GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Richard E. Dunn, Director

Air Protection Branch
4244 International Parkway
Suite 120
Atlanta, Georgia 30354
404-363-7000

NARRATIVE

TO: Kirk Drucker

FROM: Ginger Payment

DATE: July 3, 2019

Facility Name:	**Hartybake**
AIRS No.:	121-00919
Location:	Atlanta, GA (Fulton County)
Application #:	27063
Date of Application:	April 29, 2019

Background Information

Hartybake is an existing commercial bakery located at 6160 Boat Rock Blvd. SW in Atlanta (Fulton County). The bakery produces yeast-raised bakery products including breads and waffles. Permit No. 2015-121-0919-S-01-0 was issued on January 10, 2013 for the construction and operation of the commercial bakery. Permit Amendment No. 2015-121-0919-S-01-1 was issued on March 24, 2014 for the construction and operation of a new waffle line.

The first line is a bread/pretzel line and the second line is a waffle line. The dough is a mixture of flour, water, yeast, salt, dry or liquid flavoring and other minor ingredients such as olive oil in some dough. The dough is mechanically mixed, allowed to rest, shaped into loaves and waffles, allowed to rise in a proofer and then baked in an oven. The bread cools on a conveyer and is then frozen, packaged, stored and shipped. The waffle product is cooled, packaged and then some are frozen, and some are stored before shipping.

Purpose of Application

Application No. 27063 was submitted on April 29, 219 and was received on May 6, 2019 to request an increase in VOC emission limit for the baking lines. As a result of the requested emissions increase, a RACT analysis was conducted for an emission increase from 25 tpy to 40 tpy. A public advisory (PA0519-2) was issued on May 8, 2019 and expired on June 7, 2019

A public Notice was issued for this application and expired __________.

Updated Equipment List

Emission Units			Associated Control Devices	
Source Code	**Description**	**Installation Date**	**Source Code**	**Description**
M01	Mecatherm Oven 01 (Mecatherm FTC 28-03-150 Tunnel Indirect Fired – 1.2 MMBtu/hr) for Line 1 – Bread/Pretzel Line	2012	--	--
W01	Acemal Waffle Oven (Acemal Tunnel Oven Indirect Fired – 1.65 mmBtu/hr) for Line 2 – Waffle Line	2012	--	--

The facility also has a small electric boiler onsite. The flour silos (S01 and S02) were never installed; therefore, these emission units have been removed from the equipment list. Also the natural gas oven W02 has been decommissioned and has been removed from the equipment list.

Emissions Summary

The emissions from the natural gas combustion sources are based on AP-42 emission factors and the maximum heat capacity of the sources.

The emissions from the baked products were calculated using the document "Alternative Control Technology Document for Bakery Oven Emissions" (EPA 453/R-92-017, December 1992) as stated in AP 42, Fifth Edition, Volume I Chapter 9: Food and Agricultural Industries. Until testing is conducted on the baked products, it is assumed that all VOC emissions from the flavoring are emitted.

The potential emissions are based on 8760 hours of operation per year. The actual emissions are based on a 24 hour/day, 6 day/week, and 52 week/year operating schedule.

VOC emissions from the facility are limited with applicable conditions. Potential HAP emissions are below the 25/10 tpy major source threshold. PM, NOx, SO2 and CO are also below the major source thresholds.

Facility-Wide Emissions
(in tons per year)

Pollutant	Potential Emissions			Actual Emissions		
	Before Mod.	**After Mod.**	**Emissions Change**	**Before Mod.**	**After Mod.**	**Emissions Change**
$PM/PM_{10}/PM_{2.5}$	9.29E-2	9.29E-2	--	<9.29E-2	<9.29E-2	--
NOx	1.22	1.22	--	<1.22	<1.22	--
SO_2	7.34E-3	7.34E-3	--	<7.34E-3	<7.34E-3	--
CO	1.03	1.03	--	<1.03	<1.03	--
VOC	25	50	25	33.97	<50	16.03
Max. Individual HAP	2.20E-2	2.20E-2	--	<2.20E-2	<2.20E-2	--
Total HAP	2.31E-2	2.31E-2	--	<2.31E-2	<2.31E-2	--

Regulatory Applicability

The facility will continue to be subject to Georgia Rule (b) – *Visible Emissions* and Georgia Rule (d) – *Emissions from Fuel-Burning Equipment*. The facility will continue to limit the fuel to natural gas in order to avoid Georgia Rule (g) – *Sulfur Dioxide*.

