AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 12/26/2019

District Rule 4454

Refinery Process Unit Turnaround

Applicability and Purpose:
District Rule 4454 applies to the following source categories:

> Degassing a refinery vessel (and associated piping) containing VOCs that is pressurized to 5 psig or greater.

The purpose of this rule is to limit VOC emissions resulting from the purging, repair, cleaning, or otherwise opening or releasing pressure from a refinery vessel during a process unit turnaround, i.e. scheduled maintenance activities.

Benchmarks Evaluated:

- BAAQMD Reg. 8, Rule 12 – Process Vessel Depressurization (1/21/2004)
- SCAQMD Rule 1123 – Refinery Process Turnarounds (12/7/1990)
- District Permit Requirements

Summary:
The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements:

- Degassing refinery vessels containing VOCs that are pressurized to 4.6 psig (1000 mm Hg) or greater and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare and no process vessel may be opened to the atmosphere unless the internal concentration of total organic compounds has been reduced prior to release to atmosphere to less than 10,000 parts per million (ppm), expressed as methane (BAAQMD)
- Degassing refinery vessels containing VOCs that are pressurized to 5.0 psig (1020 mm Hg) or greater or is within ten percent above the minimum gauge pressure at which the vapors can be collected, whichever is lower and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare. (SCAQMD)

Conclusion:
BARCT analysis determined that potential enhanced control options would only provide limited opportunity for emission reductions (between 0.024 and 0.15 tons/year of VOC) and were not cost-effective

The existing requirements of SJVAPCD Rule 4454 satisfies BARCT.

2019 BARCT Rule Analysis

Rule 4454
Refinery Process Unit Turnaround

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Date: **Dec 26, 2019 (revised June 26, 2020)**

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4454 – Refinery Process Unit Turnaround (see Attachment A) determined that there may be some requirements in other air district rules that were potentially more stringent than the District's Rule 4454 requirements. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4454 satisfies BARCT requirements or if amendments to the rule are needed to ensure BARCT requirements are met.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

As part of the 2018 preliminary analysis of Rule 4454, other air districts' rules, including Bay AQMD, South Coast AQMD, Sacramento Metropolitan AQMD, and Ventura County APCD were reviewed. It was found that only Bay Area AQMD and South Coast AQMD had rules that compared to SJVAPCD's Rule 4454. In addition, federal regulations were reviewed including subparts for 40 CFR Part 60 and Part 63 and it was found that the federal regulations did not have requirements for refinery process unit turnaround.

This final analysis will evaluate the maximum degree of reduction achievable, taking into account specific factors such as environmental, energy and economic impacts.

DISCUSSION

District Rule 4454 applies to the following source categories:

> Degassing a refinery vessel (and associated piping) containing VOCs that is pressurized to 5 psig or greater.

The purpose of this rule is to limit VOC emissions resulting from the purging, repair, cleaning, or otherwise opening or releasing pressure from a refinery vessel during a process unit turnaround, i.e. scheduled maintenance activities.

To fully understand the steps taken during a refinery process unit turnaround event and quantify the emissions associated with each event, the District has collaborated with the 4 affected facilities:

- San Joaquin Refining Co. (SJR),
- Kern Oil and Refining Co. (KOR),
- Alon Bakersfield Refining (Alon), and
- Tricor Refining LLC (Tricor)

A refinery process unit turnaround is a scheduled event at a refinery where one or more process units are shutdown for an extended period in order to perform maintenance activities on the process unit. As part of the shutdown of the process unit, the various process unit vessels and piping are depressurized, with gasses being directed to a vapor control system. Once the vessels and piping are depressurized, the vessels and piping can be opened to the atmosphere in order to perform the required maintenance activities.

FURTHER BARCT ANALYSIS

As discussed earlier, each air pollution control district can establish its own BARCT requirements based upon the consideration of specified factors. To help perform this further BARCT analysis, the District will employ a 5-Step Top-Down approach to determine appropriate BARCT requirements.

From the District's 2018 preliminary AB 617 BARCT Rule Analysis (see Attachment A), the control options analyzed were from the following sources:

- SJVAPCD Rule 4454 - Refinery Process Unit Turnaround (12/17/1992)
- BAAQMD Reg. 8, Rule 10 - Process Vessel Depressurization (1/21/2004)
- SCAQMD Rule 1123 - Refinery Process Turnarounds (12/7/1990)

Step 1 – Identify Control Strategies

The control options include:

Option 1. *SJVAPCD*: Degassing refinery vessels containing VOCs that are pressurized to 5 psig (1020 mm Hg) or greater and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare.

Option 2. *BAAQMD*: Degassing refinery vessels containing VOCs that are pressurized to 4.6 psig (1000 mm Hg) or greater and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare and no process vessel may be opened to the atmosphere unless the internal concentration of total organic compounds has been reduced prior to release to atmosphere to less than 10,000 parts per million (ppm), expressed as methane.

Option 3. *SCAQMD*: Degassing refinery vessels containing VOCs that are pressurized to 5.0 psig (1020 mm Hg) or greater or is within ten percent above the minimum gauge pressure at which the vapors can be collected, whichever is lower and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare.

Step 2 – Eliminate Infeasible Options

All options are feasible and are documented in existing rules from the SJVAPCD, BAAQMD, and SCAQMD.

Step 3 – Rank Control Technologies

Rank #1 *Option 2, BAAQMD*. Degassing refinery vessels containing VOCs that are pressurized to 4.6 psig (1000 mm Hg) or greater and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare and no process vessel may be opened to the atmosphere unless the internal concentration of total organic compounds has been reduced prior to release to atmosphere to less than 10,000 parts per million (ppm), expressed as methane.

Rank #2 *Option 3, SCAQMD*. Degassing refinery vessels containing VOCs that are pressurized to 5.0 psig (1020 mm Hg) or greater or is within ten percent above

the minimum gauge pressure at which the vapors can be collected, whichever is lower and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare.

Rank #3 *Option 1, SJVAPCD*, Current Rule Requirement. Degassing refinery vessels containing VOCs that are pressurized to 5.0 psig (1020 mm Hg) or greater and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare.

Step 4 – Evaluation of Control Options

A. Evaluation of Control Option 2 (BAAQMD), Ranked #1

In order to properly evaluate the control option, the District assessed the potential emissions reductions that could result from implementing this option. Currently, Alon and Tricor refineries have both been idle for many years and current operating data is not available. Therefore, for potential emission reductions calculation purpose, conservatively, emission reductions from the higher of the two operating refineries (SJR and KOR) will be assigned to both, Alon and Tricor.

The total emission reduction for Option 2 is a combination of lowering the venting pressure and lowering the gas concentration. Emission reductions are calculated separately below, then summed to estimate the total emission reduction from this option.

SJR:

- Process turnaround events occur every 4 years, but as worst-case, the District will assume emissions occur annually
- Max VOC concentration is 80,000 ppm as methane (based on existing SJR practice)

KOR:

- Process turnaround events occur every 3 years, but as worst-case, the District will assume emissions occur annually
- Max VOC concentration is 5,000 ppm as methane (based on existing KOR practice)

Please note that the difference in the maximum VOC concentration of gasses released during a process turnaround is solely a function of the different work practices at SJR and KOR.

1. Lowering Venting Pressure from 5.0 to 4.6 psig

Based on the actions taken to perform a process unit turnaround, the District was able to estimate the emissions during these events for SJR and KOR. See Attachments B and C for the detailed emissions analysis from SJR and KOR, respectively.

SJR

VOC emissions:
@ 5 psig = 109.5 lb/yr
@ 4.6 psig = 107.3 lb/yr

Potential reduction in VOC emissions =109.5 – 107.3 lb/year
= 2.2 lb/year

KOR

VOC emissions:
@ 5 psig = 1.5 lb/yr
@ 4.6 psig = 1.5 lb/yr

Potential reduction in VOC emissions = 1.5 – 1.5 lb/year
= 0.0 lb/year

Alon

As discussed above, using the highest emission reduction between SJR and KOR, VOC emissions:
@ 5 psig = 109.5 lb/yr
@ 4.6 psig = 107.3 lb/yr

Potential reduction in VOC emissions = 109.5 – 107.3 lb/year
= 2.2 lb/year

Tricor

As discussed above, using the highest emission reduction between SJR and KOR, VOC emissions:
@ 5 psig = 109.5 lb/yr
@ 4.6 psig = 107.3 lb/yr

Potential reduction in VOC emissions = 109.5 – 107.3 lb/year
= 2.2 lb VOC/year

2. Lowering Vent Concentration to 10,000 ppm

Based on the actions taken to perform a process unit turnaround, the District was able to estimate the emissions during these events for SJR and KOR. See calculations below from SJR and KOR, respectively.

SJR

VOC emissions:
@ 80,000 ppm = 109.5 lb/yr
@ 10,000 ppm = 32,422 scf * 1 lbmol/379 scf * 16 lb/lbmol * 10,000 scf/10^6 scf
= 13.7 lb/yr
VOC reduction = 109.5 – 13.7 lb/year
= 95.8 lb VOC/year

KOR

VOC emissions:
@ 5,000 ppm = 1.5 lb/yr
@ 10,000 ppm = 1.5 * (10,000/5,000)
= 3.0 lb/year
VOC reduction = 1.5 – 3.0 lb/year
= -1.5 lb/year (an increase over current practices)
= 0 lb/year

Alon

As discussed above, using the highest emission reduction between SJR and KOR, VOC emissions:
@ 80,000 ppm = 109.5 lb/yr
@ 10,000 ppm = 32,422 scf * 1 lbmol/379 scf * 16 lb/lbmol * 10,000 scf/10^6 scf
= 13.7 lb/yr
VOC reduction = 109.5 – 13.7 lb/year
= 95.8 lb/year

Tricor

As discussed above, using the highest emission reduction between SJR and KOR, VOC emissions:
@ 80,000 ppm = 109.5 lb/yr
@ 10,000 ppm = 32,422 scf * 1 lbmol/379 scf * 16 lb/lbmol * 10,000 scf/10^6 scf
= 13.7 lb/yr
VOC reduction = 109.5 – 13.7 lb/year
= 95.8 lb/year

3. Total emission reduction for Option 2 (BAAQMD - lowering venting pressure to 4.6 psia and lowering venting concentration to 10,000 ppmv):

SJR

VOC Emissions:
Lowering venting pressure = 2.2 lb/year
Lowering venting concentration = 95.8 lb/year
Total emission reduction = 98 lb/year

KOR

VOC Emissions:
Lowering venting pressure = 0.0 b/year
Lowering venting concentration = 0.0 lb/year
Total emission reduction = 0.0 lb/year

Alon

VOC Emissions:
Lowering venting pressure = 2.2 lb/year
Lowering venting concentration = 95.8 lb/year
Total emission reduction = 98.0 lb/year

Tricor

VOC Emissions:
Lowering venting pressure = 2.2 lb/year
Lowering venting concentration = 95.8 lb/year
Total emission reduction = 98.0 lb/year

Emission Reductions for the 4 Refineries

Total VOC emission reductions from each of the 4 refineries:

SJR = 98 lb/year
KOR = 0 lb/year
Alon = 98 lb/year
Tricor = 98 lb/year

Conservatively, the District will consider that for each facility, the highest amount of VOC emission reductions is: 98 lb-VOC/year = 0.049 ton-VOC/year.

As presented in the analysis above, the largest amount of emission reductions for all 4 facilities combined, that can be obtained by implementing the requirements identified for control Option 2, is:

Total annual VOC emission reductions = 3 x 98 = 294.0 lb-VOC/year
= 0.15 tons-VOC/year

Furthermore, these potential reductions will only occur once every 3 or 4 years, further diminishing the benefits of these emissions reductions.

4. Cost Analysis

Assumptions:

According to SJR, KOR, Alon, and Tricor, refinery vessels located at these facilities do not currently have pressure gauges with the accuracy to measure to 4.6 psig. Newer digital equipment with higher precision gauges would need to be installed in order to comply with this lower pressure requirement. Also, in order to vent to a lower overall pressure (such as 4.6 psig), the amount of downtime the refinery may experience will increase. Furthermore, additional costs for lowering the vented gas to below 10,000 ppm will also occur.

Lowering the degassing from 5 psig to 4.6 psig vent pressure:

a) Determine lost revenue for additional downtime associated with implementing control Option #2.

According to the U.S. Energy Information Administration, the net margin for US refineries from 1977- 2009 is about $2/bbl, on average. More recent information could not be located at this time, however, this margin should be a conservative estimate due to inflation increasing over time. See the link below for more details:

https://www.eia.gov/finance/performanceprofiles/refining_marketing.php

Table 1, below, shows the processing capacity and operating status for all four refineries located in the SJVAPCD.

Table 1: San Joaquin Valley Petroleum Refining Operations

Facility Name	Location	Processing Capacity (barrels/day)	Status of Refining (2019 CEC Report)
Alon Bakersfield Refining (Delek US)	Rosedale Highway, Bakersfield, CA	66,000	Non-Refining
San Joaquin Refining Company	Shell Street, Bakersfield, CA	15,000	Operational
Kern Oil & Refining Co.	Panama Lane, Bakersfield, CA	26,000	Operational
Tricor Refining, LLC	Manor Street, Bakersfield, CA	12,500	Non-Refining

SJR

For San Joaquin Refining, with a capacity of 15,000 bbl/day, the estimated net margin would be:

SJR Net Margin = $2/bbl x 15,000 lb/day capacity = $30,000
Therefore the lost profit for each day SJR operation is down is $30,000.

KOR

For Kern Oil and Refining, with a capacity of 26,000 bbl/day, the estimated net margin would be:

KOR Net Margin = $2/bbl x 26,000 lb/day capacity = $52,000
Therefore the lost profit for each day KOR operation is down is $52,000.

Alon (currently idle)

For Alon, with a capacity of 66,000 bbl/day, the estimated net margin would be:

Alon Net Margin = $2/bbl x 66,000 lb/day capacity = $132,000
Therefore the lost profit for each day Alon operation is down is $132,000.

Tricor (currently idle)

For Tricor, with a capacity of 12,500 bbl/day, the estimated net margin would be:

Tricor Net Margin = $2/bbl x 12,500 lb/day capacity = $25,000
Therefore the lost profit for each day Tricor operation is down is $25,000.

The average cost estimate for calculating cost effectiveness with respect to emission controls is a daily loss in profit for each day down is:

Average Lost Profit per Day for the 4Refineries

Average lost profit per day for 4 refineries = ($30K + $52K + $132K + $25K)/4
= **$59,750/day**

b) Determine down time for Lowering Venting Pressure from 5.0 to 4.6 psig

Kern Oil Refinery states that by observing vessels depressurizing that it estimates the total time for their 200 vessels to depressurize between 5.0 to 4.6 psig would add approximately 6 hours to their downtime. Alon, San Joaquin and Tricor refining state that they believe that no additional down time would be required.

The average time is: (0 + 6 + 0 + 0)/4 = **1.5 hours**

Therefore, the average cost (lost income) associated for lowering venting pressure from 5.0 to 4.6 psig is:

$59,750/day x 1 day/24 hours x 1.5 hours = **$3,734**

c) Determine the average cost for changing analog gauges to digital gauges and to measure 4.6 psig from the control room with recordkeeping. It is too dangerous to monitor analogue gauges while vessels are venting while standing next to the vessels. Many times analogue gauges are out of reach.

Reported cost from each refinery:

SJR

Analog gauges would need to be replaced with digital gauges at a cost of $100 each. There are about 100 vessels.
Total cost = $100*100 = **$10,000**

KOR

Analog gauges would need to be replaced with digital gauges at a cost of $100 each. There are about 200 vessels.
Total cost = $100*200 = **$20,000**

Alon Refinery

Analog gauges would need to be replaced with certified digital gauges at a cost of $295 each. There are 569 vessels.
Total cost = $295*569 = **$167,855**

Tricor

Analog gauges would need to be replaced with digital gauges at a cost of $100 each. There are about 200 vessels.
Total cost = $100*200 = **$20,000**

Average Cost for the 4 Refineries

Average cost for the 4 refineries = ($10K + $20K + $168K + $20K)/4 = **$54,464**

Limiting Effluent gas to less than 10,000 ppm (current Rule 4454 has no concentration limit):

SJR

Based on information received from SJR, the cost to implement this control option would be **$229** for staff labor and **$5,000** for one delivery truck of nitrogen.

