

Proactive Best Available Control Technology Analysis

Dehydrator – Fruit and Vegetable, Continuous Belt Process

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I. Introduction

The objective of this project is to proactively update the Best Available Control Technology (BACT) guideline 1.6.13. BACT guideline 1.6.13 covers vegetables that are dehydrated through a continuous process, which was last updated on June 26, 1998. Based on a survey of current District permitted fruit and vegetable natural-gas fired continuous-belt dehydrators, 30 ppmv NO_x @ 3% O₂ (equivalent to 0.036 lb-NO_x/MMBtu) has been reliably met by multiple units with the use of a well-maintained low NO_x burner system. One possible exception to low NO_x burners being achieved-in-practice for this class/category of sources is onion dehydrators. Per Sensient Natural Ingredients LLC (N-1657), low NO_x burners will discolor onions turning them pink, making them less visually appealing to consumers. For this reason this BACT determination will not include onion dehydrators.

In addition, the BACT guideline class/category will be broadened to include fruit, and while the *continuous process* scope of the guideline will be more sharply defined as a *continuous belt process*. Per EPA AP 42 Fifth Edition, Volume 1 Chapter 9: Food and Agricultural Industries 9.8.2 Dehydrated Fruits and Vegetables continuous processes include tunnel, continuous belt, belt-trough, fluidized-bed, explosion puffing, foam-mat, spray, drum, and microwave-heated driers. The District has an expired BACT guideline for Dehydrator Tunnel-Fruit, Natural Gas fired (1.6.14), which is also a continuous process according to AP-42. Therefore, to minimize confusion about the class/category, BACT guideline 1.6.13 will be narrowed down to only include continuous belt dehydrators. In addition, PM₁₀ and VOC control requirements will be analyzed and updated to include the use of PUC quality natural gas fuel as the Achieved in Practice for PM₁₀ and VOC.

This proactive update is necessary to incorporate the most stringent emission control standards that have been achieved in practice. Furthermore, the proactive update to this BACT guideline will bring consistency in implementing the BACT standard throughout the regional offices of the District for new and modified continuous belt process fruit and vegetable dehydrators triggering BACT. The discussion in this document will be limited to the following items:

- Source of emissions
- Top-Down BACT Analysis for each pollutant
- Recommendation

II. Source of emissions

A dehydrator is a device that drives free water from product like fruits, vegetables, and nuts at an accelerated rate without damage to the product. The dehydrator type being analyzed in this BACT analysis is a continuous belt process in which product is placed on a belt and conveyed through a hot air system on a continuous moving belt without the use of trays.

The combustion of fuel by the burners in the vegetable and fruit dehydrating operation results in emissions of NO_x, CO, VOC, PM₁₀, and SO_x. Although the dryers will emit other criteria pollutants, this proactive BACT determination will mirror the expired BACT Guideline and focus exclusively on NO_x, VOC and PM₁₀ emissions from the combustion of fuel by the dryer's burners.

III. Top-Down BACT Analysis

A. BACT Analysis for PM₁₀ Emissions

PM₁₀ is emitted from the drying of the products and fuel combustion.

Step 1 - Identify All Possible Control Technologies

The following BACT Clearinghouse references were reviewed to determine what control technologies have been required:

- EPA RACT/BACT/LAER clearinghouse
- CARB BACT clearinghouse
- South Coast AQMD (SCAQMD) BACT clearinghouse
- Bay Area AQMD (BAAQMD) BACT clearinghouse
- Sacramento Metro AQMD (SMAQMD) BACT clearinghouse
- San Diego APCD (SDAPCD) BACT clearinghouse
- San Joaquin Valley APCD (SJVAPCD) BACT clearinghouse

In addition, rules and regulations from the following agencies were reviewed to determine what PM₁₀ emission limits are currently required for natural gas-fired continuous-belt fruit and vegetable dehydrators.

