

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

Best Available Control Technology (BACT) Guideline 4.1.2*

Emissions Unit: Petroleum Solvent Dry Cleaning

Industry Type: Dry Cleaning

Equipment Rating: All

Last Update: June 28, 2022

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
VOC	Closed-loop (ventless), dry-to-dry machine with a refrigerated vapor condenser (or equivalent) and operated in compliance with District Rule 4672		

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
4.1.2**

Proactive Best Available Control Technology Analysis

District BACT Guideline 4.1.2 Petroleum Solvent Dry Cleaning

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(Updated TBD)

I. Introduction

The objective of this project is to proactively update the Best Available Control Technology (BACT) guideline 4.1.2, which covers dry cleaning with petroleum solvent. Petroleum solvent is defined in District Rule 4672 as:

Any clear petroleum distillate having a minimum flash point of 100 F, and the following distillation ranges: not less than 50 percent over at 350 F, 90 percent over at 375 F, and the end point not higher than 410 F. The distillation is performed at standard conditions.

This guideline was last updated on April 8, 2004.

This proactive update is necessary to incorporate the most stringent emission control standards that have been achieved in practice since the last time this BACT guideline was updated. Furthermore, the proactive update to this BACT guideline will bring consistency in implementing the BACT standard throughout the District for new and modified petroleum solvent dry cleaning operations 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

BACT guideline 4.1.2 applies to petroleum solvent dry cleaning operations. The general purpose of these operations is to clean clothes, fabrics, and textiles. Dry cleaning may be necessary for difficult to remove soiling, or for materials that could be damaged by water saturation such as materials containing wool, silk, or leather, or down.

During the washing process, the load is agitated in the petroleum-based solvent. After the washing step, the extraction process takes place. The perforated washing drum rotates acting as a centrifuge separating the solvent from the clothes. The recovered solvent may be filtered and sent to solvent storage for reuse. During the drying phase, heat and/or vacuum promotes evaporation and removal of solvent from the clothes. The air stream from the dryer may be sent through a condensing device for solvent recovery.

The two basic equipment configurations used for dry cleaning are “transfer” and “dry-to-dry”. Transfer operations utilize separate chambers for washing and drying, necessitating transfer of solvent laden material from one chamber to the other during which uncontrolled evaporation of solvent may occur. The dry-to-dry configuration utilizes a combined washer and dryer, thereby eliminating the need for exposure of solvent laden material to the air.

Closed-loop describes systems designed to operate without external intake or exhaust airflows and utilizing Solvent Recovery Dryers that recycle both collected solvent and air. Collected solvent may be filtered prior to recirculation. Degraded solvent may be sequestered for disposal as hazardous waste.

Dry cleaning operations are expected to produce VOC emissions from the escape of solvent into the atmosphere from small leaks throughout the system and in the exhaust from the condenser. The content of non-exempt VOC varies among commercially available solvents.

III. Top Down BACT Analysis for VOC Emissions

As explained earlier, VOC are emitted from petroleum solvent dry cleaning operations.

Step 1 – Identify All Possible Control Technologies

1. Survey of BACT Guidelines

The following published BACT Guidelines were reviewed to determine potential control technologies for this class and category of operation:

- The U.S. Environmental Protection Agency (USEPA) RACT/BACT/LAER Clearinghouse,
- California Air Resources Board (CARB) BACT Clearinghouse,
- South Coast Air Quality Management District (SCAQMD),
- Sacramento Metropolitan Air Quality Management District (SMAQMD),
- Bay Area Air Quality Management District (BAAQMD), and
- San Joaquin Valley Air Pollution Control District (SJVAPCD)

The EPA RACT/BACT/LAER clearinghouse does not include general guidelines, only determinations made by individual agencies. There was no relevant data in the clearinghouse for petroleum solvent dry cleaning operations.

The CARB BACT clearinghouse does not include general guidelines, only individual determinations made by individual air districts. There was no relevant data in the clearinghouse for petroleum solvent dry cleaning operations.

The SCAQMD, BAAQMD, SMAPCD, and SJVAPCD BACT clearinghouses include relevant guidelines. Achieved in Practice controls, which are required of all subject operations, are summarized in the table below.

