to meet quoted performance standards. Failure to give such notice constitutes an irrevocable acceptance of the equipment and the equipment will be deemed to conform with the terms of this Agreement, and Purchaser will be bound to pay for the equipment. Upon notification of a defect as above provided, Anguil will repair the equipment and correct the system's performance.

**9. Risk of Loss**
Quotations are F.O.B., place of shipment, unless otherwise noted. The risk of loss of the equipment shipped will pass to Purchaser upon Anguil's delivery of the equipment to a carrier. Claims for damage in shipment must be filed by Purchaser with the carrier.

**10. Limitation of Liability**

*In no event will Anguil, its subcontractors, or representatives be held responsible, or liable for any claim, whether in warranty, contract, tort or strict liability for any special, indirect, incidental or consequential damages resulting from the purchase of equipment (including but not limited to incidental or consequential damages for labor, lost profits, lost sales, injury to person or to property or any other incidental loss or damages).*

*Purchaser agrees that Purchaser's exclusive remedy and Anguil's sole liability on any such claim will be limited to reimbursement from Anguil of the purchase price actually received by Anguil from Purchaser for the equipment in question.*

*Anguil shall rely on process and chemical information provided by Purchaser or its agents and not be liable for undisclosed or unknown process or chemical materials (Please refer to Customer Process Specifications section in the proposal).*

**11. Security Interest**

Purchaser grants Anguil a security interest in the equipment to secure payment of the balance due hereunder. Purchaser authorizes Anguil to file this Agreement as a Financing Statement or to sign on behalf of Purchaser and file any other Financing Statements with respect to the equipment in any place Anguil deems necessary.

**12. Attorney's Fees**

Purchaser will be liable for all reasonable expenses and attorney's fees incurred by Anguil in enforcing its rights and remedies under this Agreement.

**13. Ordinances**

Any and all required licenses, certificates and operating permits will be the sole responsibility of the Buyer unless otherwise specified by Anguil.

**14. Miscellaneous**

The terms and conditions contained herein and any other terms and conditions stated in Anguil's proposal or specifications attached hereto will constitute the entire agreement between Anguil and Purchaser. The terms and conditions stated herein are applicable to all orders accepted by Anguil unless otherwise specifically agreed to by Anguil in writing. Purchaser will be deemed to have assented to all such terms if any part of the described equipment is accepted. If Purchaser finds any terms not acceptable, Purchaser must so notify Anguil within 15 days. Any additional or different terms contained in Purchaser's order to response hereto will be deemed objected to by Anguil and will be of no effect. This proposal and its acceptance will be governed in all respects by the laws of Wisconsin. In the event of a breach, both parties agree that any suit will be brought in the jurisdiction of the Courts of Wisconsin.

**15. Destination Control Statement**

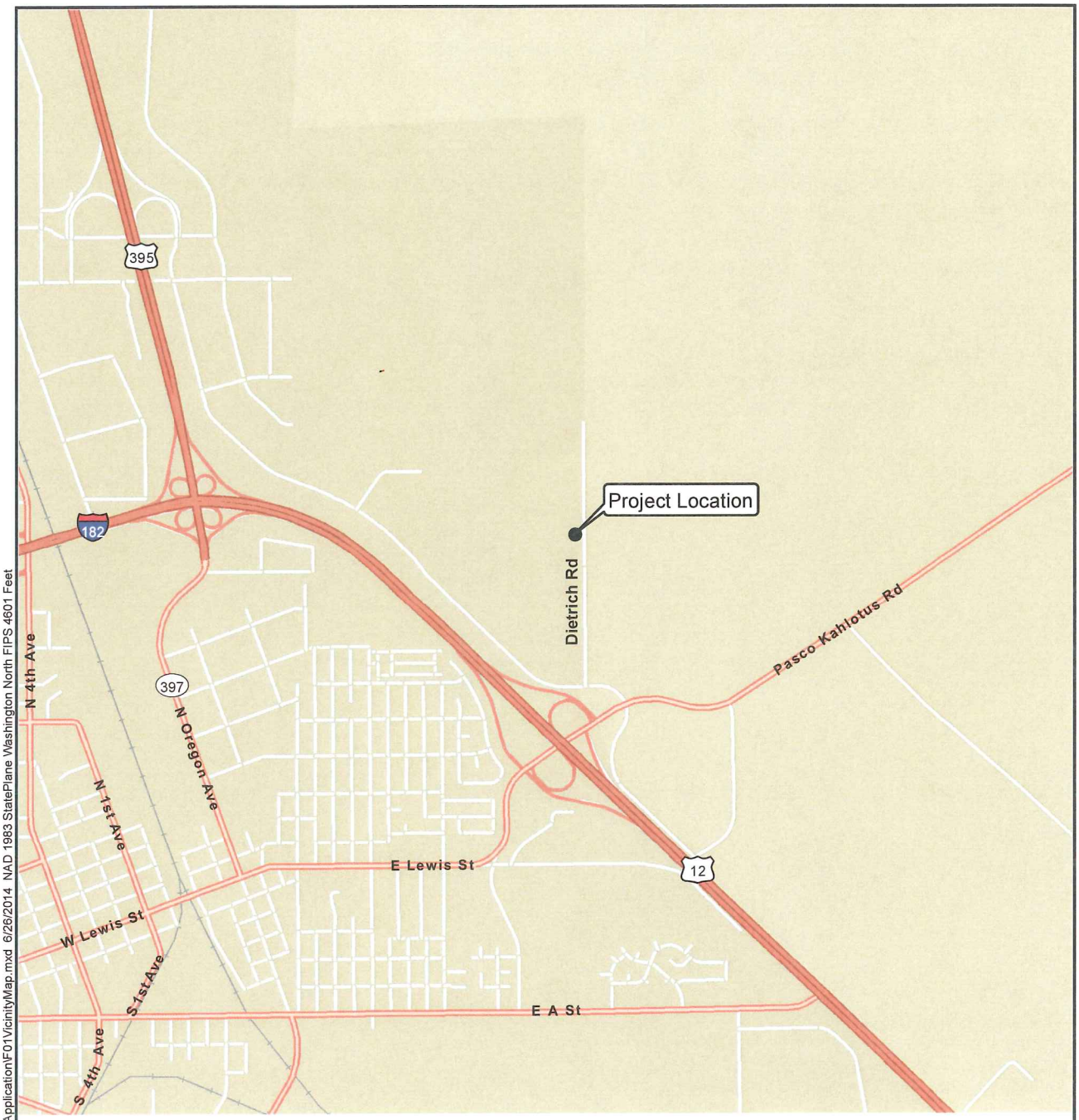
These commodities, technology or software will be exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

**ORDER ACCEPTED BY:**

| ANGUIL ENVIRONMENTAL SYSTEMS, INC. | | BUYER: | |
|---|---|---|---|
| BY: | _____ | BY: | _____ |
| PRINT: | _____ | PRINT: | _____ |
| TITLE: | _____ | TITLE: | _____ |
| DATE: | _____ | DATE: | _____ |

# Appendix B

## Existing RTO NOC Application Reference Material

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0 0.5 1

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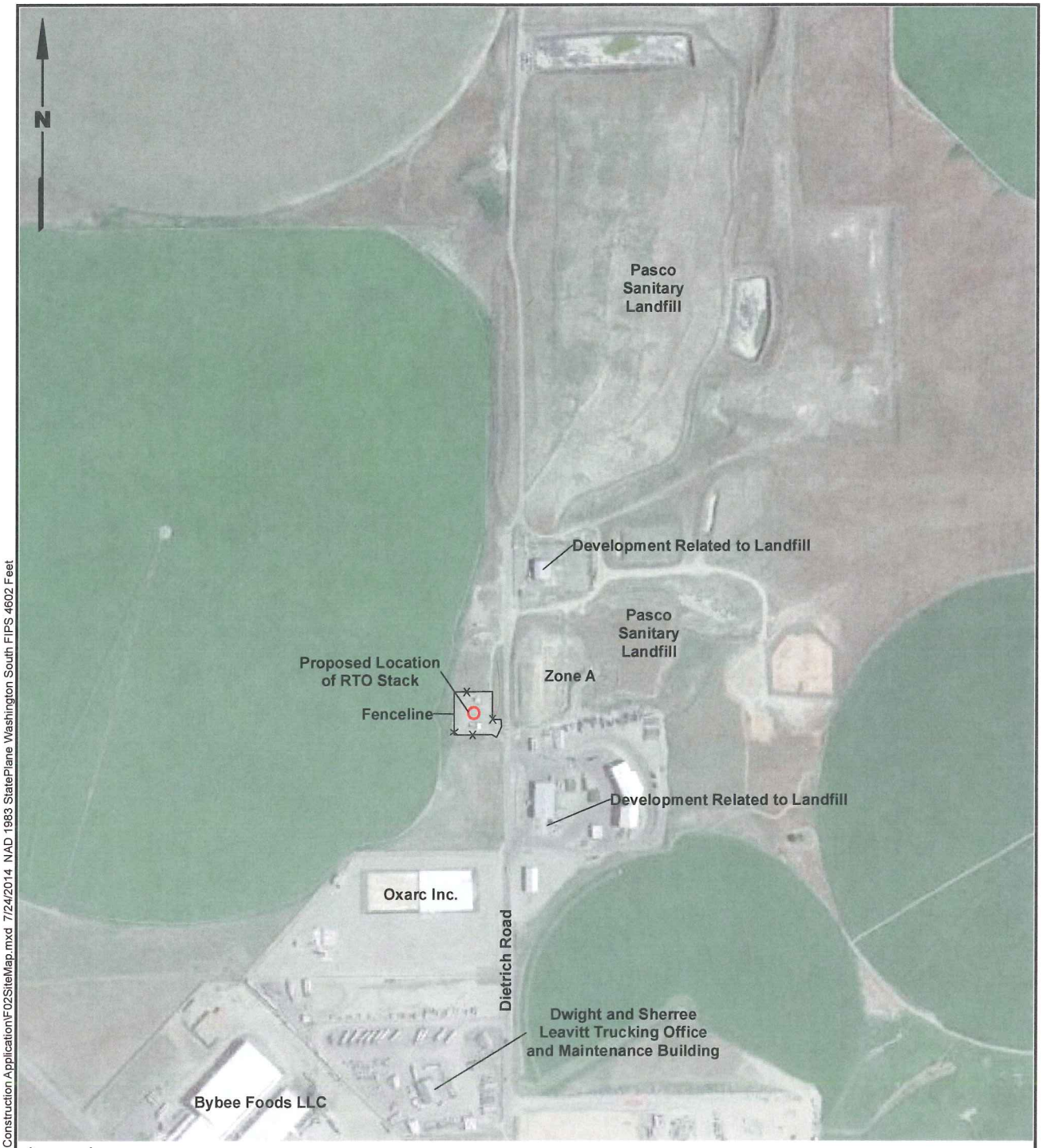
Data Source: Esri 2012