- San Diego APCD
- South Coast AQMD
- Sacramento Metro AQMD
- Bay Area AQMD
- SJVAPCD
- EPA
- ARB

Finally, the District also conducted a survey of permit limits for continuous-belt fruit and vegetable dehydrators located in SJVAPCD. The purpose of the survey is to determine what PM₁₀ emissions control standards are currently achieved in practice.

1. Survey of BACT Guidelines:

No air districts have published BACT guidelines/determinations for natural gas-fired continuous-belt fruit and vegetable dehydrators.

2. Survey of Applicable Rules and Regulations:

No applicable rules were found to apply to PM10 emission standards for natural gas-fired continuous belt fruit and vegetable dehydrators.

3. Survey of Permitted Sources:

In order to evaluate the PM10 emission rates currently being achieved by fruit and vegetable continuous-belt dehydrators, the emissions limits on units permitted in the SJVAPCD were reviewed. The emissions limits on the permits are summarized in the table below:

Facility/Permit #	Heat input rate (MMBtu/hr)	Technology in-use
Sun-Maid Growers of California (PTO C-1196-12-3)	7.2	PUC quality natural gas
Sun-Maid Growers of California (PTO C-1196-29-0)	2.7	PUC quality natural gas
Vita-Pakt (PTO C-2248-3-2)	17.6	PUC quality natural gas
Sensient Natural Ingredients LLC (PTO N-1657-22-9)	70	PUC quality natural gas
Jain Farm Fresh Food, Inc (PTO N-8853-2-0)	27	PUC quality natural gas
Treehouse California Almonds LLC (PTO S-640-11-1)	9.23	PUC quality natural gas
Kern Delta Co LLC (PTO S-8508-1-1)	64	PUC quality natural gas

As shown in the table above, based on the survey of permitted units, the use of PUC quality natural gas is the most stringent Achieved-in-Practice technology for PM10. In addition, none of the surveyed permits are equipped with either cyclones or baghouses. In now deleted permits C-412-7 and '-8, cyclones were used as material handing devices, not as emissions control devices for PM10. Therefore, the use of vents ducted to a cyclone or baghouse

to control PM10 emission for transfer points will be placed as technologically feasible option in the BACT guideline.

3. List of Control Options:

Based on the survey of the above BACT determinations, the use of PUC quality natural gas fuel is required. The survey of the applicable Rules/Regulations indicate no applicable PM10 emission limits. The following control option is commonly utilized and is considered to be Achieved-in-Practice:

- Use of PUC quality natural gas fuel (Achieved-in-Practice).

Step 2 - Eliminate Technologically Infeasible Options

There are no technologically infeasible options listed in Step 1. All of the emission control options under consideration are based on current BACT requirements. Therefore, no further discussion is required.

Step 3 - Rank Remaining Control Technologies by Control effectiveness

Rank	Control Efficiency or Emission Factor	Achieved in Practice
1	Use of PUC quality natural gas fuel.	Yes

Step 4 - Cost Effectiveness Analysis

This is a proactive determination that is not part of a permitting action. Therefore, a cost effective analysis is not necessary.

Step 5 - Select BACT

This is a proactive determination that is not part of a specific permitting action. Therefore, selecting BACT is not necessary. However, the following PM10 emission control standard has been determined as achieved in practice:

- Use of PUC quality natural gas fuel

B. BACT Analysis for NOx Emissions

NOx is emitted from the dehydrator's burners due to the combustion of fuel to create hot air used to remove moisture from the product.

Step 1 - Identify All Possible Control Technologies

The following BACT Clearinghouse references were reviewed to determine what control technologies have been required:

- EPA RACT/BACT/LAER clearinghouse
- CARB BACT clearinghouse
- South Coast AQMD (SCAQMD) BACT clearinghouse
- Bay Area AQMD (BAAQMD) BACT clearinghouse
- Sacramento Metro AQMD (SMAQMD) BACT clearinghouse
- San Diego APCD (SDAPCD) BACT clearinghouse
- San Joaquin Valley APCD (SJVAPCD) BACT clearinghouse

In addition, rules and regulations from the following agencies were reviewed to determine what NOx emission limits are currently required for natural gas-fired continuous-belt fruit and vegetable dehydrators.

