

UNDER PUBLIC REVIEW SMAQMD BACT CLEARINGHOUSE

CATEGORY:

MISCELLANEOUS

BACT Size: Minor Source BACT

SOLAR PANEL ASSEMBLY

BACT Determination Number: 197	BACT Determination Date: 7/16/2018
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Equipment Information

Permit Number: 25815
Equipment Description: SOLAR PANEL ASSEMBLY
Unit Size/Rating/Capacity: SOLDERING OPERATIONS: FLUX APPLICATION
Equipment Location: SUNERGY CALIFORNIA LLC
 4741 URBANI AVE
 MCCLELLAN, CA

BACT Determination Information

ROCs	Standard:	
	Technology Description:	Use of "no clean" fluxes with a VOC content that does not exceed 6.3 lb/gal (less water and exempt compounds) that do not require finger cleaning after soldering, and the covering of flux bath when applicator is not in operation, and (See Comments)
	Basis:	Achieved in Practice
NOx	Standard:	
	Technology Description:	No Standard
	Basis:	Achieved in Practice
SOx	Standard:	
	Technology Description:	No Standard
	Basis:	Achieved in Practice
PM10	Standard:	
	Technology Description:	No Standard
	Basis:	Achieved in Practice
PM2.5	Standard:	
	Technology Description:	No Standard
	Basis:	Achieved in Practice
CO	Standard:	
	Technology Description:	No Standard
	Basis:	Achieved in Practice
LEAD	Standard:	
	Technology Description:	No Standard
	Basis:	Achieved in Practice

Comments: minimization of entrance/exit areas

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BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NO.:	197
DATE:	July 16, 2018
ENGINEER:	Brian Krebs

Category/General Equip Description:	Solar Module Manufacturer
Equipment Specific Description:	Solder Operations: Flux Application Process
Equipment Size/Rating:	Minor Source BACT, VOC Emissions <4,000 lb/yr
Previous BACT Det. No.:	N/A

This Best Available Control Technology (BACT) determination category was determined under the project for A/C 25815 (Sunergy California, LLC.). Sunergy is a manufacturer of solar modules that will begin production at their new facility located at McClellan Business Park. The work being done at their facility will include assembling various components to make a solar module. Each module includes a solar cell, an aluminum frame, tempered glass, cables and a junction box. The completed products, which can be placed on a ground mount or rooftop, will be sold commercially in the U.S.

The emissions come from VOC's contained in adhesives/sealants used to mount and seal the junction box, cleanup solvents used for spot cleaning, and solder flux used in the soldering process that connects the individual solar cells and to electrically connect them to the junction box. The adhesives/sealants as well as cleaning solvents are addressed in BACT# 134 – Adhesive Application. Therefore, this BACT determination (BACT# 197) will only focus on VOC emissions associated with the soldering.

Soldering flux is sprayed onto appropriate areas of the solar cells that are placed adjacent to one another. These cells are interconnected by a ribbon by an infrared soldering process. In addition soldering operations are done in final connection in the junction box. The soldering flux contains VOC's that will be liberated during these processes.

BACT/T-BACT ANALYSIS

A: ACHIEVED IN PRACTICE (Rule 202, §205.1a)

The following technologies have either been currently employed as BACT/T-BACT for Solder Operations: Flux Application or are regulated by applicable District rules by the following agencies and air pollution control districts.

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US EPA

BACT

Source: EPA RACT/BACT/LAER Clearinghouse
There are no BACT standards published in the clearinghouse for this category.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category

RULE REQUIREMENTS

None

CALIFORNIA AIR RESOURCES BOARD

BACT

Source: ARB BACT Clearinghouse
There are no BACT determinations published in the clearinghouse for this category.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS

None.

SMAQMD

BACT

Source: [SMAQMD BACT Clearinghouse](#)
There are no BACT determinations published in the clearinghouse for this category.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS

[Rule 441 Organic Solvents](#) (Adopted 12-6-78)

This rule limits the emissions of organic solvents into the atmosphere that may result from the use of organic solvents.