G:\Projects\1295\001\010\014\Notice of Construction Application\F01VicinityMap.mxd 6/26/2014 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

| Pasco Sanitary Landfill<br>Pasco, Washington | **Vicinity Map** | Figure<br>1 |
|---|---|---|

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco, Washington, dated October 23, 2014




G:\Projects\1295\001\010\014\Notice of Construction Application\F02SiteMap.mxd 7/24/2014 NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

- Proposed Location of RTO Stack
- Fenceline

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 600 1,200

Scale in Feet

Data Source: 2014 Google © USGS

LANDAU ASSOCIATES

| Pasco Sanitary Landfill<br>Pasco, Washington | **Site Map** | Figure<br>2 |
|---|---|---|

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco, Washington, dated October 23, 2014


Data Source: Environmental Partners Inc.

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco, Washington, dated October 23, 2014

| | | |
|---|---|---|
| Pasco Sanitary Landfill<br>Pasco, Washington | **Soil Vapor Extraction System** | Figure<br>3 |

LANDAU ASSOCIATES

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# TABLE 1
## EMISSION RATES FOR REGENERATIVE THERMAL OXIDIZER PROCESS STREAM
## PASCO SANITARY LANDFILL
## PASCO, WASHINGTON

| SVE Vapor Analytical Data | | | Untreated Emissions | | Condensate | | RTO Outlet (98% DRE) | |
|---|---|---|---|---|---|---|---|---|
| VOC Compounds | Average Concentration (µg/L) | Maximum Concentration (µg/L) | Emissions Rate (lbs/day) | Emissions Rate (lbs/year) | Contribution from Condensate µg/L (cond) | Contribution from Condensate (lbs/day) | Emissions Rate (lbs/day) | Emissions Rate (lbs/year) |
| 1,1,1-Trichloroethane | 47 | 200 | 17.98 | 6,568.08 | 180 | 0.0004 | 0.36 | 131.36 |
| 1,1-Dichloroethane | 32 | 46 | 4.14 | 1,510.66 | 190 | 0.0005 | 0.08 | 30.22 |
| 1,1-Dichloroethene | 1.6 | 18 | 1.62 | 591.13 | 3 | 0.0000 | 0.03 | 11.82 |
| 1,2,4-Trimethylbenzene | 65 | 110 | 9.89 | 3,612.44 | 18 | 0.0000 | 0.20 | 72.25 |
| 1,2-Dichlorobenzene | 3.3 | 17 | 1.53 | 558.29 | 260 | 0.0006 | 0.03 | 11.17 |
| 1,2-Dichloroethane | 31 | 55 | 4.95 | 1,806.22 | 680 | 0.0016 | 0.10 | 36.14 |
| 1,2-Dichloropropane | 1.1 | 1.1 | 0.10 | 36.12 | | | 0.002 | 0.72 |
| 1,3,5-Trimethylbenzene | 39 | 54 | 4.86 | 1,773.38 | 630 | 0.0015 | 0.10 | 35.48 |
| 1,4-Dichlorobenzene | 0.4 | 2 | 0.18 | 65.68 | 24 | 0.0001 | 0.004 | 1.31 |
| 2-butanone (MEK) | 3,458 | 9,300 | 836.18 | 305,415.80 | 720,000 | 1.7306 | 16.76 | 6,120.96 |
| 2-Hexanone (MBK) | 22 | 28 | 2.52 | 919.53 | 18,000 | 0.0433 | 0.05 | 18.71 |
| 4-Methyl-2-pentanone (MIBK) | 758 | 1,100 | 98.90 | 36,124.45 | 150,000 | 0.3605 | 1.99 | 725.12 |
| Acetone | 2,539 | 9,700 | 872.15 | 318,551.96 | 720,000 | 1.7306 | 17.48 | 6,383.68 |
| Benzene | 4.1 | 22 | 1.98 | 722.49 | 25 | 0.0001 | 0.04 | 14.45 |
| Carbon disulfide | 0.30 | 0.39 | 0.04 | 12.81 | | | 0.001 | 0.26 |
| Chlorobenzene | 0.7 | 4.1 | 0.37 | 134.65 | 7 | 0.0000 | 0.007 | 2.69 |
| Chloroethane | 2.6 | 15 | 1.35 | 492.61 | 11 | 0.0000 | 0.03 | 9.85 |
| Chloroform | 2.1 | 8.9 | 0.80 | 292.28 | 9 | 0.0000 | 0.02 | 5.85 |
| Chloromethane | 2.2 | 12 | 1.08 | 394.08 | 5 | 0.0000 | 0.02 | 7.88 |
| cis-1,2-Dichloroethene | 7.0 | 36 | 3.24 | 1,182.25 | 46 | 0.0001 | 0.06 | 23.65 |
| Dichlorodifluoromethane (CFC-12) | 2.2 | 7.7 | 0.69 | 252.87 | | | 0.01 | 5.06 |
| Ethanol | 1,046.2 | 7,000 | 629.38 | 229,882.86 | 3,300,000 | 7.9319 | 12.75 | 4,655.60 |
| Ethylbenzene | 396 | 550 | 49.45 | 18,062.22 | 2,500 | 0.0060 | 0.99 | 361.29 |
| Isopropylbenzene | 13 | 77 | 6.92 | 2,528.71 | 140 | 0.0003 | 0.14 | 50.58 |
| m,p-Xylene | 1,221 | 1,700 | 152.85 | 55,828.69 | 9,200 | 0.0221 | 3.06 | 1,116.74 |
| Methylene chloride | 535 | 820 | 73.73 | 26,929.14 | | | 1.47 | 538.58 |
| Naphthalene | 1.1 | 7.4 | 0.67 | 243.02 | 1,200 | 0.0029 | 0.01 | 4.88 |
| n-butylBenzene | 2.0 | 7.4 | 0.67 | 243.02 | 57 | 0.0001 | 0.01 | 4.86 |
| n-propylbenzene | 24 | 98 | 8.81 | 3,218.36 | 300 | 0.0007 | 0.18 | 64.37 |
| o-Xylene | 340 | 460 | 41.36 | 15,106.59 | 3,900 | 0.0094 | 0.83 | 302.20 |
| p-Isopropyltoluene | 1.2 | 4.9 | 0.44 | 160.92 | 26 | 0.0001 | 0.009 | 3.22 |
| Tetrachloroethene | 31 | 39 | 3.51 | 1,280.78 | 140 | 0.0003 | 0.07 | 25.62 |
| Toluene | 5,796 | 9,600 | 863.16 | 315,267.92 | 21,000 | 0.0505 | 17.26 | 6,305.73 |
| Total Xylenes | 1,561 | 2,160 | 194.21 | 70,935.28 | 13,100 | 0.0315 | 3.88 | 1,418.94 |
| trans-1,2-Dichloroethene | 0.2 | 0.32 | 0.03 | 10.51 | | | 0.001 | 0.21 |
| Trichloroethene | 327 | 500 | 44.96 | 16,420.20 | 1,400 | 0.2019 | 0.90 | 329.88 |
| Trichlorofluoromethane (CFC-11) | 23 | 69 | 6.20 | 2,265.99 | 2 | 0.0003 | 0.12 | 45.32 |
| Vinyl chloride | 1.0 | 5.1 | 0.46 | 167.49 | 1 | 0.0001 | 0.009 | 3.35 |
| Acid Gas (HCl) | - | - | - | - | | | 118.05 | 43,116.85 |
| Acid Gas (HF) | - | - | - | - | | | 2.940 | 1,073.84 |
| **Total VOC Emissions** | | | 3,941 | 1,439,326 | | | 79 | 28,875 |

Notes:

Loading in lbs/day = (X) µg/L x 28.32 L/cubit foot x (Y) cubic feet/min x 0.002205 lbs/gram / 1,000,000 µg/gram x 1,440 minutes/day

| | |
|---|---|
| – | Not applicable |
| lbs | Pounds |
| scfm | Standard cubic feet per minute |
| SVE | Soil vapor extraction |
| VOC | Volatile organic compound |

Flow rate:

| | |
|---|---|
| 1,000.00 | cubic feet / min |
| 12.00 | gallons / hr |

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco Washington, dated October 23, 2014.

| Influent: | Acid Gas Total lb/day | Elemental Cl lb/day |
|---|---|---|
| TCE | 45.16 | 36.55 |
| Methylene Chloride | 73.73 | 61.55 |
| | Sum Cl = > | 98.1 |
| | HCl in Effluent (preliminary)= > | 100.9 |
| HCl in effluent (scaled-up for other contributors) | | 118 |
| | | |
| Dichlorodifluoromethane (CFC-12) | 0.69 | 0.22 |
| Trichlorofluoromethane (CFC-11) | 6.20 | 2.57 |
| | Sum F = > | 2.8 |
| | HF in Effluent (preliminary)= > | 2.9 |

–

Acid gas emissions calculations assume all influent elemental chlorine/fluorine combines with hydrogen, which is assumed to be present in excess of the stoichiometric requirement for complete conversion.
Scale-up factor based on TCE and methylene chloride making up 85% of chlorinated compounds.