KOR

No significant extra cost to implement: **$0**

Alon

No significant extra cost to implement: **$0**

Tricor

Tricor did not respond to inquiries to obtain the extra cost to implement this control option. However, as both SJR and Tricor are owned by the same parent company, the cost to implement this control option is assumed to be the same as for SJR, i.e. **$229** for staff labor and **$5,000** for one delivery truck of nitrogen.

Average Cost for the 4 Refineries:

Average cost for 4 refineries = ($5,229 + $0 + $0 + $5,229)/4 = **$2,615**

Total Cost for Option 2 (BAAQMD - lowering venting pressure and lowering venting concentration), Ranked #1:

The total average cost per facility is presented in the table below:

	Item	Method of Calculation	COST ($)
	DIRECT CAPITAL COSTS		
A	TOTAL PURCHASED EQUIP COST (PEC)	industry survey (replace pressure gauges)	$54,464
B	FREIGHT	5% Purchased Equip. Cost (PEC)	$2,723
C	SALES TAX	8.25% PEC	$4,493
D	DIRECT INSTALLATION COSTS	25% PEC	$13,616
E	*TOTAL DIRECT CAPITAL COSTS*	*A+B+C+D*	*$75,296*
	INDIRECT CAPITAL COSTS		
F	FACILITIES	5% PEC	$2,723
G	ENGINEERING	10% PEC	$5,446
H	PROCESS CONTINGENCY	5% PEC	$2,*723*
I	*TOTAL INDIRECT CAPITAL COSTS*	*F+G+H*	*$10,893*
J	PROJECT CONTINGENCY	20% PEC	$10,893
K	***TOTAL CAPITAL COSTS (TCC)***	***E+I+J***	***$97,082***
L	*ANNUALIZED CAPITAL COSTS (10 YEARS @ 10%)*	*0.1627*K*	*$15,795*
	DIRECT ANNUAL COSTS		
	OPERATING COSTS		$0
M	OPERATOR	industry survey (for nitrogen purge)	$115
N	SUPERVISOR	15% of operator	$17
	MAINTENANCE COSTS		$0
O	LABOR	0.5 hr/shift, $25/hr	$0
P	MATERIAL	delivery of nitrogen to purge vessels	$5,000
	UTILITY COSTS		$0
Q	ELECTRICITY COSTS	Variable	$0
Q*	LOST INCOME DUE TO ADDITIONAL DOWNTIME	industry survey	$3,734
R	*TOTAL DIRECT ANNUAL COSTS*	*M+N+O+P+Q+Q**	*$8,866*
	INDIRECT ANNUAL COSTS		

S	OVERHEAD	60% of O&M (M+N+O+P)	$3,079
T	ADMINISTRATIVE	0.02 x PEC	$1,089
U	INSURANCE	0.01 x PEC	$545
V	PROPERTY TAX	0.01 x PEC	$545
W	CAPITAL RECOVERY	0.13 x PEC	$7,080
X	ADMINISTRATIVE	(10% int. rate, 15 yr period)	$0
Y	*TOTAL INDIRECT ANNUAL COSTS*	*S+T+U+V+W+X*	*$12,338*
TOTAL ANNUALIZED COST =		**L+R+Y**	**$31,867**

The cost effectiveness ($/ton) of implementing Option 2 (BAAQMD) controls (lowering venting pressure and lowering venting concentration), can be calculated as follows:

Cost effectiveness = $31,867/year / 015 ton-VOC/year
= $212, 447/ton-VOC

5. Conclusion

Based on the discussions above, control Option 2 (BAAQMD), ranked #1, is determined to not be cost-effective.

Therefore, control Option 2 will be removed from consideration.

B. Evaluation of Control Option 3 (SCAQMD), Ranked #2

1. Lowering Vessel Pressure To 5.0 Psig Or To Within Ten Percent Above The Minimum Gauge Pressure, Whichever Is Lower

As discussed in the control option 3 (SCAQMD) above; both SJR and KOR have indicated that they do not have information to determine minimum gauge pressure at which the vapors can be collected and the District will conservatively estimate that 2 psig would be the minimum gauge pressure at which vapors can be collected. (i.e. 2 psig +10% = 2.2 psig).

Also, Alon and Tricor refineries have both been idle for many years and current operating data is not available. To be conservative, emissions from the higher of the two operating refineries (SJR and KOR) will be assigned to both, Alon and Tricor.

SJR

VOC emissions:
@ 5 psig (80,000 ppmv) = 109.5 lb/yr

VOC emissions at 2.2 psig: = ((2.2 +14.5)/(0 + 14.5)) * 24,109 * 1 lbmol/379 scf * 16 lb/lbmol * 80,000 scf/10^6 scf
= 93.7 lb/yr

VOC emission reduction = 109.5 – 93.7
= 15.8 lb VOC/year

KOR

VOC emissions:
@ 5 psig/5,000 ppmv = 1.5 lb/yr

VOC emissions at 2.2 psig: = ((2.2 +14.5)(2,034)(519.67))/((0 + 14.5) * (519.67))* 1 lbmol/379 scf * 16 lb/lbmol * 5,000 scf/10^6 scf
= 0.5 lb/yr

VOC emissions reduction = 1.5 – 0.5
= 1.0 lb VOC/year

Alon

As discussed above, using the highest emission reduction between SJR and KOR, VOC emissions:
@ 5 psig/80,000 ppmv = 109.5 lb/yr

VOC emissions at 2.2 psig: = 93.7 lb/yr (assume same as SJR)

VOC emission reduction = 109.5 – 93.7
= 15.8 lb VOC/year

Tricor

As discussed above, using the highest emission reduction between SJR and KOR, VOC emissions:

@ 5 psig/80,000 ppmv = 109.5 lb/yr

VOC emissions at 2.2 psig: = 93.7 lb/yr (assume same as SJR)

VOC emission reduction = 109.5 – 93.7
= 15.8 lb VOC/year

Emission Reduction for the 4 Refineries

Conservatively, the District will consider that for each facility, the highest amount of VOC emission reductions is: 15.8 lb/year = 0.008 ton/year.

As presented in the analysis above, the largest amount of emission reductions for all 4 facilities combined, that can be obtain by implementing the requirements identified for control Option 3, ranked #2, is:

Total Annual VOC emission reductions = 15.8 + 1 + 15.8 + 15.8
= 48.4 lb-VOC/year
= 0.024 tons-VOC/year

Furthermore, these potential reductions will only occur once every 3 or 4 years, further diminishing the benefits of these emissions reductions.

2. Cost Analysis

Lowering the degassing from 5 psig to 2.2

The costs (refinery downtime) for lowering pressure from 5 to 2.2 psig will conservatively be assumed to be the same as the costs in Option 2 for lowering the pressure from 5 to 4.6 psig. The downtime related cost will likely be higher than the one calculated under Option 2.

The total average cost per facility is presented in the table below:

	Item	Method of Calculation	COST ($)
	DIRECT CAPITAL COSTS		
A	TOTAL PURCHASED EQUIP COST (PEC)	Industry survey (replace pressure gauges)	$54,464
B	FREIGHT	5% Purchased Equip. Cost (PEC)	$2,723
C	SALES TAX	8.25% PEC	$4,493
D	DIRECT INSTALLATION COSTS	25% PEC	$13,616
E	*TOTAL DIRECT CAPITAL COSTS*	*A+B+C+D*	*$75,296*
	INDIRECT CAPITAL COSTS		
F	FACILITIES	5% PEC	$2,723
G	ENGINEERING	10% PEC	$5,446
H	PROCESS CONTINGENCY	5% PEC	$2,723
I	*TOTAL INDIRECT CAPITAL COSTS*	*F+G+H*	*$10,893*
J	PROJECT CONTINGENCY	20% PEC	$10,893
K	***TOTAL CAPITAL COSTS (TCC)***	***E+I+J***	***$97,082.08***
L	*ANNUALIZED CAPITAL COSTS (10 YEARS @ 10%)*	*0.1627*K*	*$15,795.25*
	DIRECT ANNUAL COSTS		
	OPERATING COSTS		$0
M	OPERATOR		$0
N	SUPERVISOR	15% of operator	$0
	MAINTENANCE COSTS		
O	LABOR	0.5 hr/shift, $25/hr	$0
P	MATERIAL		$0
	UTILITY COSTS		$0
Q	ELECTRICITY COSTS	Variable	$0
Q*	LOST INCOME DUE TO ADDITIONAL DOWNTIME	industry survey	$3,734.00
R	*TOTAL DIRECT ANNUAL COSTS*	*M+N+O+P+Q+Q**	*$3,734*
	INDIRECT ANNUAL COSTS		
S	OVERHEAD	60% of O&M (M+N+O+P)	$0
T	ADMINISTRATIVE	0.02 x PEC	$1,089
U	INSURANCE	0.01 x PEC	$545
V	PROPERTY TAX	0.01 x PEC	$545
W	CAPITAL RECOVERY	0.13 x PEC	$7,080

X	ADMINISTRATIVE	(10% int. rate, 15 yr period)	$0
Y	*TOTAL INDIRECT ANNUAL COSTS*	*S+T+U+V+W+X*	*$9,259*
TOTAL ANNUALIZED COST =		**L+R+Y**	**$28,788**

The cost effectiveness ($/ton) of implementing Option 3 controls (lowering venting pressure from 5 psig to 2.2 psig) can be calculated as follows:

Cost effectiveness = $28,788/year / 0.024 ton/year
= $1,199,500/ton

3. Conclusion

Based on the discussions above, control Option 3 (SCAQMD), ranked #2, is determined to not be cost-effective.

Therefore, control Option 3 will be removed from consideration.

C. Evaluation of Control Option 1 (SJVAPCD), Ranked #3

1. Limiting pressure to 5.0 psig prior to venting

This is the current requirements in District Rule 4454. No further analysis is required.

Step 5 – Select BARCT

As discussed above, Options 1 and 2 each resulted in VOC emission reductions that were determined to not be cost-effective.

Therefore, these two options were removed from consideration.

The most effective control option not eliminated in Step 4, control Option 1 (SJVAPCD) will be selected as BARCT:

> *Degassing refinery vessels containing VOCs that are pressurized to 5.0 psig (1020 mm Hg) or greater and abate vapors by adding them to the refinery's fuel system or combust the vapors in appropriate firebox or flare. (SJVAPCD).*

CONCLUSION

The existing requirements of SJVAPCD Rule 4454 satisfies BARCT and no further analysis is required.

Attachments:

Attachment A: 2018 Preliminary AB 617 BARCT Rule Analysis for Rule 4454
Attachment B: Calculations from San Joaquin Refining
Attachment C: Calculations from Kern Oil Refining

Attachment A

2018 Preliminary AB 617 BARCT Rule Analysis

2018 AB 617 BARCT Rule Analysis

Rule 4454
REFINERY PROCESS UNIT TURNAROUND

Engineer: **Robert Rinaldi**
Date: **August 30, 2018**

Introduction:

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Non-vehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations, and if applicable, propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Existing stationary sources in non-attainment areas such as the San Joaquin Valley have been subject to BARCT requirements since the 1980s, although some nonattainment areas with market-based criteria pollutant reduction programs were not required to apply BARCT to facilities complying with those market-based programs. Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

District Rule 4454 applies to the following source categories:

- Degassing a refinery vessel containing VOCs that is pressurized to 5 psig or greater

Description of process:

The purpose of this rule is to limit VOC emissions resulting from the purging, repair, cleaning, or otherwise opening or releasing pressure from a refinery vessel during a process unit turnaround.

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[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

SOURCE CATEGORY – Degassing a refinery vessel containing VOCs that is pressurized to 5 psig or greater

1. RULE SURVEY

1.1. District Rule

SJVAPCD Rule 4454 (Refinery Process Unit Turnaround) *(12/17/1992)*

	SJVAPCD
Applicability	Degassing refinery vessels containing VOCs that is pressurized to 5 psig or greater
Requirements	4.0 A person shall depressurize any vessel containing VOCs unless the process unit turnaround is accomplished by employing one of the following operating procedures: 4.1 The organic vapors shall either be: 4.1.1 Recovered, added to the refinery fuel gas system and combusted; or 4.1.2 Controlled and piped to an appropriate firebox or incinerated for combustion; or 4.1.3 Flared, until the pressure within the process vessel is as close to atmospheric pressure as is possible. 4.2 All process vessels shall be depressurized into the control facilities to less than 1020 mm Hg (5 psig) before venting/opening to atmosphere 4.3 All organic compounds which emerge from a refinery process vessel during the purging of said vessel and which otherwise would be emitted to the atmosphere shall be either directed to a flare or incinerator or shall be used for fuel until such disposition of emissions is not technically feasible or is less safe than atmospheric venting. Compliance with this section shall not be construed to require the installation, construction or structural modification of any equipment which is not

	required for compliance with the above paragraph requiring controls during depressurization.

1.2. Bay Area AQMD Rule

BAAQMD Reg. 8, Rule 10 (Process Vessel Depressurization) *(1/21/2004)*

	SJVAPCD	BAAQMD	Conclusion
Applicability	The purpose of this rule is to limit VOC emissions resulting from the purging, repair, cleaning, or otherwise opening or releasing pressure from a refinery vessel during a process unit turnaround.	The purpose of this Rule is to limit emissions of organic compounds from depressurizing and opening of process vessels at petroleum refineries and chemical plants.	Same Applicability
Requirements	4.0 A person shall depressurize any vessel containing VOCs unless the process unit turnaround is accomplished by employing one of the following operating procedures: 4.1 The organic vapors shall either be: 4.1.1 Recovered, added to the refinery fuel gas system and combusted; or 4.1.2 Controlled and piped to an appropriate firebox or incinerated for combustion; or 4.1.3 Flared, until the pressure within the process vessel is as close to atmospheric pressure as is possible.	8-10-301 Process Vessel Depressurizing: Emissions of organic compounds from depressurizing any process vessel at a petroleum refinery or a chemical plant shall be controlled by venting them to a fuel gas system, firebox, incinerator, thermal oxidizer, flare, or otherwise containing and treating them so as to prevent their emissions to the atmosphere. Such procedures shall continue until the pressure within the process vessel is as close to atmospheric pressure as practicably possible, in no case shall a process vessel be vented to the atmosphere until the partial pressure of organic compounds in that vessel is less than 1000 mm Hg (4.6 psig). 8-10-302 Opening of Process Vessels: Effective July 1, 2004, no process vessel may be opened to the atmosphere except as provided below:	Vapor recovery is required for any pressure above 1020 mm Hg (5 psig) in SJVAPCD Rule 4454 and 1000 mm Hg (4.6 psig) in the BAAQMD rule. The BAAQMD has a stricter requirement. The BAAQMD rule has VOC concentration limits for vessels to be opened. The SJVAPCD rule does not. The BAAQMD rule has reporting, monitoring and record keeping requirements. The SJVAPCD rule does not and is therefore less strict.

	4.2 All process vessels shall be depressurized into the control facilities to less than 1020 mm Hg (5 psig) before venting/opening to atmosphere 4.3 All organic compounds which emerge from a refinery process vessel during the purging of said vessel and which otherwise would be emitted to the atmosphere shall be either directed to a flare or incinerator or shall be used for fuel until such disposition of emissions is not technically feasible or is less safe than atmospheric venting. Compliance with this section shall not be construed to require the installation, construction or structural modification of any equipment which is not required for compliance with the above paragraph requiring controls during depressurization.	302.1 No process vessel may be opened to the atmosphere unless the internal concentration of total organic compounds has been reduced prior to release to atmosphere to less than 10,000 parts per million (ppm), expressed as methane (C1) except as provided in Section 8-10-302.2. 302.2 A process vessel at a refinery or chemical plant may be opened when the internal concentration of total organic compounds is 10,000 ppm or greater provided that the total number of such vessels opened with such concentration during any consecutive five year period does not exceed 10% of the total process vessel population as documented pursuant to section 8-10-401, and the organic compound emissions from the opening of these vessels shall not exceed 15 pounds per day. Vessels with an internal concentration of total organic compounds of 10,000 ppm or greater shall not be opened on any day on which the APCO predicts an exceedance of a National Ambient Air Quality Standard for ozone or declares a Spare the Air Day. This rule has reporting, monitoring and record keeping requirements.	