Standards

For Organic Materials:

A person shall not discharge into the atmosphere more than 6.8 kilograms (15 pounds) of organic materials in any one day, nor more than 1.4 kilograms (3.1 pounds) in any one hour, from any article, machine, equipment or other contrivance, in which any organic solvent or any material containing organic solvent comes into contact with flame or is baked, heat-cured or heat-polymerized, in the presence of oxygen, unless said discharge has been reduced by at least 85%. Those portions of any series of articles, machines, equipment or other contrivances designed for processing a continuous web, strip or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

For Photochemically Reactive Solvents:

A person shall not discharge into the atmosphere more than 18 kilograms (39.7 pounds) of organic materials in any one day, nor more than 3.6 kilograms (7.9 pounds) in any one hour, from any article, machine, equipment or other contrivance used under conditions other than described in Section 301 for employing, or applying, any photochemically reactive solvent, as defined in Section 203, or material containing such photochemically reactive solvent, unless said discharge has been reduced by at least 85%. Emissions of organic materials into the atmosphere resulting from air or heated drying of products for the first 12 hours after their removal from any article, machine, equipment, or other contrivance described in this section shall be included in determining compliance with this section. Emissions resulting from baking, heat-curing, or heat-polymerizing as described in Section 301 shall be excluded from determination of compliance with this section. Those portions of any series of articles, machines, equipment or other contrivances designed for processing for a continuous web, strip, or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

For Non-Photochemically Reactive Solvents:

A person shall not discharge into the atmosphere more than 1350 kilograms (2,970 pounds) of organic materials in any one day, nor more than 200 kilograms (441 pounds) in any one hour, from any article, machine, equipment or other contrivance in which any non-photochemically reactive organic solvent or any material containing such solvent is employed or applied, unless said discharge has been reduced by at least 85%. Emissions of organic materials into the atmosphere resulting from air or heated drying of products for the first 12 hours after their removal from any article, machine, equipment, or other contrivance described in this section shall be included in determining compliance with this section. Emissions resulting from baking, heat-curing, or heat-polymerizing as described in Section 301 shall be excluded from determination of compliance with this section. Those portions of any series of articles, machines, equipment, or other contrivance designed for processing a continuous web, strip or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

Material	Hourly Emission Limit [kg/hr] (lbs/hr)	Daily Emission Limit [kg/hr] (lbs/day)
Organic Materials which come into contact with a flame or is baked, heat-cured or heat-polymerized, in the presence of oxygen	[1.4] (3.1) Or 85% Control	[6.8] (15) Or 85% Control
Photochemically Reactive Solvents	[3.6] (7.9) Or 85% Control	[18] (39.7) Or 85% Control
Non-Photochemically Reactive Solvents	[200] (441) Or 85% Control	[1,350] (2,970) Or 85% Control

SCAQMD

BACT

Source: [Section I - SCAQMD LAER/BACT Determinations](#)
[Section II – Other LAER/BACT Determinations](#)
[Section III – Other Technologies](#)
[PART D: BACT Guidelines For Non-Major Polluting Facilities](#)

There are no BACT determinations published in the clearinghouse for this category.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category

RULE REQUIREMENTS

None

SAN DIEGO COUNTY APCD

BACT

Source: [NSR Requirements for BACT](#) There are no BACT determinations published in the clearinghouse for this category.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category

RULE REQUIREMENTS

[Rule 66.1 Miscellaneous Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds](#) (Effective 5/11/16)

This rule primarily applies to surface coating operations and solvent cleaning. However the following applies to other operations or processes that may result in emissions of VOCs.

Standards

Surface Coating and Other Operations	VOC limits
Other Operations	5 tons/yr

BAAQMD

BACT

Source: [NSR Requirements for BACT](#)

Wave Solder Operations: Flux Application	
Pollutant	Standard
VOC	Use of "no clean" fluxes that do not require finger cleaning after soldering, covering of flux bath when applicator is not in operation, and minimization of entrance/exit areas
NOx	No standard
SOx	No standard
PM10	No standard
PM2.5	No standard
CO	No standard

T-BACT

There are no T-BACT standards published in the clearinghouse for this category

RULE REQUIREMENTS

[Regulation 8, Rule 4 General Solvent and Surface Coating Operations](#) (10-16-02)

The purpose of this Rule is to limit emissions of volatile organic compounds from the use of solvents and surface coatings in any operation other than those specified by other Rules of Regulation 8.