# TABLE 2
## REPRESENTATIVE EMISSION RATES BASED ON 20 PPMV TOTAL VOCs AT STACK OUTLET
## PASCO SANITARY LANDFILL
## PASCO, WASHINGTON

| | |
|---|---|
| Avagadros number | 6.023E+23 |
| 10^6 molecules of air (moles) | 1.6603E-18 |
| R (L atm/ K mol) | 0.0821 |
| Temp (K) | 298.15 |
| Pressure (atm) | 1 |

| VOC Compounds | Molecular Weight | Normalized ratio of average VOCs (a) | RTO Outlet Concentration (b) | | RTO Outlet Emission Rate (b) | |
|---|---|---|---|---|---|---|
| | | | PPMv | µg/L | lb/day | lbs/year |
| 1,1,1-Trichloroethane | 133.40 | 0.0026 | 0.051 | 0.28 | 0.000025 | 0.0091 |
| 1,1-Dichloroethane | 98.96 | 0.0017 | 0.035 | 0.14 | 0.000013 | 0.0046 |
| 1,1-Dichloroethene | 96.94 | 0.000087 | 0.0017 | 0.0069 | 0.00000062 | 0.00023 |
| 1,2,4-Trimethylbenzene | 120.20 | 0.0036 | 0.071 | 0.35 | 0.000031 | 0.011 |
| 1,2-Dichlorobenzene | 147.00 | 0.00018 | 0.0036 | 0.022 | 0.0000019 | 0.00071 |
| 1,2-Dichloroethane | 98.96 | 0.0017 | 0.034 | 0.14 | 0.000012 | 0.0045 |
| 1,2-Dichloropropane | 113.00 | 0.000060 | 0.0012 | 0.0055 | 0.00000050 | 0.00018 |
| 1,3,5-Trimethylbenzene | 120.20 | 0.0021 | 0.042 | 0.21 | 0.000019 | 0.0068 |
| 1,4-Dichlorobenzene | 147.00 | 0.000021 | 0.00041 | 0.0025 | 0.00000022 | 0.000082 |
| 2-butanone (MEK) | 72.10 | 0.19 | 3.8 | 11 | 0.0010 | 0.36 |
| 2-Hexanone (MBK) | 100.10 | 0.0012 | 0.024 | 0.10 | 0.0000090 | 0.0033 |
| 4-Methyl-2-pentanone (MIBK) | 100.20 | 0.041 | 0.83 | 3.4 | 0.00030 | 0.11 |
| Acetone | 58.08 | 0.14 | 2.8 | 6.6 | 0.00059 | 0.22 |
| Benzene | 78.11 | 0.00022 | 0.0045 | 0.014 | 0.0000013 | 0.00047 |
| Carbon disulfide | 76.14 | 0.000016 | 0.00033 | 0.0010 | 0.000000091 | 0.000033 |
| Chlorobenzene | 112.60 | 0.000039 | 0.00079 | 0.0036 | 0.00000032 | 0.00012 |
| Chloroethane | 64.52 | 0.00014 | 0.0028 | 0.0075 | 0.00000067 | 0.00025 |
| Chloroform | 119.40 | 0.00011 | 0.0023 | 0.011 | 0.0000010 | 0.00037 |
| Chloromethane | 50.49 | 0.00012 | 0.0024 | 0.0049 | 0.00000044 | 0.00016 |
| cis-1,2-Dichloroethene | 96.94 | 0.00038 | 0.0076 | 0.030 | 0.0000027 | 0.00099 |
| Dichlorodifluoromethane (CFC-12) | 120.90 | 0.00012 | 0.0024 | 0.012 | 0.0000011 | 0.00039 |
| Ethanol | 46.07 | 0.057 | 1.1 | 2.1 | 0.00019 | 0.070 |
| Ethylbenzene | 106.20 | 0.022 | 0.43 | 1.9 | 0.00017 | 0.061 |
| Isopropylbenzene | 120.19 | 0.00068 | 0.014 | 0.067 | 0.0000060 | 0.0022 |
| m,p-Xylene | 106.20 | 0.067 | 1.3 | 5.8 | 0.00052 | 0.19 |
| Methylene chloride | 84.94 | 0.029 | 0.58 | 2.0 | 0.00018 | 0.066 |
| Naphthalene | 128.17 | 0.000060 | 0.0012 | 0.0063 | 0.00000056 | 0.00021 |
| n-butylBenzene | 134.22 | 0.00011 | 0.0022 | 0.012 | 0.0000011 | 0.00039 |
| n-propylbenzene | 120.19 | 0.0013 | 0.026 | 0.13 | 0.000012 | 0.0042 |
| o-Xylene | 106.20 | 0.019 | 0.37 | 1.6 | 0.00014 | 0.053 |
| p-Isopropyltoluene | 134.22 | 0.000065 | 0.0013 | 0.0072 | 0.00000065 | 0.00024 |
| Tetrachloroethene | 165.80 | 0.0017 | 0.034 | 0.23 | 0.000020 | 0.0075 |
| Toluene | 92.14 | 0.32 | 6.3 | 24 | 0.0021 | 0.78 |
| Total Xylenes | 106.17 | 0.085 | 1.7 | 7.4 | 0.00066 | 0.24 |
| trans-1,2-Dichloroethene | 96.94 | 0.000013 | 0.00026 | 0.0010 | 0.000000093 | 0.000034 |
| Trichloroethene | 131.39 | 0.018 | 0.36 | 1.9 | 0.00017 | 0.063 |
| Trichlorofluoromethane (CFC-11) | 137.40 | 0.0013 | 0.025 | 0.14 | 0.000013 | 0.0046 |
| Vinyl chloride | 62.50 | 0.000055 | 0.0011 | 0.0028 | 0.00000025 | 0.000091 |
| **Total VOC Emissions** | | | 20 | 70 | 0.0062 | 2.3 |

Notes:

ppmV = Parts per million by volume

µq/L = Micrograms per liter

lbs/day = Pounds per day

lbs/year = Pounds per year

RTO = Regenerative Thermal Oxidizer

(a) Normalized ratio for each compound based on average soil vapor analytical results from Zone A of landfill.

(b) Estimated concentrations and emission rates assume that all compounds have an equal destruction and removal efficiency.

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco Washington, dated October 23, 2014.

# TABLE 3
## EMISSION RATES FOR REGENERATIVE THERMAL OXIDIZER FUEL COMBUSTION
## PASCO SANITARY LANDFILL
## PASCO, WASHINGTON

| | |
|---|---|
| Natural Gas Usage During Start-up (scfh) | 750 |
| Natural Gas Heat Input During Start-up (MMBTU/ hour) | 0.765 |
| Natural Gas Heat Input During Start-up (MMBTU/year) | 18 |
| RTO Operating in Start-up Condition (hours/year) | 24 |
| Natural Gas Usage During Regular Operation (scfh) | 75 |
| Natural Gas Heat Input During Regular Operation (MMBTU/ hour) | 0.077 |
| Natural Gas Heat Input During Regular Operation (MMBTU/year) | 668 |
| RTO Operating in Regular Operating Condition (hours/year) | 8,736 |
| Heat Value of Natural Gas (BTU/cf Natural Gas) | 1020 |

| Pollutants | Natural Gas or Propane-Fired Emission Factors (lb/MMBTU)(f) | Emission Factor Source | RTO Emissions Natural Gas or Propane Combustion | | | |
|---|---|---|---|---|---|---|
| | | | lb/hr | lbs/day | lb/yr | tons/yr |
| Sulfur Dioxide ($SO_2$) | 5.9E-04 | (a) | 4.5E-04 | 1.5E-03 | 4.0E-01 | 0.0002 |
| Nitrogen Oxides ($NO_x$) | 2.7E-01 | (a) | 2.1E-01 | 6.9E-01 | 1.9E+02 | 0.09 |
| Carbon Monoxide (CO) | -- | (d) | 1.0E-01 | 2.4E+00 | 8.8E+02 | 0.44 |
| PM10/ PM2.5 (e) | 7.7E-03 | (b) | 5.9E-03 | 1.9E-02 | 5.3E+00 | 0.003 |
| HC/VOCs | 5.4E-03 | (a) | 4.1E-03 | 1.4E-02 | 3.7E+00 | 0.002 |
| Acetaldehyde | 4.2E-05 | (c) | 3.2E-05 | 1.1E-04 | 2.9E-02 | 0.000014 |
| Acrolein | 9.8E-06 | (c) | 7.5E-06 | 2.5E-05 | 6.7E-03 | 0.0000 |
| Benzene | 1.6E-04 | (c) | 1.2E-04 | 3.9E-04 | 1.1E-01 | 0.00005 |
| Ethylbenzene | 1.4E-03 | (c) | 1.1E-03 | 3.6E-03 | 9.7E-01 | 0.0005 |
| Formaldehyde | 1.1E-03 | (c) | 8.8E-04 | 2.9E-03 | 7.9E-01 | 0.000393 |
| Hexane | 2.8E-05 | (c) | 2.2E-05 | 7.2E-05 | 2.0E-02 | 0.00001 |
| Naphthalene | 1.1E-05 | (c) | 8.3E-06 | 2.7E-05 | 7.4E-03 | 0.00000 |
| Nitrogen Dioxide ($NO_2$) | 2.7E-02 | (a) | 2.1E-02 | 6.9E-02 | 1.9E+01 | 0.009 |
| Propylene | 2.4E-03 | (c) | 1.8E-03 | 6.0E-03 | 1.6E+00 | 0.00082 |
| Toluene | 5.7E-05 | (c) | 4.4E-05 | 1.4E-04 | 3.9E-02 | 0.0000 |
| Total Xylenes | 2.8E-05 | (c) | 2.2E-05 | 7.2E-05 | 2.0E-02 | 0.00001 |