1.3. South Coast AQMD Rule

SCAQMD Rule 1123 (Refinery Process Turnarounds) (12/7/1990)

	SJVAPCD	SCAQMD	Conclusion
Applicability	The purpose of this rule is to limit VOC emissions resulting from the purging, repair, cleaning, or otherwise opening or releasing pressure from a refinery vessel during a process unit turnaround.	For the purpose of this rule, the following definition shall apply. VESSEL means any container or structural envelope in which materials are processed or treated; it does not include any container whose principal purpose is material storage.	Same Applicability
Requirements	4.0 A person shall depressurize any vessel containing VOCs unless the process unit turnaround is accomplished by employing one of the following operating procedures: 4.1 The organic vapors shall either be: 4.1.1 Recovered, added to the refinery fuel gas system and combusted; or 4.1.2 Controlled and piped to an appropriate firebox or incinerated for combustion; or 4.1.3 Flared, until the pressure within the process vessel is as close to atmospheric pressure as is possible. 4.2 All process vessels shall be depressurized into the control facilities to less than 1020 mm Hg (5 psig) before venting/opening to atmosphere	Requirements: (1) During refinery process turnaround, a person shall not depressurize any vessel containing organic materials unless the vapors released from the vessel are collected and contained for use as fuel or sent to a gas disposal system until the pressure in the vessel is below five pounds per square inch, gauge, or is within ten percent above the minimum gauge pressure at which the vapors can be collected, whichever is lower. (2) For every refinery that uses inert gas displacement or vacuum eduction for process turnaround, a person operating the refinery shall submit to the Executive Officer a plan which describes at least the following: (A) the procedure used for gas displacement or eduction; (B) the disposition of the displaced or educed organic gases; (C) the stage in the displacement or eduction procedure at which the disposition is changed from a control facility to atmospheric venting, and	The SCAQMD rule allows the same 1020 mm Hg (5 psig) degassing pressure that the SJVAPCD rule allows 1020 mm Hg (5 psig). However, the limit may also be degassed to within 10% above the minimum gauge pressure at which the vapors can be collected, whichever is lower or as described in an alternative procedure. Therefore the SCAQMD rule may be more stricte. The SCAQMD rule has recordkeeping requirements. The SJVAPCD rule does not and is therefore less strict.

	4.3 All organic compounds which emerge from a refinery process vessel during the purging of said vessel and which otherwise would be emitted to the atmosphere shall be either directed to a flare or incinerator or shall be used for fuel until such disposition of emissions is not technically feasible or is less safe than atmospheric venting. Compliance with this section shall not be construed to require the installation, construction or structural modification of any equipment which is not required for compliance with the above paragraph requiring controls during depressurization.	(D) the criteria by which said stage is identifiable. (3) The Executive Officer shall approve the plan upon his determination that it provides for the maximum feasible control of emissions of displaced or educed organic gases without causing damage to equipment, malfunction of pollution control or safety devices, or violations of safety regulations and without installation or structural modification equipment which is not needed to comply with subparagraph (b)(1) of this rule. (4) After approval of a plan, all displacement operations shall be conducted according to said plan unless another specifically approved plan is used. <u>Recordkeeping:</u> A refinery operator shall maintain a record of each refinery process unit turnaround containing at a minimum the date the unit was shut down, the approximate vessel hydrocarbon concentration when hydrocarbons were first discharged into the atmosphere, and the approximate amount of hydrocarbons emitted into the atmosphere. Such records shall be kept at the facility for at least two years, and shall be made available to District staff upon request.	

1.4. Sacramento Metropolitan AQMD Rules

No equivalent rule to SJVAPCD Rule 4454 exists in the SMAQMD rules.

1.5. Ventura County APCD Rule

No equivalent rule to SJVAPCD Rule 4454 exists in the VCAPCD rules.

1.6. Rule Survey Conclusion

As presented above, BAAQMD Reg. 8, Rule 10 (Process Vessel Depressurization) and SCAQMD Rule 1123 (Refinery Process Turnarounds) seem to have more stringent control measures/emission limits and further analysis is required to determine whether District Rule 4454 meet BARCT.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

The District has a total of 4 refineries, only two of which are in operation.

All of these refineries include vessels containing VOCs that are pressurized to 5 psig or greater as part of the refining process. These refineries all comply with the Requirements of Rule 4454.

It is important to note that refineries are also subject to VOC leak detection and repair requirements in Rule 4455 – Components at Petroleum refineries, Gas Liquids Processing Facilities, and Chemical Plants. This rule essentially prohibits the direct discharge from process vessels of VOC containing vapors to the atmosphere.

2.2. State Regulations – ATCMs or other regulations

No state regulations are applicable for this source category.

2.3. Federal Regulations – CFRs

40 CFR Part 60, Subpart Ja Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007 (Amended 9/12/12, 12/19/13, 12/1/15)

This subpart does not have any requirements for refinery process unit turnaround.

40 CFR Part 63, Subpart UUU National Emission Standards for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units (12/1/15, 7/13/16)

This subpart does not have any requirements for refinery process unit turnaround.

40 CFR Part 60, Subpart GGGa, Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006 (Amended June 2, 2008)

This subpart does not have any requirements for refinery process unit turnaround.

40 CFR 60 Subpart QQQ Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems (10/17/00)

This subpart does not have any requirements for refinery process unit turnaround.

2.4. Table Comparing Potential Retrofit Control Technologies/Emission Limits

For the rules and identified above, rule applicability and rule requirements are identified with conclusions.

2.5. Other Control Technology Conclusion

As presented above, SCAQMD and BAAQMD rules may have stricter limits and more requirements. Further analysis is required to determine whether District Rule 4454 meet BARCT.

3. OVERALL ANALYSIS CONCLUSION

As presented above, other control technology/emission limits options included in SCAQMD and BAAQMD rules have been identified. A more refined analysis is required to determine whether District Rule 4454 has the most stringent control measures/emission limits in place and meet BARCT.

Additionally, equipment subject to Rule 4454 is also subject to the leak detection and repair requirements of Rule 4455.

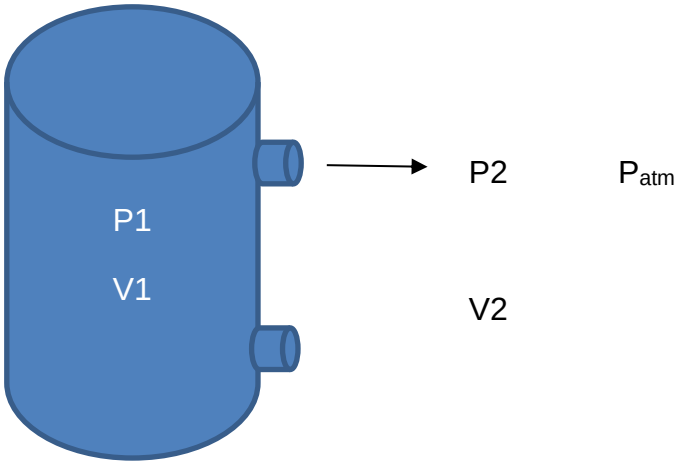
Further evaluation is necessary.

Attachment B

Calculations from San Joaquin Refining Co.

Given:

San Joaquin Oil Refinery Process Unit Turnaround Vessel to be vented to atmosphere per SJVAPCD Rule 4454 (@ 5.0 psig vent pressure)



P1 = 5 psig P2 = 0 psig P_{atm} = 14.5 psia (@ 400 ft. elevation)

Assume T1 = T2 = T_{STD}

V1 = 14,675 + 9,434 = 24,109 cf

Gas VOC concentration = 80,000 ppm $MW_{methane}$ = 16 lb/lbmole

1 lbmol = 379 scf

Find:

VOC emissions (as methane) to atmosphere after venting per event

Basic Equation:

From Ideal Gas Law: $\frac{P1\ V1}{T1} = \frac{P2\ V2}{T2}$

Solution:

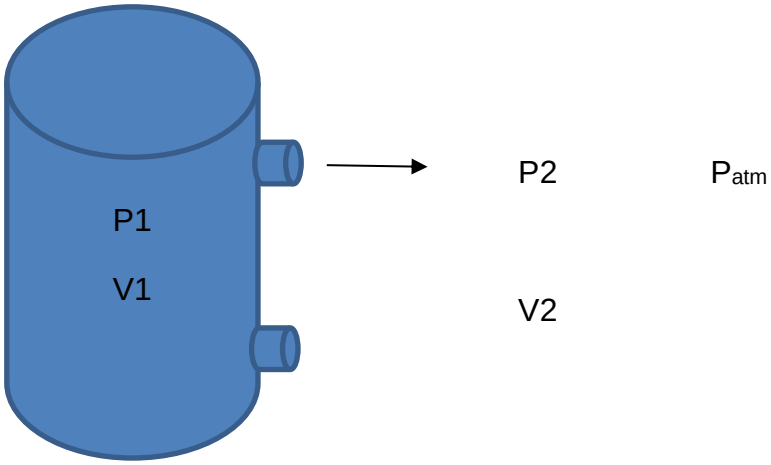
V2 = (P1/P2)*V1 = ((5 +14.5)/(0 + 14.5)) * 24,109 = 32,422 scf

VOC emissions = 32,422 scf * 1 lbmol/379 scf * 16 lb/lbmol * 80,000 scf/10^6 scf

= **109.5 lb VOC (as methane)/event every 4 yrs.**

Given:

San Joaquin Oil Refinery Process Unit Turnaround Vessel to be vented to atmosphere per SJVAPCD Rule 4454 (@ 4.6 psig vent pressure)



P1 = 4.6 psig P2 = 0 psig P_{atm} = 14.5 psia (@ 400 ft. elevation)

Assume T1 = T2 = T_{STD}

V1 = 14,675 + 9,434 = 24,109 cf

Gas VOC concentration as methane = 80,000 ppm $MW_{methane}$ = 16 lb/lbmole

1 lbmol = 379 scf at standard conditions

Find:

VOC emissions (as methane) to atmosphere after venting per event

Basic Equation:

From Ideal Gas Law: $\frac{P1\ V1}{T1} = \frac{P2\ V2}{T2}$

Solution:

V2 = (P1/P2)*V1 = ((4.6 +14.5)/(0 + 14.5)) * 24,109 = 31,757 scf

VOC emissions = 31,757 scf * 1 lbmol/379 scf * 16 lb/lbmol * 80,000 scf/10^6 scf

= **107.3 lb VOC (as methane)/event**

Difference in VOC emissions from 5.0 psig to 4.6 psig = (109.5 - 107.3) (every 4 years)

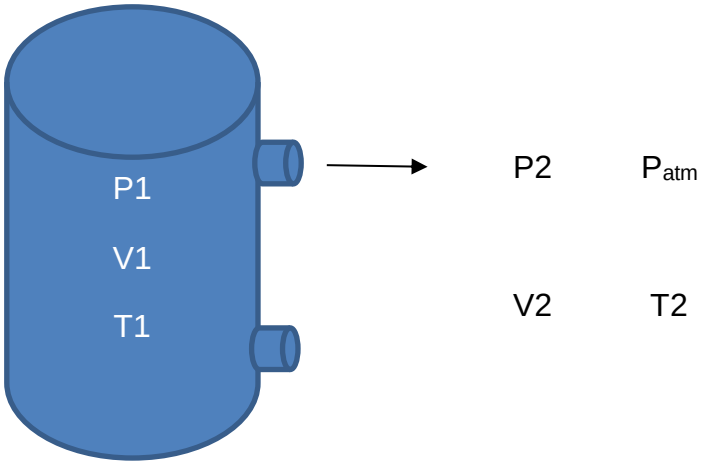
= 2.2 lb VOC (as methane)/yr.

Attachment C

Calculations from Kern Oil and Refining Co.

Given:

Kern Oil Refinery Process Unit Turnaround Vessel to be vented to atmosphere per SJVAPCD Rule 4454 (@ 5.0 psig vent pressure)



P1 = 5 psig P2 = 0 psig P_{atm} = 14.65 psia

T1 = 569.67^0 R T2 = 519.67^0 R

V1 = 2,034 cf

Gas VOC concentration = 5,000 ppm $MW_{methane}$ = 16 lb/lbmole

1 lbmol = 379 scf

Find:

VOC emissions (as methane) to atmosphere after venting per event

Basic Equation:

From Ideal Gas Law: $\frac{P1\ V1}{T1} = \frac{P2\ V2}{T2}$

Solution:

V2 = (P1*V1*T2)/(P2*T1) = ((5 +14.65)(2,034)(519.67))/((0 + 14.65)(569.67))

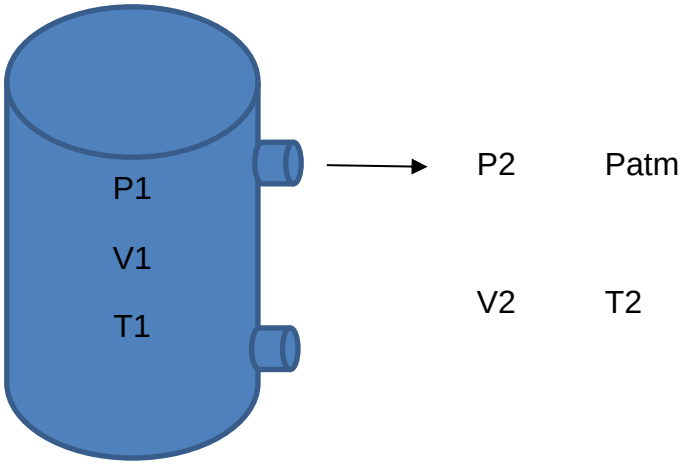
= 2,489 scf

VOC = 2,489 scf * 1 lbmol/379 scf * 16 lb/lbmol * 5,000 scf/10^6 scf

= **0.5 lb VOC/event x 3 events/year = 1.5 lb VOC (as methane)/year**

Given:

Kern Oil Refinery Process Unit Turnaround Vessel to be vented to atmosphere per SJVAPCD Rule 4454 (@ 4.6 psig vent pressure)



P1 = 4.6 psig P2 = 0 psig P_{atm} = 14.65 psia

T1 = 569.67^0 R T2 = 519.67^0 R

V1 = 2,034 cf

Gas VOC concentration as methane = 5,000 ppm $MW_{methane}$ = 16 lb/lbmole

1 lbmol = 379 scf

Find:

VOC emissions (as methane) to atmosphere after venting per event

Basic Equation:

From Ideal Gas Law: $\frac{P1\ V1}{T1} = \frac{P2\ V2}{T2}$

Solution:

V2 = (P1*V1*T2)/(P2*T1) = ((4.6 +14.65)(2,034)(519.67))/((0 + 14.65)(569.67))

= 2,438 scf

VOC emissions = 2,438 scf * 1 lbmol/379 scf * 16 lb/lbmol * 5,000 scf/10^6 scf

= **0.5 lb VOC/event x 3 events/year = 1.5 lb VOC (as methane)/year**

Difference in VOC from 5.0 psig to 4.6 psig = 1.5 – 1.5 = **0 lb VOC (as methane)/yr**

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 12/26/2019

District Rule 4641

Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations

Applicability and Purpose:
District Rule 4641 applies to the following source categories:

> The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations

The purpose of this rule is to limit VOC emissions by restricting the application and manufacturing of certain types of asphalt for paving and maintenance operations. Asphalt is defined in the rule as "a dark-brown to black refined liquid or solid cementious material of which the main constituents are bitumens suitable for use in the manufacture of paving materials or dust palliatives." The rule further defines cutback asphalt as "paving grade asphalt liquified with petroleum distillate and conforming to specification of the American Society for Testing & Materials (ASTM)", slow cure asphalt as "paving grade asphalt conforming to specification of the ASTM D2026-72" and emulsified asphalt as "any asphalt liquified with water containing an emulsifier."