Achieved in Practice BACT		
Air District	Guideline#: Source Category (revision date)	Criteria Pollutant
		VOC
SCAQMD	Dry Cleaning - Petroleum Solvent (7/9/2004)	Closed Loop, Dry-to-Dry Machine with a Refrigerated Condenser or Evaporatively Cooled Condenser
BAAQMD	58.2.1: Drycleaner – Petroleum Solvent (6/12/15)	Closed loop machine (ventless dry-to-dry system with internal refrigerated condenser achieving outlet vapor temperature < 45 F and drying sensor/controller)
SMAQMD	*236: Dry Cleaning Unit – Petroleum and non- halogenated solvents (3/4/2020)	Closed-loop, Dry-to-Dry machine with internal refrigerated condenser achieving outlet vapor temperature < 45 F and drying sensor/controller
SJVAPCD	4.1.2: Petroleum Solvent Dry Cleaning (4/8/2004)	Dry-to-dry machine vented to vapor control device

*This SMAQMD guideline has expired and there is no relevant guideline active at this time. This guideline is the most recently active relevant determination made by the SMAQMD.

Technologically Feasible options, which may be required pending project-specific cost-effectiveness evaluation, were not specified by any of the BACT guidelines identified.

Summary of BACT Guidelines:

Based on the above information, the current BACT option for petroleum solvent dry cleaning operations would be:

VOC

- Closed Loop, Dry-to-Dry Machine with a Refrigerated Condenser or Evaporatively Cooled Condenser
- Closed loop machine (ventless dry-to-dry system with internal refrigerated condenser achieving outlet vapor temperature < 45 F and drying sensor/controller)
- Dry-to-dry machine vented to vapor control device

2. Survey of Permitted Sources

The SJVAPCD currently has 66 active PTO for dry cleaning operations. With the exception of two remaining perchloroethylene operations slated for retirement prior to 2023 (C-196; C-2625), all of these operations use petroleum solvents. With the exception of one facility (S-1844) that utilizes the transfer configuration, all utilize dry-to-dry systems. All operations utilize either an integrated or external solvent recovery system.

3. Survey of District Rules

SJVAPCD Rules:

Rule 4672: Petroleum Solvent Dry Cleaning Operations (12/17/1992)

This rule applies to petroleum solvent dry cleaning operations and seeks to limit VOC emissions. This rule prescribes prevention of liquid and/or vapor leaks from the dry cleaning equipment during operation, mitigation of uncontrolled solvent evaporation during operation and machine maintenance, and recordkeeping requirements to document compliance.

Other Jurisdiction Rules:

SCAQMD Rule 1102: Dry Cleaners Using Solvent Other than Perchloroethylene (11/17/2000)¹

This SIP approved rule applies to dry cleaning facilities using solvents other than perchloroethylene. This rule phased out operation of machines in a transfer configuration effective January 1, 2005.

This rule prescribes prevention of liquid and/or vapor leaks from the dry cleaning equipment during operation, mitigation of uncontrolled solvent evaporation during operation and machine maintenance, and recordkeeping requirements to document compliance.

BAAQMD Regulation 8, Rule 17: Non-Halogenated Solvent Dry Cleaning Operations (3/4/2009)²

This rule applies to dry cleaning facilities using non-halogenated solvents except aqueous solvents, carbon dioxide, and other solvents deemed exempt by the

¹ <http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1102-dry-cleaners-using-solvent-other-than-perchloroethylene.pdf?sfvrsn=4>

² https://www.baaqmd.gov/~/_media/dotgov/files/rules/reg-8-rule-17-petroleum-dry-cleaning-operations/documents/rg0817.pdf?la=en&rev=be6a9c282c184888a86e402a60144af0

APCO. This rule prohibited new, replacement, and relocated machines in a transfer configuration effective March 4, 2009.

This rule prescribes prevention of liquid and/or vapor leaks from the dry cleaning equipment during operation, mitigation of uncontrolled solvent evaporation during operation and machine maintenance, and recordkeeping requirements to document compliance.

SMAPCD Rule 444: Petroleum Solvent Dry Cleaning (8/13/1981)³

This rule applies to petroleum solvent dry cleaning operations that consume more than 2,642 gallons of solvent per year. This rule prescribes requirements for the minimization of solvent loss to atmosphere.

Summary of Applicable Rules and Regulations:

Both SCAQMD and BAAQMD have prohibited dry cleaning operations in the transfer configuration. Therefore, requirement of the dry-to-dry configuration is Achieved in Practice.