Notes:
(a) Emission factors from EPA's AP-42, Volume I, Chapter 1.4, which provides pollutant emission factors for natural gas combustion (EPA 1995).
(b) Emission factors from EPA's AP-42, Volume I, Chapter 1.5, which provides pollutant emission factors for propane combustion (EPA 1995).
(c) Emission factors from Ventura County Air Pollution Control District's AB 2588, Combustion Emission Factors for Natural Gas Fired External Combustion Flare.
(d) The maximum hourly CO emission rate associated with natural gas combustion provided by GCE.
(e) For the purposes of this evaluation, the PM2.5 emission factor was conservatively assumed to be equal to the emission factor for PM10.
(f) The highest emission factor was chosen for each compound between natural gas and propane emission factors.
scfh = Standard cubic feet per hour

Example Calculation for SO2 Emission Rates:

$$750\ SCFH \times 1020\ \frac{BTU}{ft^3\ Nat\ Gas} \div 1{,}000{,}000\ \frac{BTU}{MMBTU} \times 0.000588\ \frac{lbs\ SO2}{MMBTU} = 0.00045\ \frac{lbs\ SO2}{hour}$$

$$0.00045\ \frac{lbs\ SO2}{hour} \times 8{,}760\ \frac{hours}{year} = 3.9\ \frac{lbs}{year}$$

$$3.9\ \frac{lbs}{year} \times 2{,}000\ \frac{lbs}{ton} = 0.0020\ \frac{tons}{year}$$

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco Washington, dated October 23, 2014.

# TABLE 4
## EMISSION-BASED EXEMPTION EVALUATION
## PASCO SANITARY LANDFILL
## PASCO, WASHINGTON

| Pollutant | Maximum Pollutant Emission Totals | | | | Registration Program Exemption Threshold | | | | TAP SQER (c) | | Modeling Reqd? (Y/N) (b) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max Hourly (lbs/hr) | Max Daily (lbs/day) | Annual (tons/yr) | Annual (lbs/yr) | Criteria Pollutants (a) | | TAPs (b) | | | | |
| PM (Total) | 5.9E-03 | 1.9E-02 | 2.6E-03 | 5.3E+00 | 1.25 | tons/yr | -- | | -- | | Y (Criteria) |
| $PM_{10}$ | 5.9E-03 | 1.9E-02 | 2.6E-03 | 5.3E+00 | 0.75 | tons/yr | -- | | -- | | Y (Criteria) |
| $PM_{2.5}$ | 5.9E-03 | 1.9E-02 | 2.6E-03 | 5.3E+00 | 0.5 | tons/yr | -- | | -- | | Y (Criteria) |
| Nitrogen Oxides ($NO_x$) | 2.1E-01 | 6.9E-01 | 9.4E-02 | 1.9E+02 | 2 | tons/yr | -- | | -- | | Y (Criteria) |
| Carbon Monoxide (CO) | 1.0E-01 | 2.4E+00 | 4.4E-01 | 8.8E+02 | 5 | tons/yr | 1.14 | lbs/hr | 50.4 | lbs/hr | Y (Criteria) |
| Volatile Organic Compounds (VOC) | 3.3E+00 | 7.9E+01 | **1.4E+01** | 2.9E+04 | 2 | tons/yr | -- | | -- | | N |
| Sulfur Dioxide ($SO_2$) | 4.5E-04 | 1.5E-03 | 2.0E-04 | 4.0E-01 | 2 | tons/yr | 0.457 | lbs/hr | 1.45 | lbs/hr | Y (Criteria) |
| 1,1,1-Trichloroethane | 1.5E-02 | 3.6E-01 | 6.6E-02 | 1.3E+02 | -- | | 6.57 | lbs/day | 131 | lbs/day | N |
| 1,1-Dichloroethane | 3.4E-03 | 8.3E-02 | 1.5E-02 | **3.0E+01** | -- | | 6 | lbs/yr | 120 | lbs/yr | N |
| 1,1-Dichloroethene | 1.3E-03 | 3.2E-02 | 5.9E-03 | 1.2E+01 | -- | | 1.31 | lbs/day | 26.3 | lbs/day | N |
| 1,2-Dichloroethane | 4.1E-03 | 9.9E-02 | 1.8E-02 | **3.61E+01** | -- | | 0.369 | lbs/yr | 7.39 | lbs/yr | Y |
| 1,2-Dichloropropane | 8.2E-05 | 2.0E-03 | 3.6E-04 | 7.2E-01 | -- | | 0.959 | lbs/yr | 19.2 | lbs/yr | N |
| 1,4-Dichlorobenzene | 1.5E-04 | 3.6E-03 | 6.6E-04 | **1.3E+00** | -- | | 0.872 | lbs/yr | 17.4 | lbs/yr | N |
| 2-butanone (MEK) | 7.0E-01 | 1.7E+01 | 3.1E+00 | 6.1E+03 | -- | | 32.9 | lbs/day | 657 | lbs/day | N |
| 4-Methyl-2-pentanone (MIBK) | 8.3E-02 | 2.0E+00 | 3.6E-01 | 7.3E+02 | -- | | 19.7 | lbs/day | 394 | lbs/day | N |
| Acetaldehyde | 3.2E-05 | 1.1E-04 | 1.4E-05 | 2.9E-02 | -- | | 3.55 | lbs/yr | 71 | lbs/yr | N |
| Acrolein | 7.5E-06 | **2.5E-05** | 3.4E-06 | 6.7E-03 | -- | | 0.000394 | lbs/day | 0.00789 | lbs/day | N |
| Benzene | 1.8E-03 | 4.0E-02 | 7.3E-03 | **1.46E+01** | -- | | 0.331 | lbs/yr | 6.62 | lbs/yr | Y |
| Carbon disulfide | 2.9E-05 | 7.0E-04 | 1.3E-04 | 2.6E-01 | -- | | 5.26 | lbs/day | 105 | lbs/day | N |
| Chlorobenzene | 3.1E-04 | 7.4E-03 | 1.3E-03 | 2.7E+00 | -- | | 6.57 | lbs/day | 131 | lbs/day | N |
| Chloroform | 6.7E-04 | 1.6E-02 | 2.9E-03 | **5.8E+00** | -- | | 0.417 | lbs/yr | 8.35 | lbs/yr | N |
| Ethylbenzene | 4.2E-02 | 9.9E-01 | 1.8E-01 | **3.62E+02** | -- | | 3.84 | lbs/yr | 76.8 | lbs/yr | Y |
| Formaldehyde | 8.8E-04 | 2.9E-03 | 3.9E-04 | 7.9E-01 | -- | | 1.6 | lbs/yr | 32 | lbs/yr | N |
| Hexane | 2.2E-05 | 7.2E-05 | 9.8E-06 | 2.0E-02 | -- | | 4.6 | lbs/day | 92 | lbs/day | N |
| Isopropylbenzene | 5.8E-03 | 1.4E-01 | 2.5E-02 | 5.1E+01 | -- | | 2.63 | lbs/day | 52.6 | lbs/day | N |
| m,p-Xylene | 1.3E-01 | **3.1E+00** | 5.6E-01 | 1.1E+03 | -- | | 1.45 | lbs/day | 29 | lbs/day | N |
| Methylene chloride | 6.1E-02 | 1.5E+00 | 2.7E-01 | **5.39E+02** | -- | | 9.59 | lbs/yr | 192 | lbs/yr | Y |
| Naphthalene | 5.7E-04 | 1.3E-02 | 2.4E-03 | **4.9E+00** | -- | | 0.282 | lbs/yr | 5.64 | lbs/yr | N |
| Nitrogen Dioxide ($NO_2$) | 2.1E-01 | 6.9E-01 | 9.4E-02 | 1.9E+02 | -- | | 0.457 | lbs/hr | 1.03 | lbs/hr | N |
| o-Xylene | 3.4E-02 | 8.3E-01 | 1.5E-01 | 3.0E+02 | -- | | 1.45 | lbs/day | 29 | lbs/day | N |
| Propylene | 1.8E-03 | 6.0E-03 | 8.2E-04 | 1.6E+00 | -- | | 19.7 | lbs/day | 394 | lbs/day | N |
| Tetrachloroethene | 2.9E-03 | 7.0E-02 | 1.3E-02 | **2.6E+01** | -- | | 1.62 | lbs/yr | 32.4 | lbs/yr | N |
| Toluene | 7.2E-01 | 1.7E+01 | 3.2E+00 | 6.3E+03 | -- | | 32.9 | lbs/day | 657 | lbs/day | N |
| Total Xylenes | 1.6E-01 | **3.9E+00** | 7.1E-01 | 1.4E+03 | -- | | 1.45 | lbs/day | 29 | lbs/day | N |
| trans-1,2-Dichloroethene | 2.4E-05 | 5.8E-04 | 1.1E-04 | 2.1E-01 | -- | | 5.30 | lbs/day | 106 | lbs/day | N |
| Trichloroethene | 3.8E-02 | 9.0E-01 | 1.6E-01 | **3.30E+02** | -- | | 4.8 | lbs/yr | 95.6 | lbs/yr | Y |
| Vinyl chloride | 3.8E-04 | 9.2E-03 | 1.7E-03 | **3.35E+00** | -- | | 0.123 | lbs/yr | 2.46 | lbs/yr | Y |
| Hydrogen chloride (HCl) | 4.9E+00 | **1.18E+02** | 2.2E+01 | 4.3E+04 | -- | | 0.0591 | lbs/day | 1.18 | lbs/day | Y |
| Hydrogen fluoride (HF) | 1.2E-01 | **2.94E+00** | 5.4E-01 | 1.1E+03 | -- | | 0.092 | lbs/day | 1.84 | lbs/day | Y |

Notes

'-- = Exemption level not available because the pollutant is not classified as a criteria pollutant or TAP.