As a result of the exceedance the previous VOC emission limit of 25 tpy, the facility will now be subject to Georgia Rule (tt) - *VOC Emissions from Major Sources* and a RACT (Reasonably Available Control Technology) analysis is required to be conducted. The following is the RACT analysis.

RACT Review for VOC

The four activities at Hartybake that have the potential to emit VOC are yeast emissions, flavor emissions, cleaners/sanitizers and natural gas combustion.

1. Yeast Emissions

   VOC emissions from yeast are determined via the document "Alternative Control Technology Document for Bakery Oven Emissions" (EPA 453/R-92-017, December 1992). Potential VOC emissions are based on the worst-case products and a run time of 8,760 hours per year.

2. Flavor Emissions

   The facility assumes that 100% of the VOC emissions from flavorings added to the baked products are emitted. The emissions are calculated using a material balance of the flavor application rate (lb/hr) and the VOC content of each flavor (%).

3. Cleaners and Sanitizers

   VOC emissions from cleaners and sanitizers are fugitive emissions. The emissions from cleaners and sanitizers are calculated by the gallons used per month and the VOC content (lb/gal) of each product. For the calculation of potential VOC emissions, it was assumed that annual VOC emissions from cleaners and sanitizers would not exceed 10 tpy.

4. Natural Gas Combustion

   Potential VOC emissions from Mecatherm Oven M01 (1.2 MMBtu/hr) and Acemal Waffle Oven W01 (1.65 mmBtu/hr) were calculated using the burner heat capacities and AP-42 Emission Factors from Chapter 1.4 for natural gas combustion.

Identify Product Alternative

1. Yeast Emissions

   There are no alternative products available to replace the yeast emissions.

2. Flavor Emissions

   The facility had previously used liquid flavorings which had significant VOC content. However, the facility is in the process of adding powder flavorings which have no VOCs and reduce the amount of liquid flavorings used in the baked products.

3. Cleaners and Sanitizers

   No alternative products have been identified to replace the cleaners and sanitizers. However, the facility is employing engineering controls to minimize use of cleaners and sanitizers.

4. Natural Gas Combustion

   There are negligible emissions from natural gas combustion and no alternative product.

<u>Identify Technological Alternatives</u>

Hartybake evaluated RACT for the waffle line and the bread/pretzel line by determining what process changes and add-on emission controls are technically feasible for the specific type of equipment. Potential emission reduction options were determined from EPA's RACT/BACT/LAER (RBLC) Clearinghouse and other research. Organic Evaporative Losses was searched for Bakeries and Snack Food (RBLC Code 70.550) and Other Agricultural Products (RBLC Code 70.590). The following control technologies are considered to be technologically feasible:

1. Biofiltration
2. Refrigerated Condensers
3. Direct Flame Incinerators
4. Adsorption
5. Recuperative Thermal Oxidizer
6. Regenerative Thermal Oxidizer
7. Catalytic Oxidizer
8. Emission Limits (Annual, Quarterly, Hourly)
9. Good Management Practices

<u>Eliminate Technically Infeasible Options</u>

1. Biofiltration

   In biofiltration, off-gases containing biodegradable organic compounds are vented, under controlled temperature and humidity, through a biologically active material. The process uses a biofilm containing a population of microorganisms immobilized on a porous substrate such as peat, soil, sand, wood, compost, or numerous synthetic media. As an air stream passes through the biofilter, the contaminants in the air stream partition from the gaseous phase to the liquid phase of the biofilm. Once contaminants pass into the liquid phase, they become available for the complex oxidative process by the microorganisms inhabiting the biofilm.