Benchmarks Evaluated:
- BAAQMD Regulation 8 Rule 15 – Emulsified and Liquid Asphalt (June 1, 1994)
- SCAQMD Rule 1108 – Cutback Asphalt (February 1, 1985)
- SCAQMD Rule 1108.1 – Emulsified Asphalt (November 4, 1983)
- SMAQMD Rule 453 – Cutback and Emulsified Asphalt Paving Materials (August 31, 1982)
- VCAPCD Rule 74.4 – Cutback Asphalt (July 5, 1983)
- District Permit Requirements

Summary:
The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements:
Emissions vented to an incinerator that is required to have a minimum destruction efficiency of 98% by weight (Current District Permit Requirements)

Conclusion:
BARCT analysis determined that there are actually no permitted emissions units that are subject to District Rule 4641 requirements that have emission control technologies more effective than those required under Rule 4641. In addition, there are no federal, state, or other air district rules that are more stringent than what is already contained within District Rule 4641.

The existing requirements of SJVAPCD Rule 4641 satisfies BARCT.

2019 BARCT Rule Analysis

Rule 4641
Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations

Engineer: **Tim Bush, AQE II**
Jesse Garcia, AQE II
Reviewed By: **Errol Villegas, Permit Services Manager**
Date: **December 26, 2019**

Introduction:

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4641 – Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations (see Attachment A) determined that there may be some requirements in certain permit units that were potentially more stringent than the District's Rule 4641 requirements. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4641 satisfies BARCT requirements or if amendments to the rule are needed to ensure BARCT requirements are met.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

As part of the 2018 preliminary analysis of Rule 4641, other air districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. None of the other districts' rule contained requirements that were more stringent than those already included in District Rule 4641. In addition, state and federal regulations were reviewed and it was found that there were no state or federal regulations that applied to emissions from this source category.

However, during the preliminary review, Tricor Refining LLC was identified as having two permit units (S-44-145 and S-44-146) with conditions that were used to manufacture cutback or slow cure asphalt. This equipment is vented to an incinerator required to have a minimum destruction efficiency of 98% by weight. Based on this preliminary, further analysis was necessary to determine if these permits units could have established BARCT for this source category.

This final analysis will evaluate the maximum degree of reduction achievable, taking into account specific factors such as environmental, energy and economic impacts.

Discussion:

District Rule 4641 applies to the following source categories:

> The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations

The purpose of this rule is to limit VOC emissions by restricting the application and manufacturing of certain types of asphalt for paving and maintenance operations. Asphalt is defined in the rule as "a dark-brown to black refined liquid or solid cementious material of which the main constituents are bitumens suitable for use in the manufacture of paving materials or dust palliatives." The rule further defines cutback asphalt as "paving grade asphalt liquified with petroleum distillate and conforming to specification of the American Society for Testing & Materials (ASTM)", slow cure asphalt as "paving grade asphalt conforming to specification of the ASTM D2026-72" and emulsified asphalt as "any asphalt liquified with water containing an emulsifier." To be subject to Rule 4641, these asphalt types are to be used for paving and maintenance operations (i.e. all activities involved in the new construction and maintenance of roadways and parking areas).

Throughout this further BARCT analysis process, the District has collaborated with industry representatives (Taylor Environmental Services) and Tricor Refining LLC representatives to fully understand how this industry is complying with the rule requirements and if there were any opportunities for establishing requirements more stringent than those already in place.

Based on discussions with the facility operator at Tricor Refining LLC, it was determined that permit units S-44-145 and -146 actually do not produce any cutback asphalt, slow cure asphalt, or emulsified asphalt from the equipment listed in those two permits. These permit units are “Asphalt air blowing operations” that produce air-blown asphalt. Air-bown asphalts also known as “oxidized asphalts” are asphalts that have been treated by blowing air through it at elevated temperatures to produce physical properties for the industrial use of the final product. These air-blown asphalts differ from cutback, slow cure, and emulsified asphalts since they are not used for paving and maintenance operations. These asphalts are used for a wide variety of industrial and specialty purposes such as: roofing applications, pipe coating enamels, undersealing for Portland cement concrete pavements, and waterproof membranes for lining canals and reservoirs.

In 2002, condtions were erronously added to the above permits as part of the initial Title V permit issuance to require the facility to comply with the requirements of Rule 4641, when in fact Rule 4641 does not apply to operations at this facility. District Rule 4641 does not apply to units S-44-145 and -146 and reference to the District Rule 4641 requirements in permit conditions are incorrect. Tricor has submitted permit applications to revise the above permits to remove the erroneous conditions related to Rule 4641 and the District is processing the application to revise the two permits accordingly.

Conclusion:

The existing requirements of SJVAPCD Rule 4641 satisfies BARCT and no further analysis is required.

Further BARCT analysis determined that there are actually no permitted emissions units that are subject to District Rule 4641 requirements and have emission control technologies more effective than those required under Rule 4641. In addition, there are no other federal, state, or local district rules that are more stringent than what is already contained within District Rule 4641.

Attachments:

Attachment A: 2018 Preliminary AB 617 BARCT Rule Analysis for Rule 4641

Attachment A

2018 Preliminary AB 617 BARCT Analysis for Rule 4641

2018 AB 617 BARCT Rule Analysis

Rule 4641
Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations

Engineer: **Tim Bush**
Date: **August 15, 2018**

Introduction

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations, and if applicable, propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Existing stationary sources in non-attainment areas such as the San Joaquin Valley have been subject to BARCT requirements since the 1980s, although some nonattainment areas with market-based criteria pollutant reduction programs were not required to apply BARCT to facilities complying with those market-based programs. Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

District Rule 4641 applies to the following source categorie:

- The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

SOURCE CATEGORY

1. RULE SURVEY

1.1. District Rule

SJVAPCD Rule 4641 *(December 17, 1992)*

	SJVAPCD
Applicability	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower

1.2. Bay Area AQMD Rule

BAAQMD Regulation 8 Rule 15 (Emulsified and Liquid Asphalt) *(June 1, 1994)*

	SJVAPCD	BAAQMD	Conclusion
Applicability	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.	The applicability is the same.
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower	A person shall not use any rapid-cure liquid asphalt in paving material or in paving and maintenance operations. A person shall not use, except as provided in Section 8-15-112 (exemption for cool weather), any medium-cure liquid asphalt in paving material or in paving and maintenance operations. A person shall not use any slow-cure liquid asphalt which contains more than 0.5 percent by volume of petroleum solvents which boil at less than 260ºC (500ºF) as determined by ASTM Distillation Method D402 in paving material or in paving and maintenance operations. A person shall not use any emulsified asphalt containing petroleum solvents in excess of 3% by volume in paving material or in paving and maintenance operations. No person shall manufacture, offer for sale or sell a liquid asphalt or emulsified asphalt product if such product is prohibited by any of the provisions of this rule.	District rule is more stringent because there is no exemption for usage of medium cure cutback.

		The prohibition of this section shall apply to the manufacture and sale of any liquid asphalt or emulsified asphalt product which will be applied at any physical location within the District.	

1.3. South Coast AQMD Rules

SCAQMD Rule 1108 (Cutback Asphalt) *(February 1, 1985)*

	SJVAPCD	SCAQMD	Conclusion
Applicability	The manufacture and use of of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.	The sale or offer for sale for use of cutback asphalt.	The applicability is different. The District Rule is not a point of sale rule.
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower	A person shall not sell or offer for sale for use in the District, or use any cutback asphalt containing more than 0.5 percent by volume organic compounds which evaporate at 260°C (500°F) or lower as determined by ASTM Method D402 (AASHTO T78) or other test method as approved by the Executive Officer.	District rule is more stringent because it includes requirements for emulsified asphalt.

SCAQMD Rule 1108.1 (Emulsified Asphalt) *(November 4, 1983)*

	SJVAPCD	SCAQMD	Conclusion
Applicability	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations	The sale or offer for sale for use of cutback asphalt.	The applicability is different. The District Rule is not a point of sale rule.
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower	A person shall not sell or offer for sale for use in the District, or use any emulsified asphalt containing organic compounds which evaporate at 260ºC (500ºF) or lower as determined by ASTM Method D244 (AASHTO T59), or other test method as approved by the Executive Officer, in excess of Medium setting type for use with any aggregate, three percent by volume.	District rule is more stringent because it includes requirements for cutback asphalt.

1.4. Sacramento Metropolitan AQMD Rule

SMAQMD Rule 453 (CUTBACK AND EMULSIFIED ASPHALT PAVING MATERIALS) *(August 31, 1982)*

	SJVAPCD	SMAQMD	Conclusion
Applicability	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations	To limit emissions of volatile organic compounds from the manufacturing for sale or use of cutback and emulsified asphalt in paving materials, paving and maintenance operations.	The applicability is the same.
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower	Cutback Asphalt: A person shall not manufacture for sale nor use for paving, road construction or road maintenance any: • Rapid or medium cure cutback asphalt; • Slow cure cutback asphalt containing organic compounds which evaporate at 260ₒC (500ₒF) or lower as determined by ASTM Method D402 or other test method as approved by the Air Pollution Control Officer. Emulsified : A person shall not manufacture for sale nor use for paving, road construction or road maintenance any: • emulsified asphalt containing organic compounds which evaporate at 260ₒC (500ºF) or lower as determined by ASTM Method D244, or other test method as approved by the Air Pollution Control Officer, in excess of (slow cure cutback asphalt):	The District rule is as stringent.

1.5. Ventura County APCD Rule

VCAPCD Rule 74.4 (Cutback Asphalt) *(July 5, 1983)*

	SJVAPCD	VCAPCD	Conclusion
Applicability	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.	The applicability is the same
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower	No person shall cause or allow the use or application of rapid cure cutback asphalt for highway or street paving or maintenance, nor manufacture, sell, or offer for sale cutback asphalt for such use or application. No person shall cause or allow the use or application of cutback asphalt for highway or street paving or maintenance, nor manufacture, sell, or offer for sale cutback asphalt for such use or application in this District except as specified below: • Where the cutback asphalt is to be used solely as a penetrating prime coat; • Where the National Weather Service official forecast of the high temperature for the 24-hour period following application is below 50ºF (10ºC). In the South Zone of the District no person shall cause or allow the use or application of an emulsified asphalt containing petroleum	District rule is more stringent there is no exemption for usage of cutback asphalt when the ambient temperature is below 50ºF.

		solvents (diluents) in excess of three percent by volume or cutback asphalt for highway or street paving or maintenance, nor manufacture, sell, or offer for sale such asphalts for such use or application. The provisions of this section shall not apply to cutback asphalt manufactured in this District for shipment and use outside this District. Road oils used for highway or street paving or maintenance applications shall contain no more than 0.5 percent of organic compounds which boil at less than 500^{o}F as determined by ASTM D402.	

1.6. Rule Survey Conclusion

As presented above, District Rule 4641 currently has in place the most stringent control measures/emission limits feasible to retrofit and implement.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

Out of twenty permitted sources. One of the following forms of the rule emission limits is placed on the permits:

- The operator shall not manufacture for sale nor use within the District any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: rapid cure cutback asphalt; medium cure cutback asphalt; slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate at 500 degrees Fahrenheit or lower; emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 degrees Fahrenheit or lower.

- The facility shall not manufacture or use cut back, slow cure, or emulsified asphalt containing organic compounds in excess of three percent by volume, which evaporates at 500 F or lower at this facility.

- Neither cutback, slow cure, or emulsified concrete products (as defined in District Rule 4641, Sections 3.2, 3.4, 3.10, and 5.1) shall be utilized or produced at this facility.

There are two permit units, S-44-145 and S-44-146, which are used to manufacture asphalt that vent to an incinerator that is required to have a minimum destruction efficiency of 98% by weight.

2.2. State Regulations – ATCMs

There are no applicable State Regulations.

2.3. Federal Regulations – CFRs

There are no applicable CFRs

2.4. Table Comparing Potential Retrofit Control Technologies/Emission Limits

	SJVAPCD	Other Control Option(s)	Conclusion
Applicability	The manufacture and use of cutback asphalt, slow cure asphalt and emulsified asphalt for paving and maintenance operations.	1. Permitted Sources – incineration with 98% control 2. State Regulations – None 3. Federal Regulations - None	There is not likely to be another control that would have a control efficiency greater than 98%.
Requirements	A person shall not manufacture for sale nor use any of the following for penetrating prime coat, tack coat, dust palliative, or other paving and maintenance operations: • Rapid cure cutback asphalt • Medium cure cutback asphalt • Slow cure asphalt which as produced for application, contains more than one-half (0.5) percent of organic compounds which evaporate 500 ºF or lower • Emulsified asphalt containing organic compounds, in excess of three (3) percent by volume, which evaporate at 500 ºF or lower		

2.5. Other Control Technology Conclusion

As presented above, incineration seems to be an available potential retrofit control technology/emission limits and further analysis is required to determine whether District Rule 4641 meets BARCT.

3. OVERALL ANALYSIS CONCLUSION

As presented above, other control technology/emission limits options such as incineration has been identified. A more refined analysis is required to determine whether District Rule 4641 has the most stringent control measures/emission limits in place and meet BARCT.

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 12/26/2019

District Rule 4104

Reduction of Animal Matter

Applicability and Purpose:
District Rule 4104 applies to the following source categories:

> Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter. Source operations used exclusively for the processing of food for human consumption is exempt from the requirements of this rule.

The purpose of this rule is to limit air contaminants from source operations used for the reduction of animal matter.

Benchmarks Evaluated:

- BAAQMD Reg. 12, Rule 2 – Rendering Plants (N/A)
- SCAQMD Rule 472 – Reduction of Animal Matter (5/7/1976)
- SMAQMD Rule 410 – Reduction of Animal Matter (8/3/1977)
- VCAPCD Rule 58 – Reduction of Animal Matter (5/23/1972)
- MBARD Rule 414 – Reduction of Animal Matter (8/21/2002)
- SDCAPCD Rule 64 – Reduction of Animal Matter (8/21/1981)
- District Permit Requirements

Summary:
The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements. Specifically:

- Gases incinerated at temperatures of not less than 1,400 °F for a period of not less than 1.0 seconds (Current District Permit Requirements)
- Gases incinerated at temperatures of not less than 1,300 °F for a period of not less than 0.4 seconds (VCAPCD Rule 58)

Conclusion:
BARCT analysis determined that potential enhanced control options would only provide limited opportunity for emission reductions (0.5 tons/year of VOC), would result in increased NO_X emissions being formed as thermal NO_X, and were not cost-effective given the significant implementation costs.

The existing requirements of SJVAPCD Rule 4104 satisfies BARCT.

2019 BARCT Rule Analysis

Rule 4104
Reduction of Animal Matter

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Date: **12/26/19**

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4104 – Reduction of Animal Matter (see Attachment A) determined that there may be some requirements in other air district rules and on permits issued by the District that were potentially more stringent than the District's Rule 4104 requirements. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4104 satisfies BARCT requirements or if amendments to the rule are needed to ensure BARCT requirements are met.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

As part of the 2018 preliminary analysis of Rule 4104, other air districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), Ventura County Air Pollution Control District (VCAPCD), Monterey Bay Air Resources District (MBARD), and San Diego County Air Pollution Control District (SDAPCD) were reviewed. In addition, state and federal regulations were reviewed and it was found that there were no state or federal regulations that applied to emissions from heated processes used for the reduction of animal matter.

This further BARCT analysis will evaluate the maximum degree of reduction achievable, taking into account specific factors such as environmental, energy and economic impacts.

DISCUSSION

District Rule 4104 applies to the following source categories:

> Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter. Source operations used exclusively for the processing of food for human consumption is exempt from the requirements of this rule.

The purpose of this rule is to limit air contaminants from source operations used for the reduction of animal matter.

Reduction of animal matter (rendering) is a process that converts waste animal tissue into stable, usable materials. For the purposes of this BARCT analysis, reduction of animal matter is defined as any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating and protein concentrating.

The majority of tissue processed at a rendering plant comes from slaughterhouses, but also includes restaurant grease, butcher shop trimmings and expired meat from grocery stores. These materials can include fatty tissue, bones, and offal, as well as entire carcasses of animals condemned at slaughterhouses, and those that have died on farms, in transit, etc. The most common animal sources processed are beef, pork, and poultry.

The rendering process simultaneously dries the material and separates the fat from the bone and protein. A rendering process typically yields a fat commodity (yellow grease, choice white grease, bleachable fancy tallow, etc.) and a protein meal (meat and bone meal, poultry byproduct meal, etc.).

