San Joaquin Valley
Unified Air Pollution Control District

Best Performance Standard (BPS) x.x.xx

Date: September 11, 2013

Class	**Dryers and Dehydrators**
Category	**Onion and Garlic Dehydrators**
Best Performance Standard	**Electric motors driving dryer fans shall have an efficiency meeting the standards of the National Electrical Manufacturer's Association (NEMA) for "premium efficiency" motors.**
Percentage Achieved GHG Emission Reduction Relative to Baseline Emissions	**2.4%**

District Project Number	C-1131649
Evaluating Engineer	Derek Fukuda
Lead Engineer	Joven Refuerzo
Public Notice: Start Date	September 11, 2013
Public Notice: End Date	October 11, 2013
Determination Effective Date	TBD

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I. Best Performance Standard (BPS) Determination Introduction

A. Purpose

To assist permit applicants, project proponents, and interested parties in assessing and reducing the impacts of project specific greenhouse gas emissions (GHG) on global climate change from stationary source projects, the San Joaquin Valley Air Pollution Control District (District) has adopted the polic*y: District Policy – Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency.* This policy applies to projects for which the District has discretionary approval authority over the project and the District serves as the lead agency for CEQA purposes. Nonetheless, land use agencies can refer to it as guidance for projects that include stationary sources of emissions. The policy relies on the use of performance based standards, otherwise known as Best Performance Standards (BPS) to assess significance of project specific greenhouse gas emissions on global climate change during the environmental review process, as required by CEQA. Use of BPS is a method of streamlining the CEQA process of determining significance and is not a required emission reduction measure. Projects implementing BPS would be determined to have a less than cumulatively significant impact. Otherwise, demonstration of a 29 percent reduction in GHG emissions, from business-as-usual, is required to determine that a project would have a less than cumulatively significant impact.

B. Definitions

Best Performance Standard for Stationary Source Projects for a specific Class and Category is the most effective, District approved, Achieved-in-Practice means of reducing or limiting GHG emissions from a GHG emissions source, that is also economically feasible per the definition of Achieved-in-Practice. BPS includes equipment type, equipment design, and operational and maintenance practices for the identified service, operation, or emissions unit class and category.

Business-as-Usual is - the emissions for a type of equipment or operation within an identified class and category projected for the year 2020, assuming no change in GHG emissions per unit of activity as established for the baseline period, 2002-2004. To relate BAU to an emissions generating activity, the District proposes to establish emission factors per unit of activity, for each class and category, using the 2002-2004 baseline period as the reference.

Category is - a District approved subdivision within a “class” as identified by unique operational or technical aspects.

Class is - the broadest District approved division of stationary GHG sources based on fundamental type of equipment or industrial classification of the source operation.

C. Determining Project Significance Using BPS

Use of BPS is a method of determining significance of project specific GHG emission impacts using established specifications. BPS is not a required mitigation of project related impacts. Use of BPS would streamline the significance determination process by pre-quantifying the emission reductions that would be achieved by a specific GHG emission reduction measure and pre-approving the use of such a measure to reduce project-related GHG emissions.

GHG emissions can be directly emitted from stationary sources of air pollution requiring operating permits from the District, or they may be emitted indirectly, as a result of increased electrical power usage, for instance. For traditional stationary source projects, BPS includes equipment type, equipment design, and operational and maintenance practices for the identified service, operation, or emissions unit class and category.

II. Summary of BPS Determination Process

The District has established onion and garlic dehydrators as a separate class and category which requires implementation of a Best Performance Standard (BPS) pursuant to the District's Climate Change Action Plan (CCAP). The District's determination of the BPS for this class and category has been made using the BPS development process established in the District's Final Staff Report, *Addressing Greenhouse Gas Emissions under the California Environmental Quality Act.* A summary of the specific implementation of the phased BPS development process for this specific determination is as follows:

Table 1 BPS Development Process Phases for Onion and Garlic Dehydrators			
Phase	**Description**	**Date**	**Description**
1	Public Notice of Intent	2/10/10	The District's intent notice is attached as Appendix 1
2	BPS Development	N/A	See evaluation document.
3	Public Participation: Public Notice Start Date	9/11/13	A Draft BPS evaluation was provided for public comment.