Cells formatted with bold values indicate exceedance of a Registration Exemption Threshold.

Cells formatted with highlighting indicate exceedance of an SQER.

(a) Emission unit NSR exemption levels for criteria pollutants are identified in WAC 173-400-110(5).

(b) Emission unit NSR exemption levels for TAPs are identified in WAC 173-400-110(5) as the *de minimis* values from WAC 173-460-150.

(c) Washington Small-Quantity Emission Rate as presented in WAC 173-460-150.

Source: Revised Notice of Construction Application, Supporting Information Report, Pasco Sanitary Landfill, Pasco Washington, dated October 23, 2014.

## Appendix C

**Screening Level Air Dispersion Modeling Technical Memorandum**
(Modeling files provided on CD attached to back cover of this report.)

AIR SCIENCES INC.
DENVER·PORTLAND·LOS ANGELES

TECHNICAL MEMORANDUM

# PASCO SANITARY LANDFILL RTO COMPARISON

**PREPARED FOR:** Pasco Sanitary Landfill

**PREPARED BY:** Kent Norville, Air Sciences Inc.

**PROJECT NO.:** 174-33

**COPIES:** John Browning, Bridgewater Group

**DATE:** October 5, 2016

The Pasco Sanitary Landfill (PSL) is replacing an existing regenerative thermal oxidizer (RTO) to treat emissions from a soil vapor extraction system with a new RTO. Instead of repeating full Tier 1/2 impact assessment, the Washington Department of Ecology (Ecology) has agreed that PSL can perform screening level modeling to demonstrate that the dispersion characteristics of the new RTO are equal to or better than the existing RTO. This technical memorandum summarizes a screening level analysis conducted by Air Sciences Inc. (Air Sciences) to demonstrate that the new RTO has better dispersion characteristics than the original RTO.

## 1.0 Source Characteristics

Table 1shows the stack characteristics of the original and new RTO. For this analysis, low and high flow conditions were evaluated. For all configurations, a unit emission rate of 1 g/sec (grams per second) was used.

**Table 1. Original and New RTO Stack Parameters**

| | Low Flow | | High Flow | |
|---|---|---|---|---|
| **Stack Parameter (unit)** | **Original** | **New** | **Original** | **New** |
| Height (m) | 6.1 | 9.14 | 6.1 | 9.14 |
| Diameter (m) | 0.305 | 0.356 | 0.305 | 0.356 |
| Temperature (K) | 338.7 | 365.0 | 449.8 | 670.0 |
| Exit Velocity (m/s) | 10.16 | 3.4 | 20.32 | 23.9 |
| Flow Rate (ACFM) | 1,573 | 717 | 3,145 | 5,040 |

## 2.0 Methodology

For this analysis, the EPA (Environmental Protection Agency) AERSCREEN model was used. AERSCREEN is a screening-level air quality model based on the US EPA AERMOD dispersion model (U.S. EPA, 2004a) and is the AERMOD equivalent of the SCREEN3 dispersion model used for single source assessments.

AERSCREEN uses a meteorological preprocessor (MAKEMET) to build a meteorological condition matrix in order to find the worst case meteorological condition. It also interfaces with AERMAP and BPIPPRM to automate the processing of terrain and building information, makes the necessary AERMOD input files, and runs the AERMOD model, utilizing the SCREEN option, to perform modeling runs. The AERSCREEN program will model a single source. Source options include a point source (vertical uncapped stack, capped stack, or horizontal stack), rectangular area source, circular area source, flare, or volume source. The AERSCREEN program also includes averaging time factors for worst-case 3-hr, 8-hr, 24-hr and annual averages.

Table 2 shows the parameters used for all modeled AERSCREEN runs.

**Table 2. AERSCREEN Settings**

| Parameter (unit) | Value |
|---|---|
| Dispersion Mode | Rural |
| Distance to Ambient Air (m) | 10 |
| Maximum Probe Distance (m) | 5,000 |
| Chemistry Option | 1 - (no chemistry) |
| Building Downwash? | No |
| Include Terrain Heights? | Yes |
| Discrete Receptors? | No |
| Flagpole Receptors? | No |
| Source Elevation (m) | AERMAP derived |
| Coordinate Type | UTM |
| Coordinates , Zone, and Datum | 341549.0, 5123836.0, 11, 4 (NAD83) |
| Minimum Ambient Temperature (K) | 270.4* |
| Maximum Ambient Temperature (K) | 303.2* |
| Minimum Wind Speed (m/s) | 0.5 (default) |
| Anemometer Height (m) | 10 (default) |
| Meteorological Option | 2 - AERMET Seasonal Table |
| Dominant Surface | 5 - Cultivated Land |
| Dominant Climate Type | 3 - Dry Conditions |

* Based on average January minimum temperature and average July maximum temperature in Pasco (http://www.usclimatedata.com/climate/pasco/washington/united-states/uswa0801)

Since the original RTO had a relatively small footprint, building downwash was not considered in this comparison. It was assumed that the new RTO would be at a similar distance to the fence line (~10 meters) as the original RTO. The receptors were set to go out to 5,000 meters from the stack. The terrain was obtained from 1/3-Arc-Second National Elevation Dataset (NED) elevation data downloaded from the National Map Seamless Server (http://www.mrlc.gov/) in a United States Geological Survey (USGS) GeoTIFF file format that is compatible with AERMAP.

## 3.0 Results

AERSCREEN was run for the original and new RTO stacks using low and high flow conditions and the results are shown in Table 3. In both the low and high flow cases, the new stack has better dispersion (and lower concentrations). In both cases, the new RTO has better worst-case dispersion that the original RTO.

Copies of the AERCREEN input and output files are included on a USB drive submitted with this memorandum.

**Table 3. Original and New RTO Maximum Impacts (in micrograms per cubic meters)**

| Low Flow | | High Flow | |
|---|---|---|---|
| Original | New | Original | New |
| 538.6 | 460.4 | 291.1 | 100.6 |

# Appendix D

# SEPA Checklist

PBS | Engineering + Environmental

4412 SW Corbett Avenue, Portland, OR 97239.
503.248.1939 Main,
866.727.0140 Fax,
888.248.1939 Toll-Free,
www.pbsenv.com

# SEPA ENVIRONMENTAL CHECKLIST
## *2016*

***Purpose of checklist:***

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

***Instructions for applicants*:**

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

***Instructions for Lead Agencies:***

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

***Use of checklist for nonproject proposals:***

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the Supplemental Sheet for Nonproject Actions (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

## A. Background

1. Name of proposed project, if applicable:

   Installation of a Regenerative Thermal Oxidizer (RTO) system at the Pasco Landfill NPL Site (Site) in Pasco, Washington

2. Name of applicant:

   Industrial Waste Area Generators – Group III (IWAG)

3. Address and phone number of applicant and contact person:

   **APPLICANT:**
   Will Ernst, Co-Chair, IWAG Group III Technical Committee
   Phone: 206-662-1752
   william.d.ernst@boeing.com

   **ADDRESS:**
   Industrial Waste Generators Group III
   c/o Will Ernst
   Co-Chair, Technical Committee
   PO Box 3707 MC 1W-12
   Seattle WA 98124

   **CONTACT:**
   Tina M. Blakley, P.E.
   Phone: 509.845.0467
   tina.blakley@pbsenv.com

   **ADDRESS:**
   PBS Engineering + Environmental
   400 Bradley Blvd. #300
   Richland, WA 99352

4. Date checklist prepared:

   October 7, 2016

5. Agency requesting checklist:

   Washington State Department of Ecology, Eastern Regional Office (Ecology).

6. Proposed timing or schedule (including phasing, if applicable):

   Work will commence upon Ecology issuance of an Approval Order for the work. The construction is expected to begin in early 2017.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   No.

The proposed work consists of installation of a new RTO system to replace an existing, similar system. Work includes installation of a new concrete slab; tie-in to existing natural gas supply line, communication line, electrical service and sub-panel. Modifications will be made to the existing SVE system effluent piping to add piping bypassing the existing RTO units to ensure flow from the SVE system equipment building to the new RTO system once it is installed and operating.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

A large number of documents regarding past and proposed work related to Zone A of the Industrial Waste Area portion of the Site are on file with Ecology. Documents for the existing SVE system include: Volumes 1 through 3 of the *As-Built and Testing Reports with Operations and Maintenance Manual* published February 25, 2013; and quarterly and annual performance monitoring reports.