Standards

Solvents and Surface Coating Requirements	VOC limits
Other Operations	5 tons/yr

San Joaquin Valley APCD

BACT

Source: [BACT Clearinghouse](#)

BACT #4.11.10

Circuit Board Manufacturing – Flux Application for Wave Soldering Machine	
Pollutant	Standard
VOC	Use of flux material(s) with a VOC content of 6.3 lb/gal (less water and exempt compounds), or lower.
NOx	No standard
SOx	No standard
PM10	No standard
PM2.5	No standard
CO	No standard

T-BACT

There are no T-BACT standards published in the clearinghouse for this category

RULE REQUIREMENTS

[Rule 4661 Organic Solvents](#) (Amended 9-20-07)

This rule is to limit the emissions of volatile organic compounds (VOCs) from the use of organic solvents.

Standards

For Organic Materials:

A person shall not discharge into the atmosphere more than 15 pounds of VOC in any one day, in which any organic solvent or any material containing organic solvent comes into contact with a flame or is baked, heat-cured or heat-polymerized, in the presence of oxygen, unless said discharge has been reduced by at least 85%. Those portions of any series of articles, machines, equipment or other contrivances designed for processing a continuous web, strip or wire which emit organic materials and using operations described in this section shall be collectively subject to compliance with this section.

For Photochemically Reactive Solvents:

A person shall not discharge into the atmosphere more than 40 pounds of VOC in any one day, from any article, machine, equipment or other contrivance used under conditions other than described in Section 5.1 for employing, or applying, any photochemically reactive solvent, or material containing such photochemically reactive solvent, unless said discharge has been reduced by at least 85%. Emissions resulting from baking, heat-curing, or heat-polymerizing, as described in Section 5.2 of this rule, shall be excluded from determination of compliance with this section. Those portions of any series of source operation designed for processing a continuous web, strip, or wire that emit VOCs in the course of using operations described in this section shall be collectively subject to compliance with this section.

All VOC-containing materials

An operator shall not emit to the atmosphere VOCs in excess of 833 pounds VOC per calendar month per facility.

As an alternative to complying with the VOC emission limit, a person may use a VOC emission control system that meets the following requirements.

- A. The VOC emission control system shall be approved by the APCO.
- B. The VOC emission control system shall have a capture efficiency of at least 90 percent by weight (90 wt%) and a control efficiency of at least 95 wt%.

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES			
Pollutant	Standard		
VOC	1. Use of flux material(s) with a VOC content of 6.3 lb/gal (less water and exempt compounds), or lower. (SJVAPCD) 2. Use of "no clean" fluxes that do not require finger cleaning after soldering, covering of flux bath when applicator is not in operation, and minimization of entrance/exit areas (BAAQMD) 3. VOC Limit of 5 tons/yr (SDCAPCD, BAAQMD, and SJVAPCD) 4. SMAQMD Rule 441 and SJVAPCD Rule 4661 requirements. (SMAQMD and SJVAPCD)		
	Material	Hourly Emission Limit [kg/hr] (lbs/hr)	Daily Emission Limit [kg/hr] (lbs/day)
	Organic Materials which come into contact with a flame or is baked, heat-cured or heat-polymerized, in the presence of oxygen	[1.4] (3.1) Or 85% Control	[6.8] (15) Or 85% Control
	Photochemically Reactive Solvents	[3.6] (7.9) Or 85% Control	[18] (39.7) Or 85% Control
	Non-Photochemically Reactive Solvents	[200] (441) Or 85% Control	[1,350] (2,970) Or 85% Control
NO_x	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]		
SO_x	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]		
PM₁₀	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]		
PM_{2.5}	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]		

CO	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]
T-BACT (VOC)	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]

Discussion:

The general organic solvent rule requirements from SMAQMD and SJVAPCD were very similar, not very restrictive, and the source would ultimately have to comply with their applicable rule requirements irrespective of whether BACT was triggered or not. For that reason, these organic solvent rule requirements will not be part of this BACT determination. In addition the 5 TPY total VOC restriction is generally above the level that technologically feasible VOC control technologies would be found to be cost effective and thus required. Therefore this requirement will also not be included. As for the remainder of the achieved in practice determinations identified above, only SJVAPCD specified a solder flux VOC content and only the BAAQMD required the use of “no clean” fluxes (which eliminates emissions from VOC cleaning solvents), covering of the flux bath when not in use, and minimization of entrance/exit areas (which minimizes evaporative emissions). Since these requirements are not directly comparable and do not seem to be mutually exclusive, the final Achieved In Practice Best Control Technology will include both of these requirements.