- San Diego APCD
- South Coast AQMD
- Sacramento Metro AQMD
- Bay Area AQMD
- SJVAPCD
- EPA
- ARB

Finally the District also conducted a survey of permit limits for continuous-belt fruit and vegetable dehydrators located in SJVAPCD. The purpose of the survey is to determine what NOx emissions control standards are currently being achieved in practice.

1. Survey of BACT Guidelines:

No air districts have published BACT guidelines/determinations for natural gas-fired continuous-belt fruit and vegetable dehydrators.

2. Survey of Applicable Rules and Regulations:

The requirements for the applicable rules and regulations are summarized in the table below:

Agency	Heat Input rate	Process Temperature	NOx (ppmv @ 3% O2)
SDAPCD Rule 68	50 MMBtu/hr or greater	--	125 ppm
SCAQMD Rule 1147	--	<1,200 °F ≥1,200 °F	20 ppmv or 0.024 lb/MMBtu 30 ppmv or 0.036 lb/MMBtu

Agency	Heat Input rate	Process Temperature	NOx (ppmv @ 3% O2)
SCAQMD Rule 1153.1	--	--	30 ppmv
SMAQMD Rule 419	5 MMBtu/hr or greater	<1,200 °F ≥1,200 °F	30 ppmv or 0.036 lb/MMBtu 60 ppmv or 0.073 lb/MMBtu
BAAQMD	No applicable rule		
SJVAPCD Rule 4309	5 MMBtu/hr or greater	--	No limit
EPA	No applicable rule		
CARB	No applicable rule		

The current most stringent NOx rule requirement for a dehydrator operating at less than 1,200 °F would be 20 ppmv corrected to 3% O₂ or 0.024 lb/MMBtu from SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources). This SCAQMD limit was established for ovens, dehydrators, dryers, heaters, kilns, calciners, cookers, roasters, furnaces, and heated storage tanks. The limit was based on 87 out of 196 units surveyed meeting the 20 ppmv limit. However, of those units, only two were fruit and vegetable dryers, and both of those were spray dryers (rated at 2 MMBtu/hr and 3 MMBtu/hr) used to convert liquids into powders, which are not comparable to the continuous belt dehydrator analyzed in this BACT analysis.

A closer examination of the definitions and applicability of SCAQMD Rule 1147 and SCAQMD Rule 1153.1 (Emissions of Oxides of Nitrogen from Commercial Food Ovens) helps to explain the absence of any continuous-belt fruit and vegetable dehydrators meeting 20 ppmv in the South Coast air basin. Per SCAQMD Rule 1153.1 (Emissions of Oxides of Nitrogen from Commercial Food Ovens), commercial drying ovens must meet a NOx emission limit of 30 ppmv regardless of process temperature. As defined in Rule 1153.1, commercial drying ovens are a cooking device used to heat, cook, dry (remove water or moisture) or prepare food or products for making beverages for human consumption that is used as part of a business. Thus, taking a strict interpretation of the definitions and applicability of Rule 1153.1, the rule would apply to a continuous-belt vegetable and fruit dehydrator. By contrast, SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources) applies to gaseous and/or liquid fuel-fired combustion equipment with NOx emissions *when other SCAQMD Regulation XI rules are not applicable to the unit*. Since SCAQMD 1153.1 would be applicable to the unit proposed in this project, Rule 1147 would not apply. According to SCAQMD staff, no new fruit and vegetable dehydrators have been permitted with the 20 ppmv NOx emission limit; therefore, the 20 ppmv NOx emission limit will not be considered as achieved-

in-practice BACT for the class/category of a *continuous-belt fruit and vegetable dehydrator* addressed in this review.