FURTHER BARCT ANALYSIS

As discussed earlier, each air pollution control district can establish its own BARCT requirements based upon the consideration of specified factors. To help perform this further BARCT analysis, the District will employ a 5-Step Top-Down approach to determine appropriate BARCT requirements.

From the District's 2018 preliminary AB 617 BARCT Rule Analysis (see Attachment A), the control options analyzed were from the following sources:

- SJVAPCD Rule 4104 – Reduction of Animal Matter (12/17/1992)
- BAAQMD Reg. 12, Rule 2 – Rendering Plants (N/A)
- SCAQMD Rule 472 – Reduction of Animal Matter (5/7/1976)
- SMAQMD Rule 410 – Reduction of Animal Matter (8/3/1977)
- VCAPCD Rule 58 – Reduction of Animal Matter (5/23/1972)
- MBARD Rule 414 – Reduction of Animal Matter (8/21/2002)
- SDCAPCD Rule 64 – Reduction of Animal Matter (8/21/1981)
- District Permit Requirements – See Attachment A, Section 2.4

Current District permit requirements and VCAPCD Rule 58 were the only identified potential control options that may be more stringent than current rule requirements.

Step 1 – Identify Control Strategies

The control options include:

Option 1. *SJVAPCD - Current Permit Requirements*: Thermal oxidizer shall be operated with a combustion chamber temperature of no less than 1,400 °F and the retention time shall be no less than one second.

Option 2. *VCAPCD Rule 58*: A person shall not operate or use any article, machine, equipment, or other contrivance for the reduction of animal matter, unless all gases, vapors and gas-entrained effluent from such an article, machine, equipment or other contrivance are: A) incinerated at temperatures of not less than 1,300 °F for a period of not less than 0.4 seconds; or B) processed in such a manner determined by the Air Pollution Control District to be equally, or more, effective for the purpose of air pollution control than the temperature and residence time requirements specified in option 2A above.

Option 3. *SJVAPCD – Current Rule 4104 Requirements*: A person shall not operate or use any article, machine, equipment, or other contrivance for the reduction of animal matter unless all gases, vapors and gas-entrained effluent from such an article, machine, equipment or other contrivance are: A) incinerated at temperatures of not less than 1,200 °F for a period of not less than 0.3 seconds; or B) processed in such a manner determined by the APCO to be

equally or more effective for the purpose of air pollution control than the temperature and residence time requirements specified in option 1A above.

Step 2 – Eliminate Infeasible Options

All options are feasible and are documented in existing rules and/or permit requirements from the SJVAPCD and VCAPCD.

Step 3 – Rank Control Technologies

While the three control options for animal matter reduction operations identified above do not identify specific control efficiency numbers, all involve specific operating parameters for the thermal incinerator combustion chamber such as incineration temperature and retention time. In order to compare these options, a discussion of each operating parameter and its effect on control efficiency is provided below.

Incineration Temperature

Animal matter reduction operations emit volatile organic compound (VOC) and particulate matter emissions (PM_{10}) in addition to various other odorant pollutants (see Attachment B). For optimal control of each pollutant, technology vendors (Ship & Shore Environmental and Perennial Energy LLC) recommend that thermal oxidizers operate at least 300 °F above the auto ignition temperature of the target compound or odorant in question. The auto-ignition temperatures for the common odorants emitted by animal matter rendering operations is also shown in Attachment B. With the exception of ammonia, the highest auto-ignition temperature for any of the compounds listed is 842 °F. This auto-ignition temperature is more than 300 °F lower than control option 3 above, which requires a minimum destruction temperature of 1,200 °F. Therefore, for these pollutants, requiring a higher minimum incineration temperature in the rule is not expected to result in any higher control efficiency for all odor compounds emitted by animal matter rendering operations, except ammonia.

The auto-ignition temperature for ammonia is 1,204 °F. It is expected that at the current minimum incineration temperature requirement of 1,200 °F identified above in District Rule 4104, the majority of the ammonia emissions will be controlled and destroyed. Requiring a higher incineration temperature in the rule may potentially result in a small increase in the control efficiency for ammonia emissions. However, requiring a thermal oxidizer to operate at a higher temperature would result in increased NO_X emissions being formed as thermal NO_X, increased oxidation of ammonia in the exhaust gas converting to NO_X, and increased oxidation of other nitrogen-bearing compounds converting to NO_X.

Therefore, on the basis of an optimal incineration temperature, allowing for effective odor control while limiting NOx emissions increase, the three control options identified above will be considered to have equivalent control efficiencies considering the expected criteria pollutant emission rates. Operating at a higher minimum incineration temperature will not meaningfully increase the destruction efficiency of the pollutants commonly associated with

animal rendering operations, and in fact doing so may increase NOx emissions, which is counterproductive to the District's Ozone and PM2.5 attainment efforts.

Retention Time

As discussed above, the control options identified as a part of this BARCT analysis only involve variations in the minimum thermal oxidizer destruction temperature and retention time. An extensive search of technical literature and discussions with thermal incinerator equipment vendors did not reveal any data that correlates thermal incinerator residence time with control efficiency. Nevertheless, while an increased minimum incineration temperature is not expected to have a significant effect on the thermal oxidizer control efficiency when used for an animal rendering operation, it is reasonable to assume a longer retention time may result in higher VOC control efficiencies by allowing more time for the oxidation reactions to occur.

Based on the discussion above, the above control options are all feasible and ranked as follows:

Rank 1: Option 1 - Gases incinerated at temperatures of not less than 1,400 °F for a period of not less than 1.0 second. (SJVAPCD – Current Permit Requirements)

Rank 2: Option 2 - Gases incinerated at temperatures of not less than 1,300 °F for a period of not less than 0.4 seconds. (VCAPCD).

Rank 3: Option 3 - Gases incinerated at temperatures of not less than 1,200 °F for a period of not less than 0.3 seconds. (SJVAPCD – Current Rule 4104 Requirements).

Step 4 – Cost Effectiveness Evaluation of Control Options

In accordance with information provided by Perennial Energy (https://www.perennialenergy.com), it would be very difficult to retrofit an existing thermal oxidizer to modify either the incineration temperature or the combustion chamber retention time. When installed, thermal incinerator units are specifically designed for the customer's requirements (e.g. process flow rates, contaminates contained in the process stream to be controlled, etc.). In addition, the thickness and type of insulating materials used on the inside of the thermal oxidizer would determine if it is possible to operate the thermal oxidizer with a longer retention time.

It was discussed if it would be possible to increase the retention time of the thermal oxidizer by using dampers or reducing the exhaust stack diameter to reduce the exhaust flow rate. Perennial Energy stated that this would increase the retention time but it would also reduce the designed processing rate of the unit and the increase in back pressure may negatively affect the operation of the burner.

Based on the factors above, retrofitting an existing thermal oxidizer to increase the retention time is not a feasible option. The only remaining option for increasing the retention time is to replace the entire thermal oxidizer with a new unit that meets the desired temperature and retention time specifications.

A. Cost Effectiveness Evaluation of Control Option 1, Ranked #1

Option 1) Gases incinerated at temperatures of not less than 1,400 °F for a period of not less than 1.0 seconds. (SJVAPCD – Current Permit Requirements); or

Thermal oxidizer vendors, Perennial and B&W MegTec, both confirmed that off-the-shelf thermal oxidizers are all designed to meet the option 1 retention time and temperature requirements and are expected to achieve an overall control efficiency of at least 98% and as high as 99%, which will be used for this determination under this option.

The following cost analysis was performed to determine the incremental cost effectiveness for modifying Rule 4104 to require the use of an incinerator with a minimum chamber temperature of 1400 °F and a minimum retention time of 1.0 seconds. Typically, the type of incinerator used at these facilities is a regenerative thermal oxidizer (RTO) since RTO's have the lowest fuel usage and result in the least amount of collateral emissions from combustion. Current Rule District Rule 4104 requires the use of an incinerator with a minimum operating chamber temperature of 1200 °F and a minimum 0.3 seconds retention time to control emissions for animal rendering processing equipment. Since existing thermal oxidizers cannot be retrofitted to increase their operating temperature and retention time, facilities would be required to replace their existing thermal oxidizer with a new unit to meet the new requirements.

Cost Analysis Assumptions:

1. The flow rate of a typical rendering operation is similar to that of meat meal line #2 at Foster Foods (Permit N-1252-30-5, See Attachment D), which has an inlet flow rate of 6,000 CFM to the thermal oxidizer.

2. Per a representative of B&W MegTec, the capital equipment cost for a new regenerative thermal oxidizer (1400 °F and 1.0 seconds retention time) to control a 6,000 CFM inlet flow rate is approximately $312,600.

3. It is conservatively assumed that there will be no increase in operating, maintenance, and direct annual costs associated with a new thermal oxidizer, since the facility already incurs these expenses for their existing thermal oxidizer. Therefore, these costs have been set equal to zero in the cost analysis below.

Cost Analysis Calculations:

The following table shows line-item costs to replace a thermal oxidizer.

	Item	Method of Calculation	COST ($)
	DIRECT CAPITAL COSTS		
A	TOTAL PURCHASED EQUIP COST (PEC)	Variable	$312,600
B	FREIGHT	5% Purchased Equip. Cost (PEC)	$15,630
C	SALES TAX	8.25% PEC	$25,790
D	DIRECT INSTALLATION COSTS	25% PEC	$78,150
E	*TOTAL DIRECT CAPITAL COSTS*	*A+B+C+D*	*$432,170*
	INDIRECT CAPITAL COSTS		
F	FACILITIES	5% PEC	$15,630
G	ENGINEERING	10% PEC	$31,260
H	PROCESS CONTINGENCY	5% PEC	$15,630
I	TOTAL INDIRECT CAPITAL COSTS	F+G+H	$62,520
J	PROJECT CONTINGENCY	20% PEC	$62,520
K	***TOTAL CAPITAL COSTS (TCC)***	***E+I+J***	***$557,210***
L	*ANNUALIZED CAPITAL COSTS (10 YEARS @ 10%)*	*0.1627*K*	*$90,658*
	DIRECT ANNUAL COSTS		
	OPERATING COSTS		
M	OPERATOR	0.5 hr/shift, $25/hr	$0 (See Assumption #3)
N	SUPERVISOR	15% of operator	$0 (See Assumption #3)
	MAINTENANCE COSTS		
O	LABOR	0.5 hr/shift, $25/hr	$0 (See Assumption #3)
P	MATERIAL	100% of labor cost	$0 (See Assumption #3)
	UTILITY COSTS		$0 (See Assumption #3)
Q	ELECTRICITY COSTS	Variable	$0 (See Assumption #3)
R	*TOTAL DIRECT ANNUAL COSTS*	*M+N+O+P+Q*	*$0*
	INDIRECT ANNUAL COSTS		
S	OVERHEAD	60% of O&M (M+N+O+P)	$0 (See Assumption #3)
T	ADMINISTRATIVE	0.02 x PEC	$0 (See Assumption #3)
U	INSURANCE	0.01 x PEC	$0 (See Assumption #3)
V	PROPERTY TAX	0.01 x PEC	$0 (See Assumption #3)
W	CAPITAL RECOVERY	0.13 x PEC	$0 (See Assumption #3)
X	ADMINISTRATIVE	(10% int. rate, 15 yr period)	$0 (See Assumption #3)
Y	*TOTAL INDIRECT ANNUAL COSTS*	*S+T+U+V+W+X*	*$0*
TOTAL ANNUALIZED COST		**L+R+Y**	**$90,658**

Additional Emission Reductions:

In order to determine the cost effectiveness of replacing the thermal oxidizer at a rendering plant on a $/ton basis, the quantity of additional emission reductions must be estimated. As discussed above, Foster Foods Meat Meal Line #2 is expected to represent a typical animal rendering plant. It is assumed that a thermal oxidizer with a 1.0 second retention time will have a maximum VOC control efficiency of 99% and a thermal oxidizer meeting current District Rule 4104 requirement of 0.3 second retention time will have a conservative control efficiency of 98%. Based on these assumptions and using the animal rendering operation under permit N-1252-30-5 (See Attachment D) as a representative example, the industry standard emission rates from the thermal oxidizer exhaust were calculated to be as follows (See Attachment C):

Rendering Line Emission Rate (RTO w/0.3 s retention time) = 2,000 lb-VOC/year
Rendering Line Emission Rate (RTO w/1.0 s retention time) = 1,000 lb-VOC/year

Emission Reductions = (2,000 lb-VOC/year – 1,000 lb-VOC/year) x ton/2000 lb
Emission Reductions = 0.5 tons-VOC/year

Cost/ton of Additional Emissions Reduced:

Cost/ton = $90,658/year ÷ 0.5 tons-VOC/year
Cost/ton = $181,316/ton of VOC reduced

Based on the discussion above, control Option 1 ranked #1, was determined to not be cost-effective ($113,322/ton of VOC).

Therefore, this control option will be removed from consideration.

B. Cost Effectiveness Evaluation of Control Option 2, Ranked #2

Option 2) Gases incinerated at temperatures of not less than 1,300 °F for a period of not less than 0.4 seconds. (VCAPCD); or

A thermal oxidizer designed to meet the Option 2 retention time (0.4 sec) and temperature requirements (1,300 °F) would require a costly custom designed unit that would not be as cost effective as an off-the-shelf unit meeting the option 1 requirements. Thus, Option 2 would be even less cost-effective than installing a thermal oxidizer meeting the option 1 specifications.

Therefore, this control option will be removed from consideration.

C. Cost Effectiveness Evaluation of Control Option 3, Ranked #3

Option 3) Gases incinerated at temperatures of not less than 1,200 °F for a period of not less than 0.3 seconds. (SJVAPCD – Current Rule 4104 Requirements)

This is the current requirements in District Rule 4104. No further analysis is required.

Step 5 – Select BARCT

As detailed above, Options 1 and 2 were determined to not be cost effective. The only remaining option, Option 3, will be selected as BARCT.

> Gases incinerated at temperatures of not less than 1,200 °F for a period of not less than 0.3 seconds. (SJVAPCD – Current Rule 4104 Requirements)

CONCLUSION

The existing requirements of SJVAPCD Rule 4104 satisfies BARCT and no further analysis is required.

Attachments:

Attachment A: 2018 Preliminary AB 617 BARCT Analysis for Rule 4104
Attachment B: Common Odorants Emitted by Animal Matter Rendering Facilities and their Auto-Ignition Temperatures
Attachment C: Emission Rate Calculations for Thermal Oxidizer Cost Analysis
Attachment D: Permit to Operate N-1252-30-5

Attachment A

2018 Preliminary AB 617 BARCT Analysis for Rule 4104

2018 AB 617 BARCT Rule Analysis

Rule 4104
Reduction of Animal Matter

Engineer: **Kai Chan**
Date: **August 20, 2018**

Introduction

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations, and if applicable, propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Existing stationary sources in non-attainment areas such as the San Joaquin Valley have been subject to BARCT requirements since the 1980s, although some nonattainment areas with market-based criteria pollutant reduction programs were not required to apply BARCT to facilities complying with those market-based programs. Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

District Rule 4104 applies to the following source categories:

- Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter. Source operations used exclusively for the processing of food for human consumption is exempt from the requirements of this rule.

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

SOURCE CATEGORY – HEATED PROCESSES USED FOR REDUCTION OF ANIMAL MATTER

1. RULE SURVEY

1.1. District Rule(s) .

SJVAPCD Rule 4104 *(Amended December 17, 1992)*

	SJVAPCD
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.

1.2. Bay Area AQMD Rule(s)

BAAQMD Regulation 12, Rule 2 (Rendering Plants) *(Revised April 24, 2018)*

	SJVAPCD	BAAQMD	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	Any heated process including rendering, cooking, drying, dehydrating, digesting, evaporating, and protein concentrations at plants whose purpose is the reduction of animal matter.	Same applicability.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	Emissions from the reduction of animal matter shall be incinerated at a temperature of not less than 650° C (1,202° F) for a period of not less than 0.3 seconds or processed in manner, which is equally, or more effective for emissions control.	Same requirements.