   The microorganisms used in biofiltration cannot survive at temperatures exceeding 105 °F; however, the temperature of the exhaust stream from the baking lines ranges from 150 - 214°F. In addition, based on RBLC research on VOC control technology for all processes, biofiltration has not been placed in operation aside from very limited applications. Based on these findings, biofiltration was not considered technically feasible.

2. Refrigerated Condensers

Condensers operate by lowering the temperature of the exhaust gas streams containing condensable VOC to a temperature at which the target VOC's vapor pressure is lower than its entering partial pressure (saturation point). Before the VOC can condense, any sensible heat present in the exhaust gas above the saturation point must be removed. Cooling the exhaust stream to a temperature below the saturation point removes the latent heat from the exhaust and allows the VOC to condense on the surface of the condenser tubes for collection and recycle to the process or disposal to an appropriate location. The tubes located within the condenser contain re-circulating cooling liquid that provides a heat sink for rejecting both sensible and latent heat from the hot exhaust gas stream. Available cooling fluids (depending on the necessary outlet temperature of the exhaust stream to achieve high levels of recovery for the condensable VOC) include chilled water, brine, or refrigerants. Once the cooling liquid is passed through the condenser, it is chilled to the required condenser inlet temperature and recycled back to the cooling liquid inlet of the condenser.

The VOC efficiency achieved by a condenser, as a sole add-on control device, is a function of: 1) the heat capacity and temperature of the inlet exhaust stream, 2) the heat transfer characteristics of the condenser (including the heat transfer area and the heat transfer coefficient), and 3) the outlet temperature of the exhaust gas exiting the condenser. Condensers are most effective in single component systems involving emission streams with a high percentage of a condensable VOC, because less heat must be removed from the exhaust gas to reduce the sensible heat of non-condensable gases and the required condenser temperature to achieve high levels of recovery. Unlike other VOC control devices for which quantifying control efficiency can require emissions testing, only the outlet exhaust gas temperature is required to estimate the VOC control efficiency of a condenser if the temperature, VOC concentration, and flow rate of the non-condensable in the inlet exhaust stream are all known. Since the control efficiency of a condenser is dynamic based on the outlet temperature and inlet concentration of VOC in the exhaust stream, condensers exhibit a wide range of VOC control efficiency from as low as 50% to as high as 99%.

Refrigerated condensers were determined to be infeasible in these cases because the concentrations by volume of VOC in the oven exhausts are well below 5,000 ppmv. According to the US EPA Air Pollution Control Cost Manual, refrigerated condensers are used as air pollution control devices for treating emission streams with high VOC concentrations (usually > 5,000 ppmv) in applications for example involving gasoline bulk terminals, storage, etc. The concentration of VOC by volume in the waste gas streams is 212 ppmv. Due to the low concentration, condensation of the waste gas streams was not considered technically feasible.

3. Direct Flame Incinerators

Straight thermal oxidizers without heat recovery are reserved for applications where the heating value of the exhaust stream routed to the oxidizer is high enough that large amounts of supplemental fuel combustion or high levels of heat recovery are not necessary to bring the exhaust gases to oxidation reaction temperatures. In order to provide VOC control in a practical and efficient manner, straight thermal oxidizers require a VOC inlet concentration of greater than

1,500 ppmv, because at this concentration, the heat of combustion produced from oxidizing VOC present in the exhaust gas is sufficient to sustain adequate operating temperatures without the addition of large quantities of expensive auxiliary fuel. The concentration of VOC by volume in the waste gas streams is 212 ppmv which is well below 1,500 ppmv. In addition, based on RBLC research on VOC control technology for all processes for the past ten years, direct flame incinerators were not used by any facilities. Direct flame incinerators was not considered technically feasible.

Technical Feasibility Determination

4. Adsorption

Regenerative adsorption systems are typically a batch operation involving two or more fixed adsorption beds. One or more of the beds operates in adsorption mode while the others operate in regeneration mode. Several adsorbent materials with substantial surface area per unit volume can be used in adsorbers including activated carbon, organic resin polymers, and inorganic materials such as zeolite. An induced draft fan is typically used to force the VOC-laden gas through the adsorption bed where the VOC molecules are physically bound to the pore space in the adsorbent by Van der Waals nuclear attraction forces. There are many types of carbon, polymer, and zeolite adsorbents available with different affinities for adsorbing various VOC. A key selection criterion for determining the appropriate adsorbent is the range of pore sizes relative to the largest molecular size of the VOC to be adsorbed.