Documents submitted to Ecology related to the proposed RTO system installation include:

- *Final Draft Report: Soil Vapor Extraction Off-Gas Treatment Assessment, Pasco Landfill – Zone A, Pasco, Washington*, Landau, July 25, 2012
- *Notice of Construction (NOC) Application Supporting Information Report, Pasco Sanitary Landfill, Pasco, Washington*, (*NOC Application*) Bridgewater Group, October, 2016
- *Report: Second-Tier Risk Analysis for Hydrogen Chloride Emissions, Pasco Sanitary Landfill, Pasco, Washington*, (*Second-Tier Analysis*) Landau Associates, August 25, 2014
- *Revised Report: Second-Tier Risk Analysis for Hydrogen Chloride Emissions, Pasco Sanitary Landfill, Pasco Washington*, (*Revised Second-Tier Analysis*) Landau Associates, October 23, 2014
- *Technical Memorandum RE: Supplemental Exposure Assessment for Basin Disposal Inc., Second-Tier Health Impact Assessment, Pasco Sanitary Landfill, Pasco, Washington*, (*BDI Exposure Assessment*) Landau Associates, January 27, 2015

Ecology has posted several of the documents related to the proposed RTO system installation on the Pasco Landfill NPL Site webpage located at:

https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=1910

A comprehensive list of all publicly available documents regarding the Site may be found by contacting Ecology's Site Manager, Mr. Chuck Gruenenfelder at (509) 329-3439 or Ecology's Public Disclosure Coordinator, Kari Johnson, in Ecology's Eastern Region Office at:

E-mail: kari.johnson@ecy.wa.gov
Phone: 509-329-3415

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

No.

10. List any government approvals or permits that will be needed for your proposal, if known.

1. Approval of this State Environmental Policy Act (SEPA) Environmental Checklist.

2. Final approval of Notice of Construction Permit by Ecology.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description).

A two-canister RTO system will be installed within the existing fenced SVE system equipment compound on the landfill property. The system will be installed on a newly poured concrete slab along with necessary communication, electrical, and natural gas supply lines. Piping will be installed to deliver extracted vapors and condensate from the existing SVE system equipment building to the RTO.

The RTO system includes a combustion chamber, heat recovery chambers, fans, motors, upgrades to existing control panel, 30-foot tall vertical exhaust stack, and associated equipment. The equipment footprint is expected to be approximately 1000 square feet.

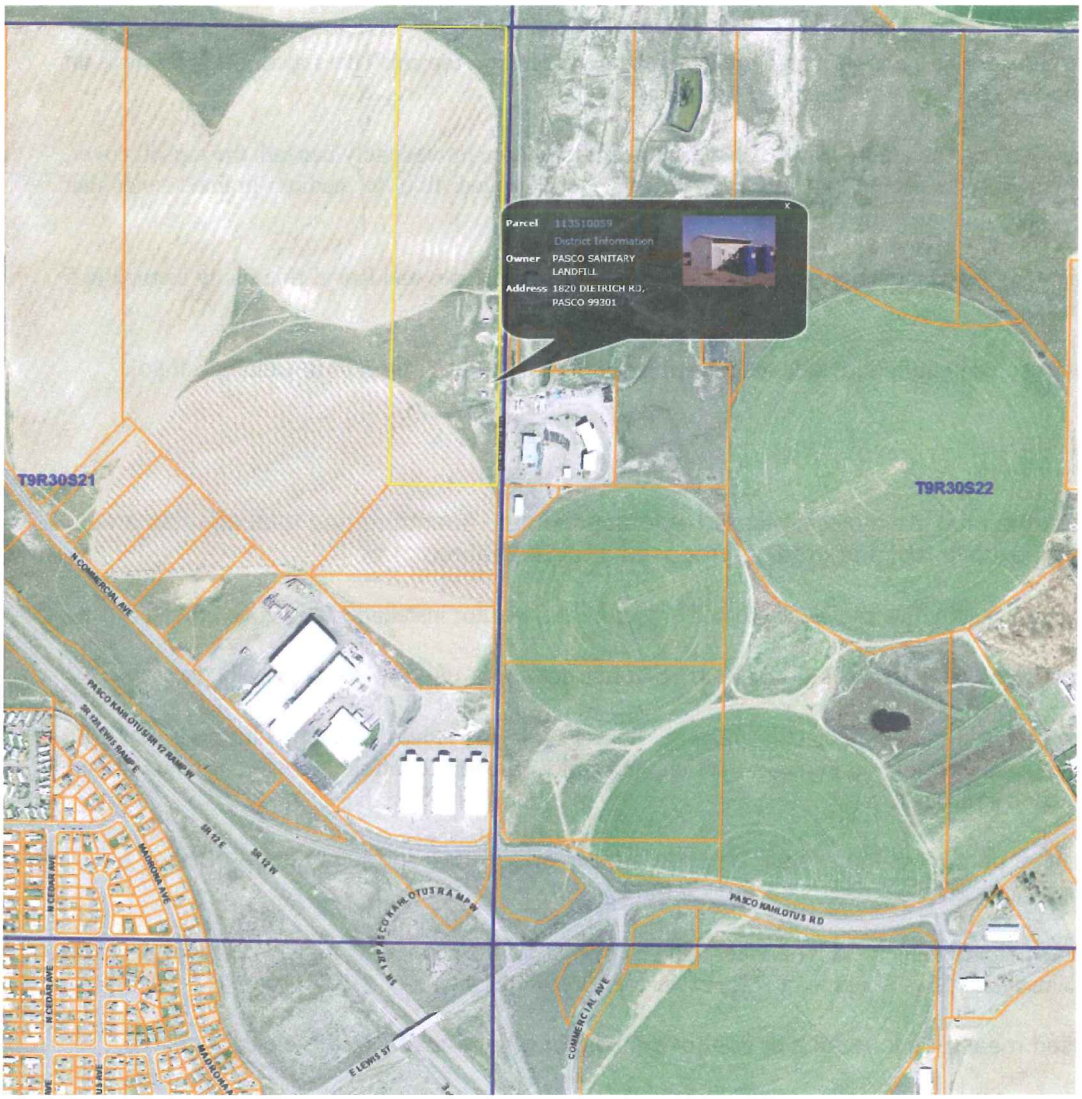
The RTO system is designed to control emissions from and destroy volatile organic compounds (VOCs) and certain semi-volatile organic compounds (SVOCs) removed from the Zone A Landfill by the SVE system. The SVE system, and the proposed RTO, will be operated as a component of cleanup activities in compliance with requirements of Ecology Agreed Order No. DE 9240.

The RTO system is designed to accommodate 1,000 standard cubic foot per minute (scfm) of SVE system process vapor and 1,500 scfm of dilution air. The destruction and removal efficiency of the RTO is expected to be 98 percent or less than or equal to 20 parts per million by volume (ppmv).

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The Site is located at 1820 Dietrich Road in Pasco, Washington. The new RTO will be installed in the existing equipment compound on the west side of Dietrich Road approximately 0.5 miles north of

the intersection of Dietrich Road and North Commercial Avenue. It will be located just to the west (e.g., within 5 meters) of the existing RTO unit, which will be retained on site for a short period in an inoperable status once the new RTO unit is installed and placed into operation. The equipment compound is on Franklin County Washington Parcel Number 113510059. The legal description of the parcel is: E 600' of NE4 of 21-9-30, EXC 30' RD. The approximate coordinates are latitude 46.249715, longitude -119.055428. See map from Franklin County Mapsifter website below.




## B. ENVIRONMENTAL ELEMENTS

### 1. Earth

a. General description of the site
(circle one): Flat, rolling, hilly, steep slopes, mountainous,
other _____

Flat

b. What is the steepest slope on the site (approximate percent slope)?

The construction area within the fenced equipment compound is level.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The surface soils at the project area are generally a sandy loam topsoil. The uppermost soil unit is an eolian layer consisting of silt and fine sand deposits.

Touchet Beds, are generally encountered at or near the surface immediately beneath the topsoil cover. The Touchet Bed soils are typically gray-brown, poorly graded, fine- to medium-grained sands that can be locally silty and gravelly.

Soils are mapped as Quincy loamy fine sand, 0 to 15 percent slopes and Royal fine sandy loam, 2 to 5 percent slopes.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Minor grading activities will be conducted to prepare the area for installation of a concrete slab.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Erosion as a result of this project is unlikely. Average rainfall is approximately 8 inches a year. To limit potential erosion during construction, temporary erosion controls will be installed during construction as necessary.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

An area of approximately 38 by 22 feet will be covered by a concrete slab on which the RTO system will be installed. This is less than 1/2% of the total area of the site.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Please see response to question B.1.f., above.

**2. Air**

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Construction phase:

Construction and installation of the RTO system will include pouring of a concrete slab in a nearly level area within a fenced gravel-covered equipment compound. Site grading and equipment movement will be minimal. The RTO components will be assembled and installed upon the concrete slab. Piping will be installed between the SVE equipment building and the newly installed RTO system. After the RTO system has been tested and verified to be functioning in an acceptable manner, the connection of the current RTO to the SVE system will be removed, and connection of the SVE system to the new RTO will be made.

Operations and Maintenance phase:

Estimates of emission rates and quantities for the functioning RTO system will be provided in the *Notice of Construction Application* for the new RTO system. Emissions are anticipated to include particulate matter, nitrogen oxides, carbon monoxide, HCl or HF, and VOCs.

The upper limit of controlled emission rates are calculated to be as follows:

| Type or Compound | Value (in ppmv unless otherwise indicated) |
|---|---|
| Opacity | 5 % |
| 1,1,1-Trichloroethane | 0.04 |
| 1,2,4-Trimethylbenzene | 0.06 |
| 2-Butanone (MEK) | 8.12 |
| 4-Methyl-2-pentanone | 1.8 |
| Ethanol | 2.8 |
| Ethylbenzene | 0.5 |
| Isopropylbenzene | 0.02 |
| Total Xylenes (o, m and p) | 2.9 |
| Methylene chloride | 1.6 |
| n-Propylbenzene | 0.03 |
| Toluene | 22.1 |
| Trichloroethene | 0.08 |
| Hydrofluoric Acid (HF) | 0.12 |
| Total VOCs | 75.9 |

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No. There are small quantities of temporary and variable odors from the BDI transfer station across Dietrich Road to the east that should not affect the proposal.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Any airborne dust produced during construction will be managed through the use of standard dust control techniques such as application of water.