1.3. South Coast AQMD Rule(s)

SCAQMD Rule 472 (Reduction of Animal Matter) *(Adopted May 7, 1976)*

	SJVAPCD	SCAQMD	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	Any equipment used for the reduction of animal matter, except for the exclusive processing of food for human consumption.	Same applicability.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	Emissions from the reduction of animal matter shall be incinerated at a temperature of not less than 650° C (1,202° F) for a period of not less than 0.3 seconds or processed in manner, which is equally, or more effective for emissions control.	Same requirements.

1.4. Sacramento Metropolitan AQMD Rule(s)

SMAQMD Rule 410 (Reduction of Animal Matter) *(Amended August 3, 1977)*

	SJVAPCD	SMAQMD	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	Any heated process including rendering, cooking, drying, dehydrating, digesting, evaporating, and protein concentrating at animal matter reduction facilities, except for the exclusive processing of food for human consumption.	Same applicability.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	Emissions from the reduction of animal matter shall be incinerated at a temperature of not less than 650° C (1,202° F) for a period of not less than 0.3 seconds or processed in a manner, which is equally, or more effective for air pollution control.	Same requirements.

1.5. Ventura County APCD Rule(s)

VCAPCD Rule 58 (Reduction of Animal Matter) *(Revised May 23, 1972)*

	SJVAPCD	VCAPCD	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	Any article, machine, equipment or other contrivance for the reduction of animal matter, except for the exclusive processing of food for human consumption.	Same applicability.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,300° F for a period of not less than 0.4 seconds or processed in such a manner to be equally or more effective for air pollution control.	VCAPCD requires the incinerator to operate at a higher temperature with a longer retention time.

1.6. Monterey Bay Unified Air Pollution Control District

	SJVAPCD	MBUAPCD	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	All rendering plants operated within the Air District, except for the exclusive processing of food for human consumption.	Same applicability.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for air pollution control.	Same requirements.

1.7. San Diego County Air Pollution Control District

	SJVAPCD	SDAPCD	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	Any heated process including rendering, cooking, drying, dehydrating, digesting, evaporating, and protein concentrating of animal matter, except for the processing of food, other than fish cooking for commercial canning, for human consumption.	Same applicability.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200° F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for air pollution control.	Same requirements.

1.8. Rule Survey Conclusion

As presented above, VCAPCD Rule 58 requires incinerators to operate at a higher temperature and longer retention time, which may result in more stringent control of emissions. However, more research regarding the effects of higher incinerator operating temperatures and longer residence times is necessary to determine if VCAPCD Rule 58 is more stringent than District Rule 4104.

Nevertheless, a longer retention time would require the resizing of the incinerator combustion chamber, which may not be a retrofitable control method.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

Permit Number	Equipment Description	Control Technology/Emission Limits
N-1252-1-15	Meat meal processing plant #1 consisting of 20 steam heated meat cookers, 5 perk pans, and 3 expeller presses. The meat cookers	The 3.2 MMBtu/hr thermal oxidizer serving the meat cookers is required to operate at no less than 1,400° F and the

	are vented through a knock-out cyclone, an AC Corp. ACC-250 condenser, a venturi scrubber, mist eliminator, and a 3.2 MMBtu/hr thermal oxidizer all in series. The perk pans and the expellers are vented to a C-12 condenser and a pack bed odor scrubber in series. The packed bed odor scrubber is vented to 2 cross-flow scrubbers in parallel. The knock-out cyclone, the AC Corp. ACC-250 condenser, the venturi scrubber, the mist eliminator, the thermal oxidizer, the C-12 condenser, the packed bed odor scrubber, and the cross flow scrubbers are shared by permit units N-1252-1 and N-1252-2.	retention time shall be no less than 1 second.
N-1252-2-15	Feather hydrolizing operation consisting of 2 feather hydrolizers vented through the primary control system, which consists of a knock-out cyclone, an AC Corp. ACC-250 condenser, a venturi scrubber, a mist eliminator, and a 3.2 MMBtu/hr thermal oxidizer all in series. The equipment also includes a secondary emission control system, which consists of a knock-out cyclone, an AC Corp. ACC-250 condenser, a C-12 condenser, and a pack bed odor scrubber all in series. The packed bed odor scrubber is vented through 2 cross-flow scrubbers in parallel. The knock-out cyclone, the AC Corp. ACC-250 condenser, the venturi scrubber, the mist eliminator, the thermal oxidizer, the C-12 condenser, the packed bed odor scrubber, and the cross flow scrubbers are shared by permit units N-1252-1 and N-1252-2.	The 3.2 MMBtu/hr thermal oxidizer serving the feather hydrolizers is required to operate at no less than 1,400^{o} F and the retention time shall be no less than 1 second.
N-1252-30-5	Meat meal processing plant #2 consisting of 1 raw material receiving hopper, 1 fat tank, 1 fat centrifuge, 1 Sweco separator, 1 Dupps 200-U steam cooker, 1 18” continuous percoluator, 2 Dupps 10” presses, 1 Mighty Samson 660-16 hammermill, 1 Rotex shaker, served by a shell and tube heat recovery condenser, ACC-250 air-cooled condenser, a venturi scrubber with mist eliminator, a packed bed water scrubber, and a 2.0 MMBtu/hr regenerative thermal oxidizer, in series. Room air will be served by a 50,000 cfm packed bed room air scrubber.	The 2.0 MMBtu/hr regenerative thermal oxidizer serving the Dupps 200-U steam cooker is required to operate at no less than 1,400^{o} F and the retention time shall be no less than 1 second.

N-2107-9-17	Food processing byproduct recycling operation including 3 Dupps pre-heat cookers, a Haarslev 2564 cooker and air cooled condenser served by a shared 3.0 MMBtu/hr natural-gas fired Gulf Coast Environmental regenerative thermal oxidizer (RTO) with a venturi scrubber prior to the RTO (controls served with permit unit N-2107-14).	The 3.0 MMBtu/hr regenerative thermal oxidizer serving the cookers is required to operate at no less than 1,400^{o} F and the retention time shall be no less than 1 second.
N-2107-14-0	Feather recycling operatin consisting of an indoor feather receiving hopper, a stearm-fired continuous feather hydrolyzer, a feather press, a steam-fired feather dryer, a blood staging tank, a blood centrifuge, spray chamber and air cooled condenser served by a shared 3.0 MMBtu/hr natural gas-fired Gulf Coast Environmental regenerative thermal oxidizer (RTO) with a venturi scrubber prior to the RTO (controls shared with permit unit N-2107-9).	The 3.0 MMBtu/hr regenerative thermal oxidizer serving the feather hydrolyzer and associated equipment is required to operate at no less than 1,400^{o} F and the retention time shall be no less than 1 second.
C-72-3-14	Animal rendering operation including meat and bone meal cooking operation with: 1 hogger, 1 screen screw, conveyance screw system, 18 fat, yellow grease, and tallow tanks, 1 clarifer, 1 centrifuge, 3 Dupps Model 1200 cookers vented to 3 air-to-air vapor condensers and to a 60” 1D-1D moisture knock-out cyclone, 3 pressors, tallow work tanks, bird machine, screen screw, over press screw, hogger, crax transfer elevators, and tallow elevator vented to a 60” 1D-1D moisture knock-out cyclone, hot crax holding bin and crax transfer screw vented to a 16" 2D-2D moisture knock-out cyclone, and all cyclones venting to a 10 MMBtu/hr Spencer thermal oxidizer/afterburner serial #1295 and a 250 HP Hurst waste heat recovery boiler	The 10.0 MMBtu/hr thermal oxidizer/afterburner serving the cookers is required to operate at a minimum of 1,200^{o} F and a minimum retention time of 0.57 seconds.
C-406-2-6	Animal rendering operation equipped with an Atlas-Stord TST-2264 cooker, tallow work tank, Roto-Shear fat drainer, presses, screws, centrifuge, and condenser served by a 12,000 cfm venturi scrubber and an 18 MMBtu/hr natural gas-fired thermal oxidizer with an associated 350 bhp heat recovery steam boiler.	The 18 MMBtu/hr thermal oxidizer serving the cookers and associated equipment is required to operate at a minimum of 1,200^{o} F and a minimum retention time of 0.5 seconds.

2.2. State Regulations – ATCMs

There currently are no state regulations applicable to emissions from heated processes used for the reduction of animal matter.

2.3. Federal Regulations – CFRs

There currently are no federal regulations applicable to emissions from heated processes used for the reduction of animal matter.

2.4. Table Comparing Potential Retrofit Control Technologies/Emission Limits

	SJVAPCD	Other Control Option(s)	Conclusion
Applicability	Source operations using any heated process, including rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration for the processing of animal matter, except for the exclusive processing of food for human consumption.	1. The following District permits operate heated processes used for the reduction of animal matter: N-1252-1-15, N-1252-2-15, N-1252-30-5, N-2107-9-17, N-2107-14-0, C-72-3-14, and C-46-2-6. 2. No applicable State Regulations were found. 3. No applicable Federal Regulations were found.	There are seven District permitted sources, which operate heated processes used for the reduction of animal matter. No applicable State and Federal Regulations were found.
Requirements	Emissions from any article, machine, equipment, or other contrivance for the reduction of animal matter shall be incinerated at temperatures of not less than 1,200º F for a period of not less than 0.3 seconds or processed in such a manner to be equally or more effective for emissions control.	1. Permits N-1252-1-15, N-1252-2-15, and N-1252-30-5 utilizes a thermal oxidizer operating at a temperature of not less than 1,400º F with a retention time of no less than 1 second. 2. Permits N-2107-9-17 and N-2107-14-0 utilizes a regenerative thermal oxidizer operating at a temperature of no less than 1,400º F with a retention time of no less than 1 second. 3. Permit C-72-3-14 utilizes a thermal oxidizer operating at a minimum of 1,200º F with a minimum retention time of 0.57 seconds. 4. Permit C-406-2-6 utilizes a thermal oxidizer operating at a minimum of 1,200º F with a minimum retention time of 0.5 seconds.	The District permitted operations utilize thermal oxidizers and regenerative thermal oxidizers with higher operating temperatures and longer retention times.

2.5. Other Control Technology Conclusion

As presented above, several District permitted sources utilize thermal or regenerative oxidizers with higher operating temperatures and longer retention times, which may result in more stringent control of emissions. However, more research regarding the effects of higher oxidizer operating temperatures and longer residence times is necessary to determine if District permitted sources is more stringent than District Rule 4102.

Nevertheless, a longer retention time would require the redesign and resizing of the oxidizer combustion chamber, which may not be a retrofitable control method.

3. OVERALL ANALYSIS CONCLUSION

As presented above, other control technology/emission limits options such as operating an oxidizer at a minimum operating temperature of 1,400^{o} F with a minimum retention time of 1.0 second have been identified. A more refined analysis is required to determine whether District Rule 4104 has the most stringent control measures/emission limits in place and meet BARCT.

Attachment B

Common Odorants Emitted by Animal Matter Rendering Facilities and their Auto-Ignition Temperatures

Optimized Design and Operating Parameters for Minimizing Emissions During VOC Thermal Oxidation

by Edward Donley and David Lewandowski,
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The Clean Air Act (CAA) Amendments of 1990 are intended to reduce emissions of volatile organic compounds (VOCs) by 70 to 90%. They specifically designate 189 compounds as hazardous air pollutants (HAPs). The EPA estimates that the aerospace industry generates 208,000 tons per year of HAPs plus an additional 145,000 tons per year of VOCs. Maximum Achievable Control Technology (MACT) standards for regulating HAP emissions from the aerospace industry were proposed by the EPA. The most common HAPs found in the aerospace industry are glycol ethers, xylene, toluene, methyl ethyl ketone, trichloroethane, and methyl isobutyl ketone. Most HAP emissions come from clean-up solvents.

Thermal oxidation systems play, and will continue to play, a prominent role in meeting CAA-mandated VOC and HAP emission-reduction targets. According to a study conducted for the American Institute of Chemical Engineers in 1993, oxidation systems are projected to be the technology of choice in 43% of the applications requiring VOC reduction.[1] Thermal oxidation systems can be applied to 80% of the compounds classified as HAPs under the CAA.

On the one hand, thermal oxidation of VOCs is a very simple process. Organic compounds are burned to innocuous by-products. But on the other hand, proper design principles must be applied to ensure complete destruction of the organics while minimizing formation of undesirable by-products. Both design and operating parameters affect performance. This article discusses those principles used to maximize VOC destruction while minimizing the emissions of other pollutant species.

THERMAL OXIDATION FUNDAMENTALS

As its name implies, thermal oxidation oxidizes organic compounds to innocuous by-products. A generic representation of this process is shown below:

$$VOC + O_2 \rightarrow CO_2 + H_2O \quad (1)$$

Heat is evolved as these reactions occur; however, unless the quantity of VOCs present is very large, additional energy is required to raise the VOC to the temperature required for complete destruction. This is usually supplied by an auxiliary fuel such as natural gas.

Thermal oxidation is not the only process that can be used to treat VOCs; however, it offers several advantages when compared with competing processes. These are listed in Table I. The primary advantage is that the VOCs are destroyed rather than captured. Capturing the VOCs requires further treatment for their ultimate disposal.

OPERATING PARAMETERS

Thermal oxidation systems can achieve very high levels of VOC destruction when properly designed and operated. The parameters that define these conditions have been historically described by the three Ts of destruction: time, temperature, and turbulence. A fourth item must also be included, excess oxygen. VOC destruction efficiencies greater than 99.99% can be attained if these four parameters are in the proper ranges.

Temperature

No parameter has a greater impact on VOC destruction than the operating temperature of the thermal oxidizer. Generally, this temperature is held in the range of 1,400 to 2,200°F. The exception is total reduced sulfur (TRS) compounds. These can be effectively destroyed at temperatures as low as 1,200°F. Examples of TRS compounds are hydrogen sulfide, methyl mercaptan, and dimethyl sulfide.

At a given operating temperature, destruction efficiency varies with the specific compound treated. That is, a higher destruction efficiency will be achieved for some compounds in comparison to others at a specific temperature. One method of assessing the difficulty of destroying an organic compound is its Thermal Sability Ranking.[2] Although conditions for achieving a given degree of destruction are not identified specifically, it does provide a relative ranking of the degree of difficulty of destroying over 300 organic compounds.

Another generally accepted method of determining the temperature required for destruction of an organic compound is its Auto-Ignition Temperature (AIT). Compounds with higher auto-ignition temperatures are usually more difficult to destroy. AITs of common VOCs are shown on Table II.

Residence Time

Residence time does not have the same impact as temperature on VOC destruction; however, sufficient time must be allowed for the chemical kinetic reactions to occur. Generally, thermal oxidizer residence times range from 0.5 to 2.0 seconds. Lower residence times correspond to lower destruction efficiencies and vice versa. A 1.0-second residence time is generally applied when a destruction efficiency of 99.99% or higher is required; however, the Toxic Substances Control Act (TSCA), which regulates wastes containing polychlorinated biphenyls

Table I. Advantages of Thermal Oxidation

VOC destruction greater than 99.99%
Minimal number of process components
Ease of operation and control
Amenable to variations of waste flow and composition
Continuous process
No by-product disposal
Can be applied to more than 80% of CAA air toxics

CAA, Clean Air Act; VOC, volatile organic compound.

Table II. Auto-Ignition Temperatures of Common Organic Compounds

Compound	Auto-Ignition Temperature (°F)
869	Acetone
1,204	Ammonia
1,097	Benzene
840	Butadiene
693	Butanol
257	Carbon disulfide
1,128	Carbon monoxide
1,245	Chlorobenzene
1,185	Dichloromethane
403	Dimethyl sulfide
950	Ethane
907	Ethyl acetate
799	Ethanol
870	Ethylbenzene
965	Ethyl chloride
775	Ethylene dichloride
775	Ethylene glycol
1,076	Hydrogen
1,000	Hydrogen cyanide
500	Hydrogen sulfide
490	Kerosene
890	Maleic anhydride
999	Methane
878	Methanol
960	Methyl ethyl ketone
1,224	Methylene chloride
475	Mineral spirits
475	Petroleum naphtha
924	Nitrobenzene
1,084	Phthalic anhydride
874	Propane
940	Propylene
915	Styrene
932	Trichloroethane
997	Toluene
488	Turpentine
800	Vinyl Acetate
924	Xylene

(PCBs), requires a temperature of 2,192°F (1,200°C) with a 2-second gas residence time.