The requirements for minimization of solvent loss during operation and maintenance from the applicable rules and regulations are summarized in the following table:

Comparison of Relevant District Rules				
Agency Rule/Regulation	Leak Check Interval	Residual Solvent in Waste Filters	Drying Average Solvent Recovery Rate (L/min)	Solvent Mileage (weight solvent lost : weight materials cleaned)
SCAQMD Rule 1102	30 days	Drained at least 24 hrs	n/s	0.045
BAAQMD Rule 8-17	n/s	Drained at least 8 hours	n/s	0.03
SMAPCD Rule 444	n/s	Drained at least 12 hours; 1 kg / 100 kg cleaned	0.05	0.035
SJVAPCD Rule 4672	15 days	Drained at least 24 hrs; 1 kg / 100 kg cleaned	0.05	0.03

n/s indicates a requirement is not specified

³ <http://www.airquality.org/ProgramCoordination/Documents/rule444.pdf>

SJVAPCD Rule 4672 contains the most stringent requirements for closed-loop, dry-to-dry petroleum solvent dry cleaning operations. Permitted operations within the SJVAPCD are understood to operate in compliance with this rule. Therefore, the compliance with District Rule 4672 is considered achieved in practice.

The following achieved in practice guidelines result from evaluation of district rules:

- Dry-to-dry machine vented to vapor control device
- Compliance with SJVAPCD District Rule 4672

4. List of Control Options

Based on the survey of the above BACT determinations, rules and regulations, and District permitted operations, the following control options have been identified:

1. VOC

- Closed Loop, Dry-to-Dry Machine with a Refrigerated Condenser or Evaporatively Cooled Condenser
- Closed loop machine (ventless dry-to-dry system with internal refrigerated condenser achieving outlet vapor temperature < 45 F and drying sensor/controller)
- Dry-to-dry machine vented to vapor control device
- Compliance with SJVAPCD District Rule 4672

Step 2 - Eliminate Technologically Infeasible Options

1. VOC

The requirement of outlet vapor temperature <45 F is believed to be most relevant to perchloroethylene dry cleaning⁴, but not necessarily universally relevant to petroleum solvent dry cleaning. Therefore, this specification is deemed technologically infeasible and omitted from the proposed guideline below.

The intent of the requirement for a drying sensor/controller is to prevent the operator from opening the chamber door prior to completion of the drying cycle. The same purpose is achieved by the Rule 4672 requirements that (5.3) the equipment shall remain closed at all times except as required for proper operation and maintenance, and that (5.9) the average solvent recovery rate

⁴ California Dry Cleaning Industry Technical Assessment Report, CARB (2006)
<https://ww2.arb.ca.gov/sites/default/files/classic/toxics/dryclean/finaldrycleantechreport.pdf>

during the drying cycle, as determined by EPA CFR Part 60, Subpart JJJ, § 60.624, shall not exceed 0.05 L/min. Therefore, the specification of “drying sensor/controller” is not necessary provided operation is in compliance with Rule 4672.

All other VOC emission control options under consideration are based on current BACT requirements, permitted operations, or common industrial technologies.

The remaining VOC control options are:

1. Closed Loop, Dry-to-Dry Machine with a Refrigerated Condenser or Evaporatively Cooled Condenser
2. Closed loop machine (ventless dry-to-dry system with internal refrigerated condenser)
3. Dry-to-dry machine vented to vapor control device
4. Compliance with SJVAPCD District Rule 4672

Step 3 - Rank Remaining Control Technologies by Control effectiveness

1. VOC

The control options #1 through #3 identified above which specify a closed loop machine are functionally equivalent. Furthermore, compliance with District Rule 4672 is applicable to each of the 3 options (options #1 through #3). Therefore, The above control options have been condensed into a single control option. The BACT options are ranked by control in the table below.

Rank	Control Efficiency or Emission Rate	Achieved in Practice
1	Closed-loop (ventless), dry-to-dry machine with a refrigerated vapor condensor (or equivalent) and operated in compliance with District Rule 4672	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

1. VOC

The requirement of a closed-loop (ventless) dry-to-dry machine has been determined to provide the highest level of control of operational VOC emissions. Compliance with District Rule 4672 ensures equipment is maintained in good working order and provides for additional control of VOC emission during maintenance. Therefore, these requirements are synthesized into the recommended as the Achieved in Practice Requirement.

- Closed-loop (ventless), dry-to-dry machine with a refrigerated vapor condenser (or equivalent) and operated in compliance with District Rule 4672

IV. Recommendation

Upon approval, adopt the proposed draft BACT guideline in Appendix A into the District's BACT Clearinghouse.

Appendices

Appendix A: Proposed BACT Guideline 4.1.2
Appendix B: BACT Guideline 4.1.2 (4/8/2004)

Appendix A
Proposed Draft BACT Guideline 4.1.2.

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Appendix B
BACT Guideline 4.1.2 (4/8/2004)

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Best Available Control Technology (BACT) Guideline 4.1.2*

Last Update: 4/8/2004

Petroleum Solvent Dry Cleaning

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