The batch nature of the adsorption process concludes when the adsorbent bed becomes saturated with VOC and must be replaced or regenerated. The gas-solid interface within the bed at which adsorption is occurring is referred to as the mass transfer zone (MTZ), and the location of this MTZ within the bed determines its level of bed saturation and the time at which it must be replaced or regenerated. When the MTZ nears the end of the bed, the VOC concentration of the exhaust gas will increase producing a phenomenon referred to as "breakthrough."

After breakthrough has occurred in an adsorbent bed, it must be replaced with a new bed or regenerated using a thermal swing or vacuum process. For this analysis, it was assumed bed replacements would be selected over bed regeneration since the collected VOC would need to undergo thermal treatment for final destruction.

The typical VOC inlet concentration required for effective adsorption falls in the range of 400 to 2,000 ppm, and adsorbers and their associated follow-up control devices (i.e., condenser or decanter) are typically capable of achieving VOC control efficiencies greater than 95%. The concentration of exhaust stream from the baking lines is at 212 ppm which is slightly below the concentration range for effective adsorption. Adsorption system was considered to be technically feasible.

5. Recuperative Thermal Oxidizer

Oxidizers with heat recovery are either considered recuperative or regenerative depending on the design of the incoming process gas to exhaust gas heat exchange system. Recuperative oxidizers (labeled herein as a TO) use plate-to-plate or shell-and-tube gas heat exchangers to recover up to 70% of the sensible heat present in the hot exhaust to transfer it to the incoming process gas. U.S. EPA expects that a TO can achieve a destruction/removal efficiency (DRE) of greater than 98%

depending on the system requirements of the air contaminant stream. Typical gas flow for TOs are 500 to 50,000 scfm. While the concentration and exit temperature of the exhaust stream from the baking lines is comparatively low for this option to be feasible, a recuperative oxidizer was considered to be technically feasible.

6. Regenerative Thermal Oxidizer

A regenerative thermal oxidizer (RTO) uses a high-density packed heat transfer media, typically ceramic random saddle packing or honeycomb monolith structures, to preheat incoming waste gas streams and to achieve 85 to 95% heat recovery. The RTO consists of at least two modules that are cycled between inlet and outlet service to maintain appropriate operating temperatures and to conserve as much thermal energy as possible. The high level of heat integration offered by RTOs is particularly suited for high flow rate and low VOC concentration waste gas streams that do not vary in composition or flow rate over time. When necessary, the feed gas stream in an RTO can also be further heated to the oxidizer's operating temperatures (1,400 to 2,000 °F) through supplemental fuel combustion. RTOs have been used effectively in applications where the inlet VOC concentration is as low as 100 ppmv, and, therefore, they are the preferred oxidizer design for low VOC concentration exhaust stream U.S. EPA expects that an RTO can achieve a destruction/removal efficiency of greater than 95% depending on the system's requirements and the characteristics of the contaminated stream.

Typical gas flow for regenerative incinerators are 5,000 to 500,000 scfm. While the concentration and exit temperature of the exhaust stream from the baking lines is comparatively low for this option to be feasible, a regenerative thermal oxidizer (RTO) was considered to be technically feasible.

7. Catalytic Oxidizer

Thermal oxidation systems designed to pass the gas stream over a catalyst bed (usually a noble metal such as palladium or platinum), where combustible compounds can be oxidized at a faster rate and at a lower temperature than is possible with a TO or RTO, are called catalytic oxidation systems (CatOx). The process requires temperatures of 600 to 1,000°F to achieve high destruction efficiencies for VOC. Below this range, the reaction rate drops sharply and effective oxidation of VOC is no longer feasible. Typical gas flow for packaged catalytic incinerators are 700 to 50,000 scfm. While the mass emission rate of Hartybake's exhaust stream is relatively low compared to other bakeries using a catalytic oxidizer, a catalytic oxidizer was considered to be technically feasible.