Turbulence

Complete mixing of oxygen and VOC molecules is required for the chemical oxidation reactions to occur. This is accomplished by ensuring a high degree of turbulence within the thermal oxidizer. Turbulence is generally defined by the gas Reynolds number. The Reynolds number is calculated as follows:

$$Re = DV\rho/\mu \qquad (2)$$

where D is the inside diameter of the oxidizer, V is the gas velocity, ρ is the gas density, and μ is the gas viscosity. To ensure complete turbulence, the Reynolds number should be greater than 10,000.

A simplification can be made by recognizing that some of the parameters in the Reynolds number equation are interrelated. For example, velocity is dependent upon oxidizer ID. Velocity, density, and viscosity are dependent on temperature. Furthermore, the composition of the products of combustion generally fall within a fairly narrow range. Thus, the density and viscosity vary within a very narrow range for a given temperature.

Not intuitively obvious is the requirement for higher velocities at higher temperatures. This occurs because the gas density decreases and viscosity increases at higher temperatures. As a rule of thumb, maintaining gas velocities above 25 ft/sec will ensure adequate turbulence under all conditions.

Table III. VOC Destruction Efficiency versus Time and Temperature

Destruction Efficiency (%)	Degrees Above Auto-Ignition Temperature (°F)	Residence Time (sec.)
95	300	0.5
98	400	0.5
99	475	0.75
99.9	550	1.0
99.99	650	2.0

VOC, volatile organic compound.

Oxygen Concentration

The concentration of oxygen molecules is another important component of thermal oxidation reactions. These are generally supplied by the addition of combustion air or, in the case of a VOC-contaminated air stream, may be present as part of the waste stream itself. To ensure that VOC molecules come in contact with oxygen molecules, excess oxygen is supplied to the system. Typically, this excess oxygen is established by maintaining an oxygen concentration in the products of combustion of at least 3.0%.

VOC Destruction Efficiency

VOC destruction rates are difficult to quantify from a purely theoretical standpoint. A statistical model has been proposed from laboratory studies.[3] This model relates design and operating parameters with VOC characteristics; however, this model was developed under plug flow conditions, which do not exist in real systems. It only applies to destruction efficiencies of 99% or greater. Waste gas stream characteristics can vary over a wide range. Selection of thermal oxidizer operating parameters to achieve optimum VOC destruction is best left to companies that have accumulated years of operating data at a variety of conditions; however, with this caveat, Table III provides guidelines for VOC destruction efficiency as a function of temperature and residence time. This table assumes that at least 3.0% oxygen concentration is present in the products of combustion, and that sufficient turbulence, as defined above, is present.

Halogenated Compounds

Thermal oxidation of compounds containing halogens requires special considerations. In general, these compounds are among the most difficult to destroy. Examples are chlorinated solvents (e.g., methylene chloride, chlorobenzene, dichloromethane, trichloroethane). This difficulty in destruction is reflected in their high AITs.

There are additional considerations when destroying halogenated compounds. One is acid gas emissions. For example, with chlorinated compounds, the chlorine atoms in the original VOC are converted to a mixture of primarily hydrogen chloride gas (HCl) plus a small amount of chlorine gas (Cl_2).

Environmental regulations limit chlorine (HCl or Cl_2) emissions to the atmosphere. These compounds can be removed with an acid gas scrubber downstream of the thermal oxidizer; however, hydrogen chloride can be removed simply by scrubbing with water while chlorine gas requires a caustic agent such as caustic soda (sodium hydroxide). By operating the thermal oxidizer at a higher temperature, the proportion of chlorine gas generated versus hydrogen chloride decreases. An example is shown on Table IV. By operating at a high temperature, the cost and complexity of caustic scrubbing may be avoided.

Another consideration with halogenated compounds is acid gas dewpoint. For example, HCl formed can combine with water vapor in the products of

Table IV. Chlorine Equilibrium Concentration versus Temperature

Oxidation Temperature (°F)	HCl (ppmv)	Cl_2 (ppmv)
1,600	3,850	12.0
1,800	3,843	5.7
2,000	3,828	3.0
2,200	3,810	1.7

Example: 4 scfm of methyl chloride in a 1,000 scfm air stream.

combustion, condense on a cold oxidizer inner metal shell, and initiate corrosion. This can be prevented by operating with a relatively hot shell (>300°F). At this temperature, condensation cannot occur. The hot shell temperature is achieved by selecting a less insulating inner refractory material, reducing the amount of refractory, or externally insulating the thermal oxidizer outer shell. These same considerations should be applied to ducting, boiler economizer tubes, and stacks if associated with a thermal oxidizer system destroying halogenated compounds. Hot surfaces should be shielded for personnel protection.

BY-PRODUCT EMISSIONS

Carbon Monoxide

All combustion processes have the potential to produce undesirable by-products. Carbon monoxide (CO) is one of these; however, its formation can be minimized through selection of proper operating conditions. CO emissions are a very strong function of temperature and a weaker function of excess oxygen.

With waste gases that do not already contain CO, CO emissions will be less than 0.02 lb/MM BTU of heat release if operating temperatures are greater than 1,600°F. The CO emissions increase exponentially below 1,600°F and can be as high as 0.10 Lb/MM BTU of heat release at 1,400°F.

Many times, CO is a constituent of waste gases. It has a relatively high AIT (1,128°F) and, as such, is more difficult to destroy than most VOCs. A plot of temperature versus destruction efficiency for CO is shown on Figure 1 assuming at least 3.0% oxygen in the combustion products. The dramatic affect of operating temperature is evident.

Nitrogen Oxides

Nitrogen oxides (NO_x) are one of six chemical species classified as a criteria pollutant under the National Ambient Air Quality Standards (NAAQS). NO_x in combination with VOCs present in the atmosphere can combine in the presence of sunlight to form ozone. Ozone has been found to be damaging to human health in concentrations as low as 0.1 ppmv.

NO_x are formed to some extent in all combustion processes. They exist in two different chemical forms: nitric oxide (NO) and nitrogen dioxide (NO_2). At normal thermal oxidation temperatures, the nitric oxide form prevails; however, when combustion offgases containing NO enter the atmosphere, the NO is converted to NO_2 as the gas cools.

NO_x are formed from one of three sources in a combustion process: thermal NO_x, fuel bound NO_x, and prompt NO_x. Most NO_x emissions from combustion processes are generated from thermal fixation of nitrogen in the combustion air. The generally accepted mechanism of thermal NO_x formation is described by the Zeldovich equilibrium reactions shown below.

$$N_2 + O^* = NO + N^* \quad (3)$$

$$O_2 + N^* = NO + O^* \quad (4)$$

The N^* and O^* are produced by the thermal dissociation of N_2 and O_2 at elevated temperatures. Reducing the peak flame temperature is a well established method of reducing the NO_x generation rate.

Fuel or chemically bound NO_x is generated from nitrogen compounds present in the waste gas or auxiliary fuel. Generally, gaseous fuels, such as natural gas or propane, are free of nitrogen compounds; however, a significant amount of fuel-bound NO_x can be generated from liquid fuels such as fuel oils, which can contain as much as 1% of nitrogen by weight. Nitrogen-containing constituents of the waste gas also produce fuel-bound NO_x. Forty-two of the 189 compounds listed as HAPs under Title III of the CAA amendments contain nitrogen.

Fuel or waste nitrogen compounds are only partially converted to the equivalent amount of NO_x. The rate of conversion is much less than 1:1 in most cases. The exact conversion rate is a complex function of stoichiometry, temperature, and the specific nitrogen compound oxi-

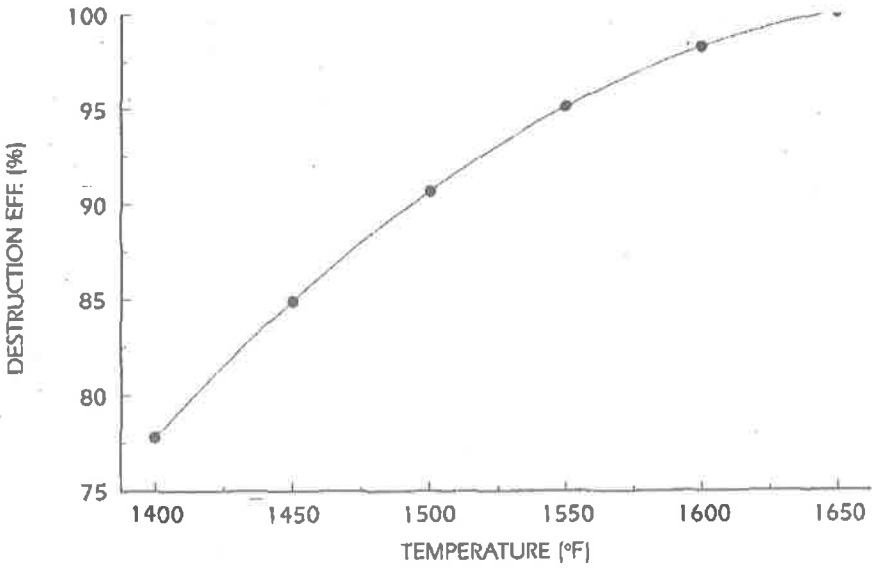

Figure 1. Carbon monoxide destruction versus temperature.

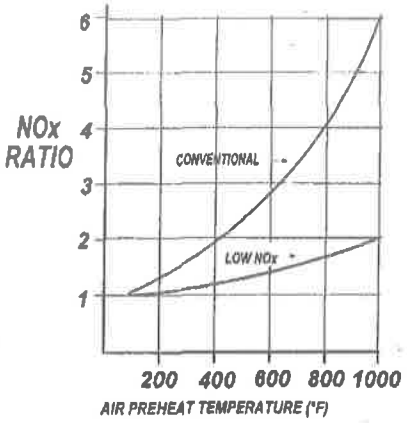

Figure 2. Effect of air preheat on No_x conventional versus low NO_x burner (at 3% oxygen and 100°F).

dized; however, for most compounds and conditions, the conversion rate is in the range of 20 to 70%.

A lesser known type of NO_x formation is termed "prompt NO_x." Here, hydrocarbon radicals (CH, CH_2, etc.) formed from fuel fragmentation react with nitrogen in the combustion air to form a hydrogen cyanide (HCN) intermediate. The HCN then reacts with oxygen and nitrogen in the combustion air to form nitrogen oxides as shown below.

$$CH^* + N_2 = HCN + N^* \quad (5)$$

$$HCN + OH^* = CN^* + H_2O \quad (6)$$

$$CN^* + O_2 = NO + CO \quad (7)$$

The formation of prompt NO_x is proportional to the number of carbon atoms present in the fuel and has a weak temperature dependence and a short lifetime. Prompt NO_x is only significant in fuel-rich flames that inherently produce low NO_x levels. Thus, prompt NO_x is usually a minor contributor to overall NO_x emissions.

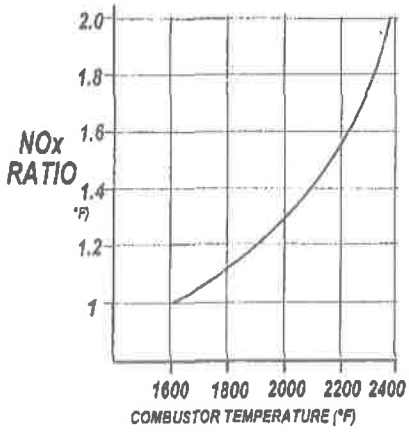

Figure 3. Effect of combustor treatment on No_x (at 3% oxygen and 1,600°F).

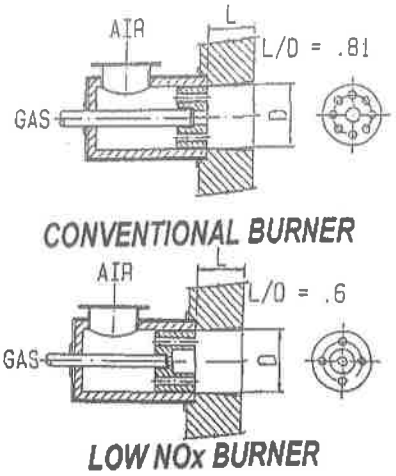

Figure 5. Conventional versus low NO_x burner.

Thermal oxidizer operating parameters can also effect the NO_x generation rate. In many applications, the combustion air is preheated through heat exchange with the oxidizer products of combustion. This increases the thermal efficiency of the process and lowers the auxiliary fuel requirements; however, it also produces a higher flame temperature and consequently higher NO_x emissions. The effect of combustion air preheat temperature on NO_x emissions is shown in Figure 2 for both conventional and low NO_x burners. Even with low NO_x burners, preheating the combustion air to 1,000°F doubles with NO_x generation rate. The effect is much more dramatic with conventional burners.

The oxidizer operating temperature also effects NO_x generation. This is quantified in Figure 3. Increasing the temperature from 1,600°F to 2,400°F doubles the NO_x generation rate.

The oxygen concentration in the flame envelope also affects NO_x generation. At lower oxygen levels, increasing the oxygen concentration increases NO_x; however, a point is reached at which the sensible heat load of increased excess air more than offsets the effect of oxygen concentration due to the reduction in peak flame temperature. The corresponding oxygen concentration for peak NO_x generation varies with burner type and operating conditions. Figure 4 shows a generic curve for ambient combustion air.[4]

Combustion Control Techniques

There are many methods to reduce NO_x generation in VOC thermal oxidation systems. The most economical method of NO_x control is the use of low NO_x burners. Recirculation of products of combustion back into the flame envelope is a well-established method of NO_x reduction.

A low NO_x burner design is compared with a conventional burner design in Figure 5. In the low NO_x burner, a baffle arrangement using only four holes provides a space between the air holes to allow for recirculation of products of combustion back to the primary combustion zone. There is also an additional recirculation zone in the center of the burner at the point of gas injection.

Another method of NO_x reduction is air staging. It is usually applied to fuels or wastes containing nitrogen. With this method, the combustion air is split into two streams. The first is mixed with the fuel or high BTU waste in

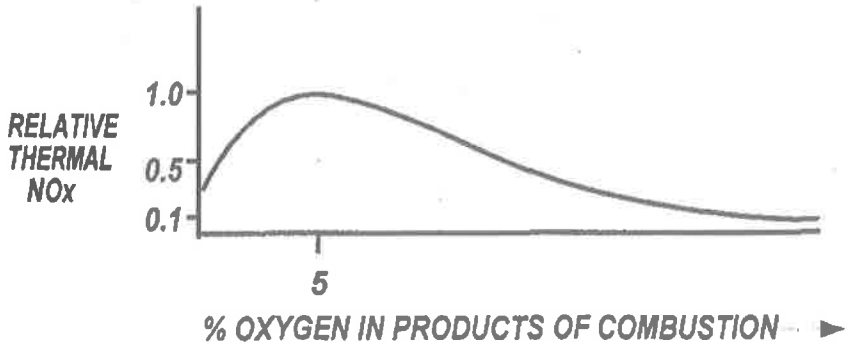

Figure 4. Generic curve for ambient combustion air.

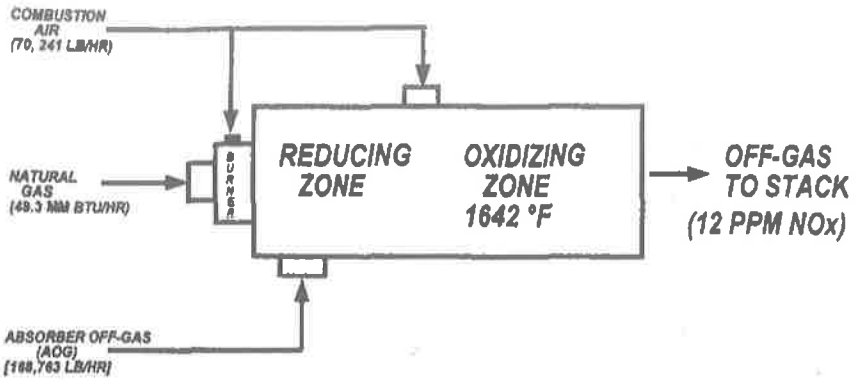

Figure 6. Schematic of an air-staged thermal oxidation system.