III. Class and Category

Dryers and dehydrators are units used to drive free water from products like fruits, vegetables, and nuts, at an accelerated rate without damage to the product, and devices in which material is dried or cured in direct contact with the products of combustion. Since onions and garlic are dried in direct contact with the products of combustion in onion and garlic dehydrators, they are included in the dryers and dehydrators class.

Onion and garlic dehydrators are designed to remove water from onions and garlic to prepare them for further processing which may include milling to produce onion or garlic chunks, or grinding to produce onion or garlic powder. Raw vegetables will enter a dehydrator with a moisture content ranging from 65% to 90%. The dehydrated vegetables will exit the dehydrator with a moisture content of 4% to 5%. The environment inside onion and garlic dehydrators is very important to ensure a final marketable product. To ensure a final product that is marketable, the onion and garlic exiting the dehydrator must be near white in color. Without the correct dehydrator environment, onions or garlic may be pink in color when they exist the dehydrator. This discoloration is not an issue when dehydrating other types of vegetables. The delicate nature of dehydrating onions and garlic requires very specialized dehydrating equipment and quality control measures; therefore onion and garlic dehydrators should be classified as a separate category.

IV Public Notice of Intent

Prior to developing the development of BPS for this class and category, the District published a Notice of Intent. Public notification of the District's intent to develop BPS for this class and category was sent on February 10, 2010 to individuals registered with the CCAP list server. The District's notification is attached as Appendix 1.

The Notice of Intent that was published covered all Dryers and Dehydrators. Therefore, the District received comments concerning various types of dryers and dehydrators. The comments received that are applicable to the class and category of equipment being evaluated in this BPS evaluation are presented in Appendix 2. These comments have been used in the development of this BPS as presented below.

V. BPS Development

STEP 1. Establish Baseline Emissions Factor for Class and Category

The Baseline Emission Factor (BEF) is defined as the three-year average (2002-2004) of GHG emissions for a particular class and category of equipment in the San Joaquin Valley (SJV), expressed as annual GHG emissions per unit of activity. The Baseline Emission Factor is calculated by first defining an operation which is representative of the average population of units of this type in the SJV during the Baseline Period and then determining the specific emissions per unit throughput for the representative unit.

A. Representative Baseline Operation

For onion and garlic dehydrators**,** the representative baseline operation has been determined to be a natural gas-fired dehydrator with multiple drying stages and standard efficiency fans and electric motors. This determination is based on facilities permitted in the SJVAPCD during the baseline years.

B. Basis and Assumptions

- All direct GHG emissions are produced due to combustion of natural gas in this unit.
- GHG emissions are stated as "CO_2 equivalent" (CO_2e) which includes the global warming potential of methane and nitrous oxide emissions associated with gaseous fuel combustion.

- Fuel consumption for a representative unit is 4.57 MMBtu (NG)/ton dry product. This number is based on emission inventory results from the baseline period for natural gas-fired onion and garlic dryers.
- The GHG emission factor for natural gas combustion is 117 lb-CO_2e/MMBtu per CCAR document[1].
- Indirect emissions are produced due to operation of the various circulating and exhaust fans, and conveyors. The circulating and exhaust fans, and conveyors have hp ratings between 10 hp and 20 hp. The total electric motor hp for all the circulating and exhaust fans, and conveyors for a representative unit is 670 hp.
- The hourly dry product throughput rate for a representative unit is 2.3 tons per hour.
- The California Energy Commission document "Updated macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report" dated October 15, 2007 (available at http://www.climatechange.ca.gov/climate_action_team/reports/2007-10-15_MACROECONOMIC_ANALYSIS.PDF) provides an estimate of GHG emissions due to electricity consumption in California as a result of implementing various strategies to reduce GHG emissions in the State by 2020. Indirect emissions from electric power consumption are calculated using this standardized emission factor for electricity use of 313 kg-CO2e/MWh = 0.690 lb-CO2e/kWh
- Electric motor efficiency will depend on the size and efficiency classification of the motor, as shown in the following table:

Electric Motor Efficiency (%)		
Rating HP	**Standard**	**Premium**
1 – 4	78.8	85.5
5 – 9	84.0	86.5
10 – 19	85.5	89.5
20 – 49	88.5	91.7
50 – 99	90.2	93.0

Notes:
- Standard Efficiency values reflect NEMA Design B motors, 1 hp and larger that operate more than 500 hours per year.
- Premium Efficiency values reflect the nominal efficiency standards for motors manufactured after December 19, 2010, under the *Energy Independence and Security Act of 2007*.

[1] California Climate Change Action Registry (CCAR), Version 3.1, January, 2009 (Appendix C, Tables C.7 and C.8)

C. Unit of Activity

To relate Business-as-Usual to an emissions generating activity, it is necessary to establish an emission factor per unit of activity, for the established class and category, using the 2002-2004 baseline period as the reference.

The resulting emissions factor is the combination of
GHG emission reductions achieved through technology, and
GHG emission reductions achieved through changes in activity efficiencies.

D. Calculations

1. Direct GHG Emissions

Direct GHG emissions are based on the amount of natural gas used by the onion and garlic dehydrator to produce one ton of dried product. The calculation for these emissions is shown below:

Direct GHG = 4.57 MMBtu/ton dry product x 117 lb-CO_2e/MMBtu
= 534.7 lb-CO_2e/ton dry product

2. Indirect GHG Emissions

Indirect GHG emissions are based on the electric motor horsepower of the onion and garlic dehydrator fans, conveyors, and the amount of dry product that can be processed by an onion and garlic dehydrator. The calculation incorporates the electric motor horsepower efficiency of a conventional electric motor. As stated above, the typical electric motor hp in an onion and garlic dehydrator is between 10 hp and 20 hp. Therefore, the electric motor efficiency from the hp rating range of 10 hp -19 hp (85.5%) will be used to calculate the indirect GHG emissions. The calculation for these emissions is shown below.

Electricity Usage (kWh) = 670 hp-hr x 0.7457 kW/hp x (1/85.5%)
= 584 kWh

The baseline hourly dry material throughput rate is 2.3 tons/hour. The electricity usage per ton of dry product (EU/TP) is calculated below.

EU/TP (kWh/ton) = 584 kWh ÷ 2.3 tons dry product/hr
= 254 kWh/ton dry product

Indirect GHG missions = 254 kWh/ton dry product x 0.690 lb-CO_2e per kWh
= 175.3 lb-CO_2e/ton dry product

3. Total Baseline Emissions

The Baseline Emission Factor is the sum of the direct and the indirect emissions:

BEF = 534.7 lb-CO_2e/ton dry product + 175.3 lb-CO_2e/ton dry product
= 720 lb-CO_2e/ton dry product

STEP 2. List Technologically Feasible GHG Emission Control Measures

The following findings and/or considerations are applicable to this class and category:

Catalytic Infrared Dryer (CIR)

The following description of CIR was taken from an article titled *Catalytic Infrared Dehydration of Onions* written by Michael M. Gabel, Zhongli Pan, K.S.P. Amaratunga, Linda J. Harris, and James F. Thompson

> Infrared drying offers many advantages over convection drying, including greater energy efficiency, heat transfer rate, and heat flux which results in shortened drying time and higher drying rate (Sandu 1986; Dostie 1992; Navarri and others 1992; Afzal and Abe 1997; Skjoldebrand 2002). Recent introduction of catalytic infrared (CIR) dryers for dehydration of agricultural materials has increased the interest in infrared drying for onion (Macaluso 2001). CIR uses natural gas or propane, which is passed over a mesh catalyst pad to produce thermal radiant energy through a catalytic reaction. This reaction occurs below the ignition temperature of gas so that no flame is produced. The electromagnetic radiant energy from CIR has peak wavelengths in the range of medium to far infrared. The peak wavelengths match reasonably well with the 3 absorption peaks of liquid water, which could result in rapid moisture removal. Because the CIR directly converts natural gas to radiant energy, it is more energy efficient than the typical infrared emitters using electricity.