Emissions from operation of the RTO system once installed will be controlled through proper engineering and design in order to meet the requirements listed in the Preliminary Determination. Preliminary requirements include the operation of the RTO at a minimum combustion temperature of 1650 °F or at a lower value if the required DRE can be demonstrated through testing and at a maximum inlet flow rate contained in the NOC. Operating parameters will be monitored as required by the NOC. Performance testing will be performed within 6 months and annually thereafter. Adjustments will be made in the operation of the RTO as necessary to meet operational requirements.

The RTO system is being installed to replace a current RTO that is not meeting design requirements. The RTO will have a 98% destruction and removal efficiency down to a concentration of 20 ppmv for total VOCs.

3. **Water**

a. Surface Water:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

No surface water bodies are located on the subject or adjacent parcels. There are no wetlands or surface water bodies located within at least 1,000 feet. The nearest mapped feature is a permanently flooded pond approximately 3,000 feet to the southeast that appears to have been filled. The Columbia River is approximately 2.5 miles south and the Snake River is approximately 2.5 miles east.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Not applicable.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Not applicable.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Groundwater:

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No. Neither the proposed RTO system installation or operation will use or discharge to groundwater.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste material will be discharged into the ground.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Stormwater runoff is not likely since the average rainfall at the Site is approximately 8 inches per year. The RTO system and piping from the SVE equipment building to the RTO will have level indicators, alarms, and emergency shutoff features as well

2) Could waste materials enter ground or surface waters? If so, generally describe.

No waste water will be produced.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No. The addition of a 38 x 22 foot impermeable footprint should have very limited impact on drainage especially since, as indicated above, there is very little annual rainfall at the Site.

d. Proposed measures to reduce or control surface water, groundwater, and runoff water, and drainage pattern impacts, if any:

Not applicable. See answers above.

## 4. Plants

a. Check the types of vegetation found on the site:

_____ deciduous tree: alder, maple, aspen, other
_____ evergreen tree: fir, cedar, pine, other
__x__ shrubs
__x__ grass
_____ pasture
_____ crop or grain
_____ orchards, vineyards or other permanent crops
_____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
_____ water plants: water lily, eelgrass, milfoil, other

_____ other types of vegetation

There is no vegetation located in the construction area within the equipment compound.

b. What kind and amount of vegetation will be removed or altered?

No vegetation exists or will be removed from the construction area within the fenced SVE system equipment compound.

c. List threatened and endangered species known to be on or near the site.

None.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Not applicable.

e. List all noxious weeds and invasive species known to be on or near the site.

None.

5. **Animals**

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site. Examples include:

birds: Hawk, songbird, Canadian geese, chucker, and owl
mammals: Coyote, ground squirrel, and rabbit/hare
fish: None

b. List any threatened and endangered species known to be on or near the site.

Habitat and species GIS data were procured and analyzed from the Washington Department of Fish and Wildlife (WDFW) to determine if there are any endangered species known to be on or near the project area. The data reviewed included the Wildlife Survey Data Management, Priority Habitats and Species Areas, Washington Lakes and Rivers Information System, and Marine Environment GIS datasets. No threatened or endangered species are known to occur on or within 1/2 mile of the project area.

c. Is the site part of a migration route? If so, explain.

The project area is in the Pacific Flyway, but does not have habitat to support migratory birds.

d. Proposed measures to preserve or enhance wildlife, if any:

None.

e. List any invasive animal species known to be on or near the site.

None.

6. **Energy and natural resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity will be used to power components of the RTO system. Natural gas will provide fuel to initiate the incineration process. Electricity will be used to power the control panel and motors.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The expected operating temperature of the RTO system is 1,650 to 1,800°F. Ceramic heat recovery units will be used to regeneratively heat and cool the influent and effluent materials. A maximum of 95% heat recovery efficiency is possible through this regenerating and reversal flow process.

## 7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

Environmental health hazards were evaluated in the *Second-Tier Risk Analysis* and *Supplemental Exposure Assessment*. Exposure to emissions generated by the RTO system have been determined to be within permissible limits.

There is a potential for fire or explosion during the extension of the natural gas line to the RTO. Representatives of Cascade Natural Gas have been and will be consulted during the design process and will be on Site during the critical construction periods to assist with safe hookup.

Hazardous vapors will be piped into the RTO system for thermal oxidation destruction. Piping is designed with maximum continuous runs with air and watertight joints and welds. The control system will monitor pressure and flow within each line. Bypass and emergency shutoff components are also present within the system.

1) Describe any known or possible contamination at the site from present or past uses.

The proposed location of the RTO system is within the SVE system equipment area of the Pasco Landfill NPL Site. The equipment area is located adjacent to the closed Zone A industrial waste landfill. The SVE system is being operated as an interim action at the Site to remove hazardous substances from within, beneath, and downgradient of the Zone A landfill. Groundwater contaminants have been detected in samples collected from wells located in Zone A. Upgrades made to the SVE system in 2012 have resulted in reduced concentrations and detections of chemicals of concern in groundwater samples collected from wells located within and downgradient of the equipment compound. There is no known soil contamination within the equipment compound.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

An evaluation of hazardous compounds and their effects on system design has been performed. Results of the analysis are included in the *Second-Tier Risk Analysis* and *Notice of Construction Application.* Design considerations and modifications have been made to address the hazardous nature of the RTO system influent, health and environmental effects of the RTO system effluent, acid gas production, the effects of corrosive compounds on various components of the system, and other concerns. Checks of all system components will occur before startup to ensure that the system operates properly within design specifications.

A high-pressure natural gas main pipeline runs diagonally across the subject parcel from the southeast to the northwest. The gas line is located approximately 12 feet northeast of the northeastern corner of the fenced SVE equipment compound and approximately 100 feet from the RTO system construction area. The gas main will not affect installation of the RTO system.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

As discussed above, the SVE system produces soil vapors that will be processed by the RTO system. During the SVE vapor recovery process condensate accumulates within four underground moisture separators and three secondary water knockout tanks upstream of the blowers within the SVE Operations Building. The condensate is pumped into an oil-water separator to remove light non-aqueous phase liquids (LNAPL), which then drain into a holding tank for temporary storage. Based on historical condensate and LNAPL analysis, the LNAPL will likely contain toxic and/or hazardous compounds. In the future, possible evaporation of the condensate with injection of the condensate vapor into the RTO for treatment may be implemented. Further information on specific compounds contained within these vapors and condensate and their historical concentrations is included in the *Notice of Construction Application* and *Second-Tier Analysis.*

4) Describe special emergency services that might be required.

Work and operations at the Site are currently performed under the *Health and Safety Plan – Soil Vapor Extraction System Operations and Maintenance and Groundwater Monitoring, Pasco Sanitary Landfill Site, Pasco, Washington* (*Health and Safety Plan*) dated February 2014. The Health and Safety Plan contains Site specific emergency procedures, lines of authority, project-specific requirements, risk analysis and control, Site control and communications, decontamination procedures, health and safety training, requirements for personal protection equipment, air monitoring, Site hazards, and medical surveillance.

5) Proposed measures to reduce or control environmental health hazards, if any:

Measures to reduce health hazards are evaluated in the *Notice of Construction Application* and *Second-Tier Analysis.*

Appropriate personal protective equipment (PPE) will be worn during project activities. Expected PPE use will include hard hats, work boots, appropriate gloves, and protective eyewear and ear protection, as necessary. The Site Health and Safety Officer may make variations of PPE use dependent on work activity and approval.

b. **Noise**

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Intermittent short-term noise will be generated by RTO installation activities during daylight hours.

Long-term noise will continue to be generated within the SVE equipment building located on-site as a result of an operating regenerative blower and associated motors and other equipment.

Noise from the RTO system components will be below allowable City of Pasco noise limitations at the property line as established in Pasco Municipal Code PMC 9.61.030 and 9.61.040.

3) Proposed measures to reduce or control noise impacts, if any:

Equipment will be required to have functional mufflers or other noise-reducing appurtenances, as appropriate. Equipment not in use will be shut off.

All project area workers will be required to wear ear protection if exposed to noise levels above permissible exposure limits (PELs).

## 8. Land and shoreline use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The subject parcel is currently used as an equipment compound for the Zone A SVE system, hazardous and non-hazardous waste storage area, and work trailer/office for cleanup workers.

The current uses of parcels adjacent to the subject parcel (project area) are:

- North: Agricultural use – Department of Natural Resources.
- East of the northern three-fourths of the subject parcel: Closed landfills/Superfund Cleanup Site.
- East of the southern quarter of the subject parcel: Basin Disposal Inc. transfer station and recycling facility.
- South: Oxarc, Inc. lime slurry evaporation lagoon and hydrogen production facility.
- West: Agricultural use.

The proposed is not expected to affect land use of adjacent parcels. Air quality impacts associated with the proposed project were evaluated and reported in the *Revised NOC Application, Revised Second-Tier Risk Analysis*, and *BDI Exposure Assessment*. Exposure concentrations calculated for receptor locations were compared to relevant non-cancer risk-based toxilogical values. The hazard index was calculated to be less than 1, indicating that non-cancer effects are not likely to result from acute or chronic exposure to cumulative toxic air pollutant (TAP) impacts at nearby residential, commercial/industrial, sensitive/institutional or maximum impacted boundary receptors. The project-related health risks are estimated to be less than the limits permissible under WAC 173-460-090.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No agricultural or forest land will be converted as a result of this proposal. The proposed RTO system will be installed within a fenced equipment compound that has been used to house the SVE system and other remedial equipment since at least May 1997.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

The proposed RTO system installation will not affect or be affected by farm operations such as oversize equipment access, the application of pesticides, tilling, and harvesting.

A literature review was conducted to determine the potential impacts of HCl emissions to a generic agricultural crop. Information on the direct influences of HCl emissions to crop growth is limited; however, some studies, relevant to test firing of rocket engines (which release extremely high levels of HCl to the atmosphere) have examined some effects to agriculture.