Summary of Applicable Rules and Regulations:

As shown in the above table, the current most stringent Rule requirement for fruit and vegetable continuous belt dehydrators is:

- NOx emissions of 30 ppmv @ 3% O₂ or 0.036 lb-NOx/MMBtu

3. Survey of Permitted Sources:

In order to evaluate the NOx emission rates currently being achieved by fruit and vegetable continuous-belt dehydrators, the permitted emissions limits on units permitted in the SJVAPCD were reviewed. The emissions limits on the permits are summarized in the table below:

Facility/Permit #	Heat input rate (MMBtu/hr)	Technology in-use	Year Permitted with current NOx EF	Permitted Emissions* (lb-NOx/MMBtu)
Sun-Maid Growers of California (PTO C-1196-12-3)	7.2	PUC quality natural gas	2006	0.06
Sun-Maid Growers of California (PTO C-1196-29-0)	2.7	PUC quality natural gas, Low NOx Burner	2011	0.0304 ⁽¹⁾ (25 ppmv)
Vita-Pakt (PTO C-2248-3-2)	17.6	PUC quality natural gas	2004	0.06
Sensient Natural Ingredients LLC (PTO N-1657-22-9)	70	PUC quality natural gas, Low NOx Burner	1995	0.036**
Jain Farm Fresh Food, Inc (PTO N-8853-2-0)	27	PUC quality natural gas	2013	0.047
Treehouse California Almonds LLC (PTO S-640-11-1)	9.23	PUC quality natural gas	2014	0.0376 ²
Kern Delta Co LLC (PTO S-8508-1-1)	64	PUC quality natural gas, "Ultra Low-NOx" Burner	2014	0.036

¹ Per permit C-1196-29-0, the NOx limit is 2.65 ppmv corrected to 19% O₂ and 0.0303 lb-NOx/MMBtu; however, after reviewing project C-1110368 where this permit was initially evaluated, the manufacture guaranteed 25 ppmv NOx corrected to 3% O₂ and this was converted to 0.0304 lb-NOx/MMBtu.

² Permit unit S-640-11-1 is used for almonds and would be better categorized in the Dryer - Almond Meat Processing BACT guideline 1.6.9

*Dehydrators with limits higher than 0.06 lb/MMBtu were omitted.

**Sentient dehydrates onions and has informed the District that regardless of the NOx limit on the permit, their burners are not operated as low-NOx because low-NOx burners discolor the onions turning them pink. Because of the sensitivity of some fruits and vegetables to this effect, Rule 4309 does not require dehydrators to use low-NOx burners. For this reason, the BACT will exclude the dehydration of onions.

Note that the table above only includes permits whose implementation has been confirmed.

Of the surveyed dehydrators, units equipped with low-NOx burners have a NOx emission limit of 0.036 lb/MMBtu while the dehydrator at Sun-Maid Growers of California (PTO C-1196-29-0) has a NOx emissions limit of 0.0304 lb/MMBtu. However, the manufacturer's (Eclipse's) NOx emissions guarantee for the Sun-Maid installation was narrow for the maximum firing rate of a single burner sized 2.7 MMBtu/hr up to a temperature of 215 °F. Given the smaller burner and low temperature the Sun-Maid unit will not be considered as the BACT standard for this class/category. The other dehydrator with higher heat input is more comparable to the dehydrators used for fruit and vegetable dehydration.

Summary of Survey of Permitted Sources:

From the review of the above permitting data, 0.036 lb-NOx/MMBtu appears to be the most stringent achieved-in-practice NOx emission standard (that would also apply over a reasonably broad firing range) on the permits issued for continuous-belt fruit and vegetable dehydrators:

- Low-NOx burner - 0.036 lb/MMBtu

4. List of Control Options:

Summary of Rules:

Based on the above survey of applicable Rules/Regulations, the minimum NOx emission rate limit is 30 ppmv @ 3% O₂ (0.036 lb-NOx/MMBtu).