BEST CONTROL TECHNOLOGIES - ACHIEVED IN PRACTICE	
Pollutant	Standard
VOC	Use of “no clean” fluxes with a VOC content that does not exceed 6.3 lb/gal (less water and exempt compounds) that do not require finger cleaning after soldering, and the covering of flux bath when applicator is not in operation, and minimization of entrance/exit areas (SJVAPCD) (BAAQMD)
NOx	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]
SOx	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]
PM10	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]
PM2.5	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]
CO	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]

T-BACT (VOC)	N/A – [SMAQMD, SCAQMD, SDCAPCD, BAAQMD, SJVAPCD, ARB, EPA]
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B: TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (Rule 202, §205.1.b.)

Technologically Feasible Alternatives:

Any alternative basic equipment, fuel, process, emission control device or technique, singly or in combination, determined to be technologically feasible by the Air Pollution Control Officer.

The table below shows the technologically feasible alternatives identified as capable of reducing emissions beyond the levels determined to be “Achieved in Practice” as per Rule 202, §205.1.a.

Pollutant	Technologically Feasible Alternative
VOC	1. Carbon Adsorber 2. Thermal Oxidizer 3. Catalytic oxidizer
NOx	No other technologically feasible option identified
SOx	No other technologically feasible option identified
PM10	No other technologically feasible option identified
PM2.5	No other technologically feasible option identified
CO	No other technologically feasible option identified

Cost Effective Determination:

After identifying the technologically feasible control options, a cost analysis is performed to take into consideration economic impacts for all technologically feasible controls identified.

Maximum Cost per Ton of Air Pollutants Controlled

1. A control technology is considered to be cost-effective if the cost of controlling one ton of that air pollutant is less than the limits specified below:

<u>Pollutant</u>	<u>Maximum Cost (\$/ton)</u>
VOC	17,500
NO _x	24,500
PM10	11,400
SO _x	18,300
CO	TBD if BACT triggered

Cost Effectiveness Analysis Summary

VOC

Several BACT cost effectiveness evaluations have been performed for VOC control in various coating industries and for a molded polyurethane foam manufacturing process. In all cases, carbon adsorption was found to be the most cost effective option. Just looking at carbon adsorption in these prior assessments, the cost effectiveness thresholds, in all cases, were found to be above 4,000 lb/yr. The project for which this BACT determination is intended for is for a large solar panel assembly line. At full production, the VOC emissions from the solder flux is expected to be less than 1,400 lb/yr.

CONCLUSION

Therefore, no identified technologically feasible controls are considered cost effective for a plant of this scale.

C: SELECTION OF BACT

BACT (#197) SOLDERING OPERATIONS: FLUX APPLICATION VOC EMISSIONS <4,000 lb/yr	
Pollutant	Standard
VOC	Use of "no clean" fluxes with a VOC content that does not exceed 6.3 lb/gal (less water and exempt compounds) that do not require finger cleaning after soldering, and the covering of flux bath when applicator is not in operation, and minimization of entrance/exit areas (SJVAPCD) (BAAQMD)
NOx	N/A
SOx	N/A
PM10	N/A
PM2.5	N/A
CO	N/A

D: SELECTION OF T-BACT

Solder fluxes are usually acid based and are not expected to result in toxic emissions that are considered significant. None of the Districts', EPA or ARB BACT Clearinghouses have a T-BACT determination for this source category. Therefore, T-BACT was not evaluated for this determination.

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REVIEWED BY: _____ **DATE:** _____

APPROVED BY: _____ **DATE:** _____