8. Emission Limits (Annual, Quarterly, Hourly)

The facility is proposing to limit emissions to less than 40 tons of VOC during any 12-month period from the baking operations.

9. Good Management Practices

The use of good management practices at the facility includes using powder flavor where possible, and recordkeeping and reporting to Georgia EPD if VOC emissions from the baking lines exceeds 3.33 tons per month or 40 tons/rolling 12-month period.

Rank Remaining Control Technologies

Control Ranking	Control Technology	Destruction / Control Efficiency
1	Recuperative Thermal Oxidizer	99%
2	Regenerative Thermal Oxidizer	95-99%
3	Carbon Adsorption	98%
4	Catalytic Thermal Oxidizer	95%
5	Good Management Practices	N/A

Energy, Environmental and Economic Impacts

The energy consumption of each control technology and emission unit pairing was calculated using the procedures specified in the EPA Air Pollution Control Cost Manual and calculation spreadsheet provided by EPA (dated in 2018). These impacts are important because the nation's energy supply and distribution capacity is limited. The securing, production, and distribution of energy has impacts on the availability and cost of energy, the nation's balance of trade, and national security. While estimating the cost of these externalities is beyond the scope of this analysis, it is important that the magnitude of these impacts is considered when evaluating potential pollution control technologies. As such, the estimated annual consumption of electricity and natural gas for each such control technology is listed below.

Secondary environmental impacts of proposed control technologies were also considered, as they may create emissions of one type while controlling emissions of another. Based on the estimated annual energy consumption of each control technology, the estimated nitrogen oxides (NOx), carbon monoxide (CO), and greenhouse gas (GHG) emissions of each pairing are summarized below.

Control Technology	Natural Gas Consumption (scf/yr)	Electricity Consumption (kWh/yr)	NO_x Emissions (tpy)	CO Emissions (tpy)	GHGs (CO_2e) Emissions (tpy)
Recuperative Thermal Oxidizer	38,681,101	292,724	1.93	1.62	245.9
Carbon Adsorption	--	--	--	--	--
Regenerative Thermal Oxidizer	11,003,075	292,724	0.55	0.46	69.94
Catalytic Thermal Oxidizer	18,599,504	241,816	0.93	0.78	118.2

Cost Effectiveness

Economic analyses were performed to compare total costs (capital and annual) per ton of pollutant removed for control technologies that have been deemed technically feasible. Capital costs include the initial cost of the components intrinsic to the complete control system. Annual operating costs include the financial requirements to operate the control system on an annual basis including overhead, maintenance, outages, raw materials, and utilities.

Cost analysis is based on EPA Air Pollution Control Cost Manual and calculation spreadsheet provided by EPA (dated in 2018). Note that capture cost is not included in EPA's calculation template. Therefore, additional duct work costs were calculated separately based on EPA Air Pollution Control Cost Manual - Sixth Edition (EPA 452/B-02-001), Section 2, Chapter 1 - Hoods, Ductwork, and Stacks.

Note that this evaluation assumed that the capture efficiencies of process VOC emissions from the baking lines are 100% for Hartybake's existing capture system. However, emissions from the four mixers are not captured and are emitted as fugitive emissions. In addition, proof boxes at the facility are not 100% captured. Additional cost will be required to capture all emissions from the proof boxes and reroute to the stack. The cost of adding vacuum pickup points and routing gas to stacks were not estimated as part of the evaluation. In addition, improving the capture efficiencies will increase the flow rate and decrease the VOC concentration of the waste stream, which will increase the cost as well.

Hartybake evaluated the cost effectiveness of each control strategy by developing annualized cost estimates used to determine the unit cost of reducing one (1) ton of VOC emissions. The following table indicates the cost effectiveness of the technically feasible control options for reducing VOC emissions from the two production lines combined. See Appendix D of the applicaiton for detailed calculations regarding cost effectiveness of the technically feasible control options.