District Survey of Permitted Source:

Based on a survey of District permitted fruit and vegetable continuous-belt dehydrators, 0.036 lb-NOx/MMBtu has been reliably met by multiple units with the use of a well-maintained low NOx burner system. Therefore, 0.036 lb-NOx/MMBtu with low NOx burners are considered to be the Achieved-in-Practice BACT level for all burner heat input ranges.

Technologically Feasible Control Alternatives

Based on information provided in a recent District Project (S-1234547), there are commercially available ultra low-NOx burner systems for continuous belt dehydrators that are capable of achieving NOx emission level of 0.011 lb-NOx/MMBtu. Although this option was not demonstrated to be cost-effective in the top-down BACT analysis performed in District Project S-

1234547, an ultra low-NOx burner with emission 0.011 lb/MMBtu will be considered as Technologically Feasible BACT for all burner heat input ranges.

Alternative Basic Equipment

In addition, under recent District project (S-1234547), an electric heater was evaluated as an alternative basic equipment. However, when evaluated for cost effectiveness comparing the electrical cost vs the cost of fuel it was determined that the cost of reduction for this control option was greater than the cost effective threshold for NOx emissions. Therefore, the option will be considered as alternative basic equipment.

Step 2 - Eliminate Technologically Infeasible Options

There are no technologically infeasible options listed in Step 1. All of the emission control options under consideration are based on current BACT requirements. Therefore, no further discussion is required.

Step 3 - Rank Remaining Control Technologies by Control effectiveness

Rank	Control Efficiency or Emission Factor	Achieved in Practice
1	Electric Heater	No
2	Ultra-low NOx burner with NOx emission less than or equal to 0.011 lb/MMBtu	No
3	Low NOx burner with NOx emissions less than or equal to 30 ppmv @3%O ₂ equivalent to 0.036 lb/MMBtu	Yes

Step 4 - Cost Effectiveness Analysis

This is a proactive determination that is not part of a permitting action. Therefore, a cost effective analysis is not necessary.

Step 5 - Select BACT

This is a proactive determination that is not part of a specific permitting action. Therefore, selecting BACT is not necessary. However, the following NOx emission control standard has been determined to be achieved in practice:

- Low-NOx burner with emissions less than or equal to 30 ppmv @3% O₂ or equivalent to 0.036 lb-NOx/MMBtu

C. BACT Analysis for VOC Emissions

VOC is emitted from the dehydrator's burners due to the combustion of fuel to create hot air used to remove moisture from the product.

Step 1 - Identify All Possible Control Technologies

The following BACT Clearinghouse references were reviewed to determine what control technologies have been required:

- EPA RACT/BACT/LAER clearinghouse
- CARB BACT clearinghouse
- South Coast AQMD (SCAQMD) BACT clearinghouse
- Bay Area AQMD (BAAQMD) BACT clearinghouse
- Sacramento Metro AQMD (SMAQMD) BACT clearinghouse
- San Diego APCD (SDAPCD) BACT clearinghouse
- San Joaquin Valley APCD (SJVAPCD) BACT clearinghouse

In addition, rules and regulations from the following agencies were reviewed to determine what VOC emission limits are currently required for natural gas-fired continuous-belt fruit and vegetable dehydrators.

- San Diego APCD
- South Coast AQMD
- Sacramento Metro AQMD
- Bay Area AQMD
- SJVAPCD
- EPA
- ARB

Finally, the District also conducted a survey of permit limits for continuous-belt fruit and vegetable dehydrators located in SJVAPCD. The purpose of the survey is to determine what VOC emissions control standards are currently achieved in practice.

1. Survey of BACT Guidelines:

No air districts have published BACT guidelines/determinations for natural gas-fired continuous-belt fruit and vegetable dehydrators.