Use of Premium Efficiency Motors:

An electric motor efficiency standard is published by the National Electrical Manufacturers Association (NEMA) which is identified as the "NEMA Premium Efficiency Electric Motors Program". For large motors, the NEMA premium efficiency motor provides a gain of approximately 5-8 percentage points in motor efficiency when compared to a standard efficiency motor. The NEMA specification covers motors up to 500 horsepower and motors meeting this

specification are in common use and are available from most major electric motor manufacturers.

Listing of Technologically Feasible Control Measures

For the specific equipment or operation being proposed, all technologically feasible GHG emissions reduction measures are listed, including equipment selection, design elements and best management practices, that do not result in an increase in criteria pollutant emissions compared to the proposed equipment or operation.

Table 2
Technologically Feasible GHG Control Measures for Onion and Garlic Dehydrators

GHG Control Measures	Qualifications
Catalytic Infrared Dryers (CIR)	The use of CIR in place of fuel fired burners can increase the energy efficiency of a dryer by increasing the heat transfer rate and heat flux which will result in shorter drying times.
Electric motors driving dryer fans shall have an efficiency meeting the standards of the National Electrical Manufacturer's Association (NEMA) for "premium efficiency" motors.	Use of premium efficiency motors on all fans significantly reduces electric power consumption by the drying operation.

All of the GHG emissions control measures identified above are equipped with control equipment for criteria pollutants which meets current regulatory requirements. None of the identified GHG emission control measures would result in an increase in emissions of criteria pollutants.

STEP 3. Identify all Achieved-in-Practice GHG Emission Control Measures

For all technologically feasible GHG emission reduction measures, all GHG reduction measures determined to be Achieved-in-Practice are identified. Achieved-in-Practice is defined as any equipment, technology, practice or operation available in the United States that has been installed and operated or used at a commercial or stationary source site for a reasonable period of time sufficient to demonstrate that the equipment, the technology, the practice or the operation is reliable when operated in a manner that is typical for the process. In determining whether equipment, technology, practice or operation is Achieved-in-Practice, the District will consider the extent to which grants,

incentives or other financial subsidies influence the economic feasibility of its use.

The following findings or considerations are applicable to this class and category:

- CIR dryers are currently in a testing phase. The technology has been proven to generate faster drying times while maintain a consistent and useable product. However, there are no known commercial onion and garlic operations utilizing a dehydrator with CIR, therefore this technology is not achieved in practice.

- Premium efficiency electric motors are readily available and currently operating at many facilities.

Based on a review of available technology and with consideration of input from industry, manufacturers and other members of the public, the following is determined to be the Achieved-in-Practice GHG emission reduction measures for this class and category:

Table 3
Achieved-in-Practice GHG Control Measures for Onion and Garlic Dehydrators

GHG Control Measures	Achieved-Qualifications
Electric motors driving dryer fans shall have an efficiency meeting the standards of the National Electrical Manufacturer's Association (NEMA) for "premium efficiency" motors.	Use of premium efficiency motors on all fans significantly reduces electric power consumption by the drying operation.