Control Technology	Control Technology (%)	Potential Emissions (tpy)	Pollutant Removed (tpy)	Cost Effectiveness ($/ton removed)
Recuperative Thermal Oxidizer	99	40	39.6	$11,416
Carbon Adsorption	98	40	39.2	$75,976
Regenerative Thermal Oxidizer	97	40	38.8	$9,061
Catalytic Thermal Oxidizer	95	40	38.0	$9,368

Selection of VOC RACT

The cost of all add-on VOC control technologies would exceed the benefit of VOC reduction. Therefore, RACT for the two baking lines at the Hartybake facility is determined to be:

- Good Management Practices, including using powder flavor where possible
- Recordkeeping and reporting to Georgia EPD if VOC emissions from the baking lines exceeds 3.33 tons per month or 40 tons/rolling 12-month period.

Cleaner/Sanitation Chemicals

VOC emissions from cleaner and sanitation chemicals are emitted as fugitive emissions in the production building. The cleaner and sanitation chemicals are using in different production areas within the facility. Hartybake is proposing good management practices for controlling emissions from the use of cleaner and sanitation chemicals. In addition, Hartybake will track emissions from cleaner and sanitation chemicals to ensure compliance with the facility-wide VOC limit of 50 tpy. Hartybake will report to Georgia EPD if facility-wide VOC emissions exceed 50 tons/rolling 12-month period.

Permit Conditions

- Condition 2.1 was modified to limit the VOC emissions to less than 50 tpy. This limit includes a 40 tpy limit for the baking lines as determined in the RACT analysis.
- Condition 2.5 is new condition that limits the VOC emissions from the baking lines to less than 40 tpy as determined in the RACT analysis.
- Condition 2.6 requires the facility to use powder flavorings as a requirement for good management practices as determined by RACT.

- Condition 6.2 is a new condition which allows the facility to test the flavorings. The facility is currently required to assume that 100 % of the VOC emissions from the flavorings is emitted; however, they may test for flavoring retention. Testing is not required though.
- Condition 7.1 was modified to include record retention of flavoring usage, flavoring VOC-content, natural gas usage and records for cleaning and sanitizing chemicals.
- Condition 7.2 was modified to remove the natural gas emissions from the equation. Natural gas emissions are now a separate condition by itself and Condition 7.2 only addresses the VOC emissions from yeast.
- Condition 7.3 is a new condition which requires the calculation of VOC emissions from natural gas usage.
- Condition 7.4 is a new condition which requires the calculation of VOC emissions from flavorings.
- Condition 7.5 is a new condition which requires the calculation of VOC emissions from cleaning and sanitizing chemicals.
- Condition 7.6 (previously Condition 7.3) was modified to change the monthly VOC total for notifications to 4.16 tons during any month.
- Condition 7.7 (previously Condition 7.4) was modified to change the 12-month rolling VOC notification to 50 tpy for total VOC emissions.
- Conditions 7.8 and 7.9 are new conditions which require the facility to determine the monthly and 12-month rolling totals of VOC emissions from the baking operations only. The facility is required to notify the Division if any one month exceeds 3.3 tons of VOC emissions or if any 12-month total exceeds 40 tpy. These calculations will confirm the emission limitation for the baking operations as determined by the RACT analysis.

Toxic Impact Assessment

A toxic impact assessment was prepared by the Division using information provided by the facility. SCREEN3 was used to evaluate ethanol emissions from the facility. The TIA was based on the maximum allowed ethanol emissions (40 tpy). As a worst-case scenario, all emissions were vented from one stack. The maximum concentration of ethanol was below the acceptable ambient pollutant concentrations.

Summary & Recommendations

I recommend issuance of Permit Amendment No. 2051-121-0919-S-01-2 to Hartybake which is located at 6160 Boat Rock Blvd. SW in Atlanta (Fulton County). This permit amendment allows for an increase in VOC emission limit for the baking lines based on a RACT analysis. A Public Notice was issued for this application and expired __________. The SSCP will continue to be responsible for compliance and inspection of this facility.