2. Survey of Applicable Rules and Regulations:

No applicable rules were found to apply to VOC emission standards for natural gas-fired continuous-belt fruit and vegetable dehydrators.

3. List of Control Options:

Based on the survey of the above BACT determinations, the use of natural gas fuel is required. There are no continuous belt dehydrators under permit that use

propane or LPG as an alternative fuel. The survey of the applicable Rules/Regulations indicate no applicable VOC emission limits. The following control option is commonly utilized and is considered Achieved-in-Practice for all burner heat input ranges:

- Use of PUC quality natural gas fuel.

Step 2 - Eliminate Technologically Infeasible Options

There are no technologically infeasible options listed in Step 1. All of the emission control options under consideration are based on current BACT requirements. Therefore, no further discussion is required.

Step 3 - Rank Remaining Control Technologies by Control effectiveness

Rank	Control Efficiency or Emission Factor	Achieved in Practice
1	Use of PUC quality natural gas fuel with LPG as backup fuel.	Yes

Step 4 - Cost Effectiveness Analysis

This is a proactive determination that is not part of a permitting action. Therefore, a cost effective analysis is not necessary.

Step 5 - Select BACT

This is a proactive determination that is not part of a specific permitting action. Therefore, selecting BACT is not necessary. However, the following VOC emission control standard has been determined as achieved in practice:

- Use of PUC quality natural gas fuel

IV. Recommendation

The analysis performed in this BACT determination resulted in the following recommended updates to the existing BACT Guideline:

- Class/Category of the BACT Guideline updated from “Dehydrator- Vegetable, Continuous Process” to “Dehydrator- Fruit and Vegetable (excluding onions), Continuous Belt”
- Achieved in Practice BACT set as:
 - NOx: Burner(s) with emissions less than or equal to 0.036 lb-NOx/MMBtu
 - PM10: PUC quality natural gas (combustion)
 - VOC: PUC quality natural gas
- Technologically Feasible BACT set as:
 - NOx: Burner(s) with emissions less than or equal to 0.011 lb-NOx/MMBtu

- PM10: 1. Baghouse (material handling) and 2. Cyclone (material handling)
- Alternate Basic Equipment BACT set as: electric heater

Appendix

Appendix A: Draft BACT Guideline

Appendix B: Expired SJVAPCD BACT Guidelines 1.6.13

Appendix A
Draft BACT Guideline

**San Joaquin Valley
Unified Air Pollution Control District**

Best Available Control Technology (BACT) Guideline 1.6.13*

Emissions Unit: Dehydrator – Fruit and Vegetable (excluding onions), Continuous Belt

Industry Type: Fruit and Vegetable Processing

Equipment Rating: All

Last Update: 6/29/2026

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
VOC	PUC quality natural gas fuel		
PM10	PUC quality natural gas fuel	1. Baghouse (for material handling) 2. Cyclone (for material handling)	
NOx	Burner(s) with NOx emissions ≤ 0.036 lb-NOx/MMBtu	Burner(s) with NOx emissions ≤ 0.011 lb-NOx/MMBtu	Electric heater

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT**

Appendix B
Expired BACT Guideline 1.6.13

San Joaquin Valley
Unified Air Pollution Control District

Best Available Control Technology (BACT) Guideline 1.6.13*

Last Update: 06/26/1998

Dehydrator - Vegetable, Continuous Process

Pollutant	Achieved in Practice or contained in the SIP	Technologically Feasible	Alternate Basic Equipment
VOC		Use of PUC-quality natural gas fuel	
PM10		PUC-quality natural gas fuel and vents ducted to a cyclone (>90% control efficiency) on product transfer points.	baghouse
NOx		<ol style="list-style-type: none"> 1. Low-NOx Burner with SCR (<0.036 lb/MMBtu) 2. Low NOx Burner (0.036 lb/MMBtu) 3. Natural Gas Fired Burner (<0.06lb/MMBtu) 	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a State Implementation Plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

*This is a Summary Page for this Class of Source