STEP 4. Quantify the Potential GHG Emission and Percent Reduction for Each Identified Achieved-in-Practice GHG Emission Control Measure

For each Achieved-in-Practice GHG emission reduction measure identified:
a. Quantify the potential GHG emissions per unit of activity (G_a)
b. Express the potential GHG emission reduction as a percent (G_p) of Baseline GHG emissions factor per unit of activity (BEF)

Premium-Efficiency Electric Motors on Fans, Blower, and Conveyors

A. Basis and Assumptions:

- All direct GHG emissions are produced due to combustion of natural gas in this unit.
- GHG emissions are stated as "CO_2 equivalent" (CO_2e) which includes the global warming potential of methane and nitrous oxide emissions associated with gaseous fuel combustion.
- Fuel consumption for a representative unit is 4.57 MMBtu (NG)/ton dry product. This number is based on emission inventory results from the baseline period for natural gas-fired onion and garlic dryers.
- The GHG emission factor for natural gas combustion is 117 lb-CO_2e/MMBtu per CCAR document.
- Indirect emissions are produced due to operation of the various circulating and exhaust fans, and conveyors. The circulating and exhaust fans, and conveyors have hp ratings between 10 hp and 20 hp. The total electric motor hp for all the circulating and exhaust fans, and conveyors for a representative unit is 670 hp.
- The hourly dry product throughput rate for a representative unit is 2.3 tons per hour.
- Electric motor efficiency is 89.5%.
- The California Energy Commission document "Updated macroeconomic Analysis of Climate Strategies Presented in the March 2006 Climate Action Team Report" dated October 15, 2007 (available at http://www.climatechange.ca.gov/climate_action_team/reports/2007-10-15_MACROECONOMIC_ANALYSIS.PDF) provides an estimate of GHG emissions due to electricity consumption in California as a result of implementing various strategies to reduce GHG emissions in the State by 2020. Indirect emissions from electric power consumption are calculated using this standardized emission factor for electricity use of 313 kg-CO2e/MWh = 0.690 lb-CO2e/kWh

B. Calculation of Potential GHG Emissions per Unit of Activity (G_a):

1. Direct GHG Emissions

Direct GHG Emissions = 4.57 MMBtu/ton dry product x 117 lb-CO_2e/MMBtu
= 534.7 lb-CO_2e/ton dry product

2. Indirect GHG Emissions

Indirect GHG emissions are based on the electric motor horsepower of the onion and garlic dehydrator fans, conveyors, and the amount of dry product that can be processed by an onion and garlic dehydrator. The calculation incorporates the electric motor horsepower efficiency of a premium electric motor (89.5%). The calculation for these emissions is shown below.

Electricity Usage (kWh) = 670 hp-hr x 0.7457 kW/hp x (1/89.5%)
= 558 kWh

The baseline hourly dry material throughput rate is 2.3 tons/hour. The electricity usage per ton of dry product (EU/TP) is calculated below.

EU/TP (kWh/ton) = 558 kWh ÷ 2.3 tons dry product/hr
= 243 kWh/ton dry product

Indirect GHG missions = 243 kWh/ton dry product x 0.690 lb-CO_2e per kWh
= 167.7 lb-CO_2e/ton dry product

3. Total GHG Emissions (Direct Emisisons + Indirect Emissions)

G_a = 534.7 + 167.7
= 702.4 lb-CO_2e/ton dry product

C. Calculation of Potential GHG Emission Reduction as a Percentage of the Baseline Emission Factor (G_p):

G_p = (BEF - G_a) / BEF
= (720 – 702.4)/720
= 2.4%

STEP 5. Rank all Achieved-in-Practice GHG emission reduction measures by order of % GHG emissions reduction

Based on the calculations presented in Section II.4 above, the Achieved-in Practice GHG emission reduction measures are ranked in the table below:

Table 4
Ranking of Achieved-in-Practice GHG Emission Control Measures

Rank	GHG Control Measures	Potential GHG Emission per Unit of Activity (G_a) (lb-CO_2e/ton)	Potential GHG Emission Reduction as a Percentage of the Baseline Emission Factor (G_p)
1	Electric motors driving dryer fans shall have an efficiency meeting the standards of the National Electrical Manufacturer's Association (NEMA) for "premium efficiency" motors.	702.4	2.4%

STEP 6. Establish the Best Performance Standard (BPS) for this Class and Category

For Stationary Source Projects for which the District must issue permits, Best Performance Standard is – "For a specific Class and Category, the most effective, District approved, Achieved-In-Practice means of reducing or limiting GHG emissions from a GHG emissions source, that is also economically feasible per the definition of achieved-in-practice. BPS includes equipment type, equipment design, and operational and maintenance practices for the identified service, operation, or emissions unit class and category".