In 2013, Mendenhall studied the influences of rocket motor test-fire emissions deposition on corn and alfalfa (Mendenhall 2013). Mendenhall investigated the impacts of contaminant deposition (with HCl as a significant component) from rocket test emissions on residential rooftops and livestock crop foliage and soil. It was demonstrated that crop germination and growth was inhibited by the salt stress induced as HCl was neutralized to chloride in the soil. The study showed that the deposition of

test-fire emissions on soil increased chloride concentrations from approximately 50 to 120 milligrams per kilogram (mg/kg) to a range of 35,900 to 69,100 mg/kg. This resulted in dehydration, and increased the accumulation of metals in the corn and alfalfa biomass, likely due to a compensative biochemical measure to improve water uptake (calcium and potassium were the only metals of elevated levels of concern for livestock feed). These temporary HCl emission deposition influences on crop hydration, germination, and growth were mitigated by frequent rain or watering events (that rinsed foliage).

The impacts of HCl deposition on crops evaluated in the Mendenhall study were a result of HCl emissions that are several orders of magnitude greater than the anticipated emissions from the proposed RTO. For example, as described in the Mendenhall study, approximately 236,000 pounds of HCl was released into the atmosphere during the test firing of one solid rocket engine. The proposed maximum hourly HCl emission rate (4.9 lbs/hour) for the project is less than 0.002 percent of the HCl quantity that was released during the rocket test evaluated in the Mendenhall study. Even at the emission levels reported in the Mendenhall study, the suggested mitigation strategy for the rocket test firing was to simply increase irrigation of the exposed crop. Based on the results of the Mendenhall study and the conservatively high maximum emission rates calculated for the proposed RTO, impacts to nearby agricultural fields near the RTO are not anticipated.

Effect of Deposition from Static Test Fires on Corn and Alfalfa. Master's Thesis. Mendenhall, S. 2013. Available at:

http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2403&context=etd

Utah State University. Logan, Utah. Accessed July 10, 2014.

c. Describe any structures on the site.

The fenced SVE equipment compound contains the SVE system equipment building (15' x 20'), a concrete secondary containment structure containing waste water tanks (20' x 20'), and a storage shed (15' x 20'). The SVE building houses remediation equipment associated with the Zone A SVE system. A portable work trailer/office is located approximately 225 feet north of the fenced equipment compound on the subject parcel. In addition there is an existing RTO system that is being replaced by the subject RTO system that will be maintained on site for an undetermined period of time.

d. Will any structures be demolished? If so, what?

No.

e. What is the current zoning classification of the site?

Parcel Number 113-510-059 is currently zoned as 81 - Resource - Agriculture.

f. What is the current comprehensive plan designation of the site?

The Franklin County Comprehensive Plan has designated Parcel Number 113-510-059 to be zoned as 81 – Resource - Agriculture. The Pasco Landfill NPL Site, is currently being managed through Agreed and Enforcement Orders with the Washington State Department of Ecology and various potentially liable persons (PLPs). The Site is not proposed to undergo redevelopment.

g. If applicable, what is the current shoreline master program designation of the site?

Not applicable.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

No. The Benton-Franklin County Health District has acknowledged in a telephone conversation that the PSL and project area are not in an "environmentally sensitive" area.

i. Approximately how many people would reside or work in the completed project?

The Project is not residential and no employees will work on the completed RTO system full time.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Does not apply.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed scope of work is compatible with the current land use and plans for the PSL Site.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

Proposed measures to ensure compatibility with agricultural activity on the property and nearby include measures listed above and/or in the *Second–Tier Analysis* and *Notice on Construction Application* for reducing emissions from the RTO facility.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Does not apply.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Does not apply

c. Proposed measures to reduce or control housing impacts, if any:

Does not apply.

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The existing RTO system included a 20-foot stack; however, the new RTO system will include a 30 ft stack.

b. What views in the immediate vicinity would be altered or obstructed?

Does not apply—there are no other structures surrounding the project area that would have views altered or obstructed.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Does not apply. The RTO system construction site is located in an area with light-industrial use adjacent to agricultural fields, undeveloped land, and a Superfund Site.

### 11. Light and glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

No light or glare will be produced.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light and glare impacts, if any:

Not applicable.

### 12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

The property west of the project area is agricultural farmland and is used several times a year for goose hunting.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No, installation of the RTO system would not displace any recreational users.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Does not apply.

### 13. Historic and cultural preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

No. The property is a "Superfund" Site as it is listed on the National Priorities List. Landfill operations have been located on the Site since 1958. Historical aerial photographs dating back to 1941 show no development other than landfill operations and agricultural use at the Site.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

No.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

As mentioned above, historical aerial photographs dating back to 1941 show no development other than landfill operations and agricultural use at the Site.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

Does not apply.

14. **Transportation**

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

The construction area is accessed through locked gates along a private drive off of Dietrich Road.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

Not applicable. The site is on private property and not intended to be accessible to the general public.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

The project will not create nor eliminate any parking spaces.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

No road or transportation improvements are necessary.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

The completed RTO system does not house any workers. The average vehicular traffic would be less than or equal to 1 vehicle per day.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No.

h. Proposed measures to reduce or control transportation impacts, if any:

There are no impacts to transportation anticipated with the proposed scope of work.

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

No.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Does not apply.

16. **Utilities**

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other _____

Electric and communication are the utilities currently at the Site.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Additional communication and electric connections are proposed as well as installation of a natural gas line.

## C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

| | |
|---|---|
| Signature: | _____ |
| Name of signee: | Tina M. Blakley |
| Position and Agency/Organization | Senior Engineer/PBS |
| Date Submitted: | October 10, 2016 |

## D. Supplemental Sheet for Nonproject Actions

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   Proposed measures to avoid or reduce such increases are:

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

3. How would the proposal be likely to deplete energy or natural resources?

   Proposed measures to protect or conserve energy and natural resources are:

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   Proposed measures to protect such resources or to avoid or reduce impacts are:

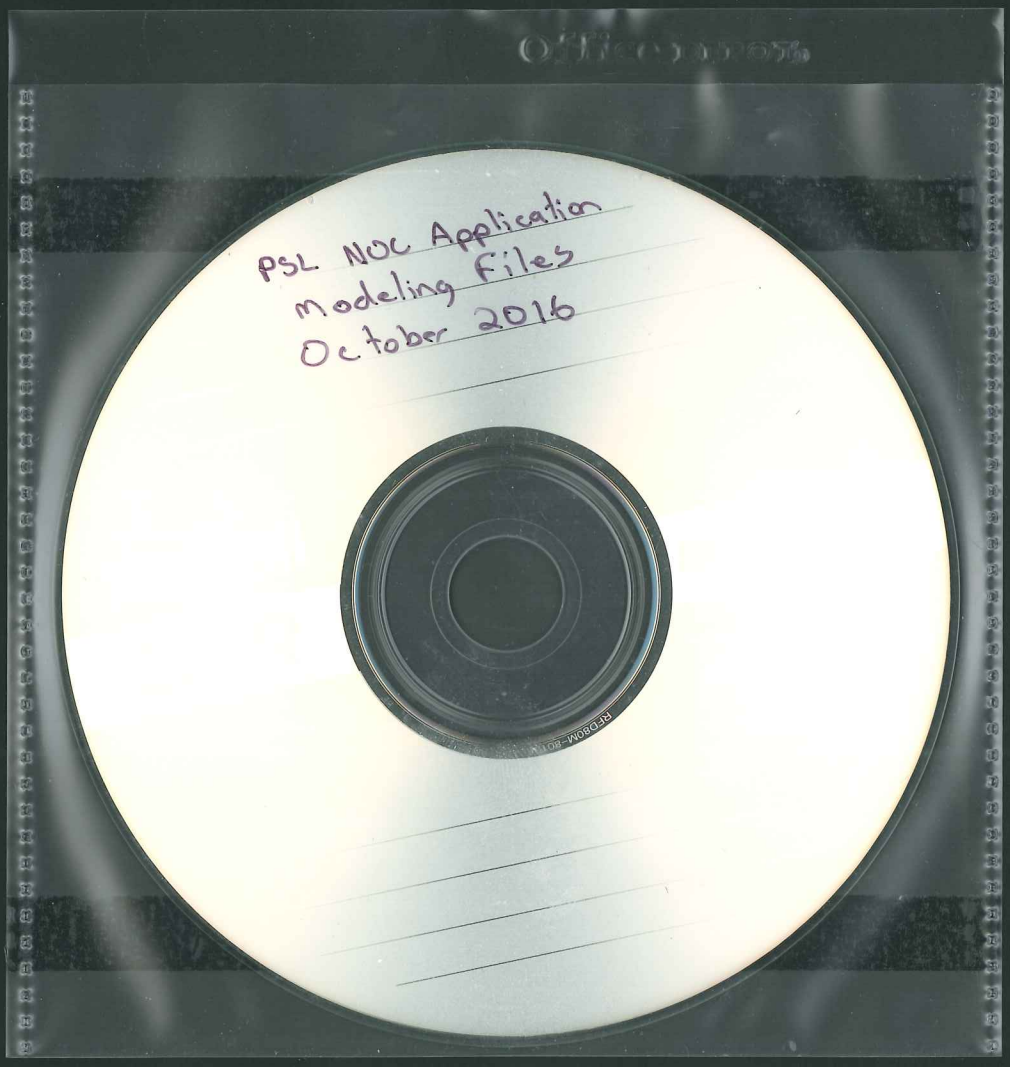
5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   Proposed measures to avoid or reduce shoreline and land use impacts are:

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   Proposed measures to reduce or respond to such demand(s) are:

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.


PSL NOC Application
Modeling Files
October 2016