Based on the definition above and the ranking of evaluated technologies, Best Performance Standard (BPS) for this class and category is determined as:

Best Performance Standard for Onion and Garlic Dehydrators

Electric motors driving dryer fans shall have an efficiency meeting the standards of the National Electrical Manufacturer's Association (NEMA) for "premium efficiency" motors.

STEP 7. Eliminate All Other Achieved-in-Practice Options from Consideration as Best Performance Standard

No other Achieved-in-Practice options were identified.

VI. Appendices

Appendix 1: Public Notice of Intent: Notice
Appendix 2: Comments Received During the Public Notice of Intent and Responses to Comments

Appendix 1

Public Notice of Intent: Notice

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING

Notice Of Development Of
Best Performance Standards

NOTICE IS HEREBY GIVEN that the San Joaquin Valley Air Pollution Control District solicits public comment on development of Best Performance Standards for the following Stationary Source class and category of greenhouse gas emissions:

DRYERS AND DEHYDRATORS
Subject to District Permit Requirements

The District is soliciting public input on the following topics for the subject Class and Category of greenhouse gas emission source:

- Recommendations regarding the scope of the proposed Class and Category (Stationary GHG sources group based on fundamental type of equipment or industrial classification of the source operation),
- Recommendations regarding processes or operational activities the District should consider when establishing Baseline Emissions for the subject Class and Category,
- Recommendations regarding processes or operational activities the District should consider when converting Baseline Emissions into emissions per unit of activity, and
- Recommendations regarding technologies to be evaluated by the District, when establishing Best Performance Standards for the subject Class and Category.

Information regarding development of Best Performance Standard for the subject Class and Category of greenhouse gas emission source can be obtained from the District's website at http://www.valleyair.org/Programs/CCAP/CCAP_idx.htm.

Written comments regarding the subject Best Performance Standard should be addressed to Derek Fukuda by email, Derek.Fukuda@valleyair.org, or by mail at SJVUAPCD, 1990 East Gettysburg Avenue, Fresno, CA 93726 and must be received by **February 23, 2010**. For additional information, please contact Derek Fukuda by e-mail or by phone at (559) 230-5917.

Information regarding the District's Climate Action Plan and how to address GHG emissions impacts under CEQA, can be obtained from the District's website at http://www.valleyair.org/Programs/CCAP/CCAP_idx.htm.

Appendix 2

Comments Received During the Public Notice of Intent and Responses to Comments

Stakeholders Written Comments

California League of Food Processors (CLFP)

1. Comment: PUC quality natural gas is used by all commercial food processing dryer and dehydrator operations. Natural gas is the lowest carbon content fuel that is commercially available, and so the use of PUC quality gas should constitute BPS. (CLFF)

Response: Since natural gas is subject to curtailment and may not be available at certain locations, the BPS will only recognize the general category of "gaseous" fuels which include propane or LPG.

2. Comment: Current dehydrator and dryer operations and maintenance plans should be documented and implemented. The industry knows how to operate these systems and have no financial incentive to use excessive amounts of natural gas and generate greenhouse gasses. (CLFP)

Response: The District has based the BPS on the type of equipment being operated during the baseline years. More than 10 years have passes since the beginning of the baseline period. There have been advancements in technology during that time period that should be explored. For example, premium efficiency electric motors were not common during the baseline years, but are now common place in industrial applications.

3. Comment: Vegetable dehydrators typically operate at low temperatures which are not adequate for most heat recovery systems such as boiler economizers. These systems should not be included as BPS. (CLFP)

Response: The District concurs. No heat recovery specification has been included in the BPS.