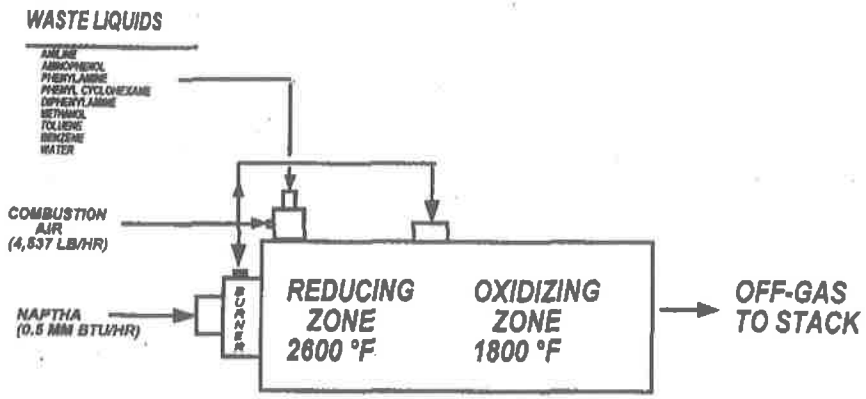

Figure 7. Schematic of staged-air combustion system with wastes having chemically bound nitrogen.

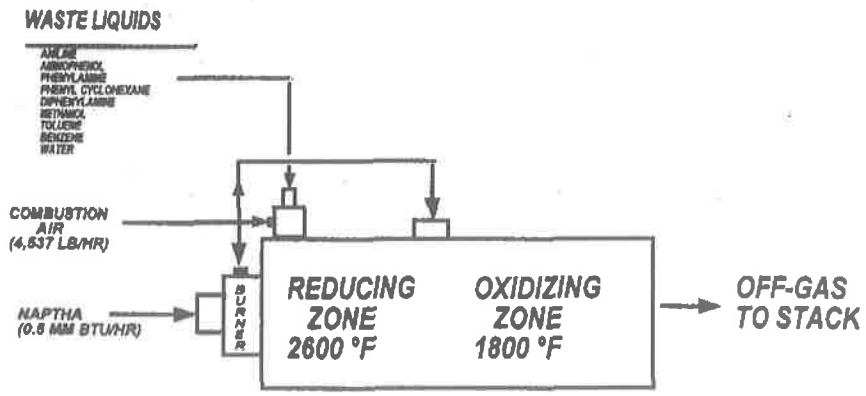

Figure 8. Schematic of fuel-stage thermal oxidation system.

substoichiometric quantities to produce a reducing environment. The second is injected downstream to complete combustion.

Air staging can also be applied to the overall thermal oxidizer design. This is typically done with wastes containing large quantities of nitrogen compounds. Operating under reducing conditions for a residence time of 0.5 to 1.0 second converts most of the nitrogen to molecular nitrogen rather than NO_x. To achieve a high level of NO_x reduction, the reducing zone stoichiometry must be controlled in a range of 0.5 to 0.8. The resulting temperature falls in the range of 1,500 to 2,800°F. Fuel-bound NO_x reductions as high as 99% can be achieved using this technique.

A schematic of an actual air-staged thermal oxidation system is shown on Figure 6 for a waste gas without nitrogen bearing compounds. Here, the air and waste gas (Absorber Off-Gas) streams are split such that the upstream zone of the thermal oxidizer is operating substoichiometric or reducing. By combusting the waste gas and auxiliary fuel in an oxygen-deficient atmosphere, thermal NO_x formation is minimized due to the absence of oxygen. The remaining air is then injected downstream to complete combustion of the carbon monoxide and hydrogen produced in the reducing zone. The total heat release of this system is 100 MM BTU/hr. NO_x emissions were 7 and 12 ppmv (at 3% oxygen) for 1,550 and 1,650°F operating temperatures, respectively.

In this case, the organic constituents of the waste gas were propane, propylene, acrylic acid, acetic acid, formaldehyde, and acrolein. The VOC destruction efficiency was 99.91% at 1,550°F and 99.997% at 1,650°F. For this case, CO was also a major constituent of the waste gas at concentrations near 1.0%. CO destruction efficiencies were 92.4% at 1,550°F and 99.96% at 1,650°F.

Another staged-air system is shown on Figure 7. In this case, the wastes consist of compounds with chemically bound nitrogen. These compounds produce extremely high levels of NO_x if oxidized using a single-stage design; however, by staging the air entry, a high-temperature-reducing zone occurs upstream of the oxidizing zone. Due to the absence of excess oxygen in the reducing zone, nitrogen compounds are converted primarily to molecular nitrogen gas rather than NO_x. Also, CO and hydrogen produced under reducing conditions react with the small amount of NO_x that is formed and convert it back to molecular nitrogen. Again, second-stage air is injected into the oxidizing zone to combust CO and hydrogen produced in the reducing zone. Based on measured NO_x emissions, only about 2% (by weight) of the chemically bound nitrogen was converted to NO_x.

Fuel staging can also be used to minimize NO_x formation. In contrast to air staging, the fuel is split into two streams. A portion of the fuel is mixed

with all of the combustion air in the primary combustion zone. Because of the high level of excess air, the peak flame temperature is lowered, resulting in correspondingly lower NO_x generation. Secondary fuel is then injected downstream. A schematic of a fuel staged thermal oxidation system is shown on Figure 8. In this case, a low-BTU waste gas serves as the secondary fuel.

CONCLUSIONS

By judicious selection of operating parameters, thermal oxidation systems can provide VOC destruction levels to meet all current and future environmental emission limits. In comparison to competing technologies, thermal oxidation destroys rather than captures VOCs. Thus, no additional treatment is necessary.

As with any combustion process, small amounts of undesirable by-products can be produced if thermal oxidation systems are not operated correctly. These are primarily oxides of nitrogen and CO; however, by applying proper design and operating principles, the production of these pollutant species can be minimized.

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1. "VOC Control: Current Practices and Future Trends," *Chemical Engineering Progress*, July 1993
2. Dellinger, B. et al., "Development of Thermal Stability Ranking of Hazardous Organic Compound Incinerability," *Environmental Science and Technology*, vol. 24; 1990
3. Lee, K.C. et al., "Revised Model for the Prediction of the Time-Temperature Requirements for Thermal Destruction of Dilute Organic Vapors and Its Usage for Predicting Compound Destructibility," *Proceedings of the 75th Annual Meeting of the Air Pollution Control Association*, New Orleans, June 20–25, 1982
4. Nutcher, P.B. and D.A. Lewandowski, "Maximum Achievable Control Technology for NO_x Emissions from VOC Thermal Oxidation," *Proceedings of the 87th Annual Meeting of the Air and Waste Management Association*, Cincinnati, June 19–24, 1994 **MF**

Attachment C

Emission Rate Calculations for Thermal Oxidizer Cost Analysis

Emission Rate Calculations for Thermal Oxidizer Cost Analysis

Foster Foods Livingston Plant includes a meat meal rendering line (Permit N-1252-30-5, See Appendix D) that is served by a thermal oxidizer with a 1400° combustion chamber temperature and 1.0 seconds of retention time. The unit is permitted at a throughput of 20,000 tons of meat meal/year, with a VOC emission factor of 0.05 lb-VOC/ton of meat meal processed. Thus, the controlled emission rate at the thermal oxidizer outlet is:

$VOC_{Controlled, 99\%}$ = 20,000 tons/year x 0.05 lb-VOC/ton = 1,000 lb-VOC/year

A thermal oxidizer meeting the 1.0 second retention time specification is assumed to control 99% of VOC emissions. Using this control efficiency, the uncontrolled VOC emission rate would be:

$VOC_{Uncontrolled}$ = 1,000 lb-VOC/year ÷ (1-0.99) = 100,000 lb-VOC/year

A thermal oxidizer meeting a 0.3 seconds retention time is assumed to achieve 98% control of VOC emissions. Thus, the controlled rate for the oxidizer would be:

$VOC_{Controlled, 98\%}$ = 100,000 lb-VOC/year x (1-0.98) = 2,000 lb-VOC/year

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Attachment D

Permit to Operate N-1252-30-5

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-1252-30-5 **EXPIRATION DATE:** 09/30/2023

EQUIPMENT DESCRIPTION:
MEAT MEAL PROCESSING PLANT #2 CONSISTING OF ONE RAW MATERIAL RECEIVING HOPPER, ONE FAT TANK, ONE FAT CENTRIFUGE, ONE SWECO SEPARATOR, ONE DUPPS 200-U STEAM COOKER, ONE 18" CONTINUOUS PERCOLATOR, TWO DUPPS 10" PRESSES, ONE MIGHTY SAMSON 660-16 HAMMERMILL, ONE ROTEX SHAKER, SERVED BY A SHELL AND TUBE HEAT RECOVERY CONDENSER, ACC-250 AIR-COOLED CONDENSER, A VENTURI SCRUBBER WITH MIST ELIMINATOR, A PACKED BED WATER SCRUBBER, AND A 2.0 MMBTU/HR REGENERATIVE THERMAL OXIDIZER, IN SERIES. ROOM AIR WILL BE SERVED BY A 50,000 CFM PACKED BED ROOM AIR SCRUBBER

PERMIT UNIT REQUIREMENTS

1. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
2. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201]
3. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
4. Vapors from the fat tank, SWECO separator, percolator, fat centrifuge, and the two crax presses shall be captured and vented to the venturi scrubber and regenerative thermal oxidizer, in series. [District Rule 2201]
5. Vapors from the Dupps steam cooker shall be capture and vented to the air-cooled condenser, the venturi scrubber, and the regenerative thermal oxidizer, in series. [District Rule 2201 and 4104]
6. In the event the regenerative thermal oxidizer shuts down during raw material processing, all meat cooker emissions shall be routed from the venturi scrubber to the 50,000 CFM packed bed room air scrubber. The thermal oxidizer shall be restarted as soon as practical and upon reaching operating temperature the contaminated air stream shall be immediately re-routed to the regenerative thermal oxidizer. [District Rule 2201]
7. The exhaust stacks shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]
8. The regenerative thermal oxidizer shall be operated with a combustion chamber temperature of no less than 1400 degrees F and the retention time shall be no less than one second. A continuous temperature monitoring and recording device shall be used and kept in good working order. [District Rules 2201 and 4104]
9. The regenerative thermal oxidizer shall be heated to proper operating temperature prior to any contaminated process air entering the oxidizer. [District Rules 2201 and 4104]
10. The quantity of meat meal produced shall not exceed 85 tons of finished product during any one day. [District Rule 2201]
11. The quantity of meat meal produced shall not exceed 20,000 tons of finished product during any 12-month rolling period. [District Rule 2201]
12. The heat input for the thermal oxidizer shall not exceed 6,210 MMBtu during any 12-month rolling period. [District Rule 2201]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

13. Emissions from the thermal oxidizer shall not exceed any of the following limits: 0.1 lb-NOx/MMBtu, 0.2 lb-SOx/ton of finished product, 0.295 lb-PM10/ton of finished product, 0.50 lb-CO/MMBtu, or 0.05 lb-VOC/ton of finished product. [District Rule 2201]
14. Emissions from the room-air scrubber shall not exceed any of the following: 2.6 ppmvd VOC (as methane), 0.281 lb-PM10/ton of finished meat meal produced, or 0.166 lb-hydrogen sulfide per ton of finished meat meal produced. [District Rule 2201]
15. Source testing to measure the PM10, VOC, and SOx emissions from the regenerative thermal oxidizer exhaust shall be conducted at least once every 12 months. [District Rule 2201]
16. Source testing to measure the PM10, VOC, and H2S emissions from the room air scrubber exhaust shall be conducted at least once every 12 months. [District Rule 2201]
17. Source testing shall be performed while processing raw material under full load conditions or another load previously approved by the District in writing. [District Rules 1081 and 2201]
18. Source testing to measure the VOC emissions shall be conducted using EPA Methods 18, 25, 25A, or 25B or CARB Method 100. [District Rule 2201]
19. Source testing to measure PM10 emissions shall be conducted using EPA Methods 201 and 202, EPA Methods 201A and 202, or CARB Methods 501 and 5. [District Rule 2201]
20. Source testing to measure SOx emissions shall be conducted using EPA Method 6C, EPA Method 8, ARB Method 100, or SCAQMD Method 307.91. [District Rule 2201]
21. Source testing to measure H2S emissions shall be conducted using CARB Method 15 or 16A, EPA Method 11, or SCAQMD Method 307.91. [District Rule 2201]
22. Stack gas oxygen (O2) shall be determined using EPA Method 3 or 3A or ARB Method 100. [District Rule 2201]
23. Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]
24. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081]
25. When using chlorine dioxide, the concentration of chlorine dioxide in the packed-bed odor scrubber shall be continuously monitored using an oxidation-reduction potential controller. The concentration shall be measured as free chlorine using the HACH DPD method. The reading shall be in millivolts, and the range shall be 450 millivolts to 550 millivolts. The oxidation reduction potential controller shall be maintained in proper operating condition at all times. [District Rule 2201]
26. When using chlorine dioxide, if the ORP of the scrubber's liquor solution used in any of the scrubbers falls outside the prescribed range as specified in this permit, the permittee shall immediately correct the ORP of the scrubber liquor solution to comply with the acceptable range. If the ORP of the liquor solution continues to be outside the acceptable range for more than 10 consecutive minutes, the permittee shall notify the District within the following 1 hour. [District Rule 2201]
27. When using ReNew Technologies liquor solution, the pH of the solution in the packed bed odor scrubber shall be equal to or greater than 6.0, and less than or equal to 9.0. The ion selective electrode (ISE) reading shall be less than 250 ppm. If the pH or ISE measurement is found to be outside the allowable ranges, permittee shall take additional instrument verification measurements using pH strips or a portable ISE monitor or take actions necessary to bring the scrubber liquor within the allowable ranges within 2 hours. [District Rule 2201]
28. The processing facility shall be kept under negative pressure at all times when in operation. [District Rule 2201 and 4102]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

29. Permittee shall take monthly readings with a portable anemometer to verify that the main processing building is under negative pressure during periods of plant operation. The anemometer shall be calibrated per the manufacturer's recommendations. Additionally, the anemometer shall be made available to District inspection staff upon request. Records of anemometer measurements and calibrations shall be kept, maintained, and made readily available for District inspection upon request. [District Rules 2201 and 4102]
30. Permittee shall keep a daily record of the quantity of meat meal produced, in tons of finished product. [District Rule 2201]
31. Permittee shall keep a record of the rolling 12-month quantity of meat meal produced, in tons of finished product. This record shall be updated on at least a monthly basis. [District Rule 2201]
32. Permittee shall keep a record of the rolling 12-month heat input for the thermal oxidizer, in MMBtu. This record shall be updated on at least a monthly basis. [District Rule 2201]
33. Permittee shall keep records of the following: (1) measurements of the thermal oxidizer combustion chamber temperature, (2) the hourly ORP monitor readings for the packed-bed odor scrubber when using chlorine dioxide scrubber liquor, and (3) hourly pH and ISE measurements when utilizing the Renew-A/ReNew-B scrubber liquor. [District Rule 2201]
34. All records shall be maintained and retained on-site for a period of at least five years and shall be made available for District inspection upon request. [District Rules 1070 and 2201]
35. Except during periods of equipment breakdown as determined by the District under Rule 1100, all material shall be processed within 24 hours of receipt. Each delivery of material shall be monitored to ensure that processing is performed within this time limit. [District Rules 1100, 2201, and 4102]

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 12/26/2019

District Rule 4409

Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities

Applicability and Purpose:

District Rule 4409 applies to the following source categories:

Components containing or contacting VOC streams at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.

The purpose of this rule is to limit VOC emissions from components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities. The rule further defines a component (which includes, but is not limited to) as "any valve, fitting, threaded connection, pump, compressor, pressure relief device, pipe, polished rod."

Benchmarks Evaluated:

- BAAQMD Regulation 8 Rule 18 – Equipment Leaks (12/16/15)
- SCAQMD Rule 1173 – Control Of Volatile Organic Compound Leaks and Releases From Components at Petroleum Facilities And Chemical Plants (2/6/09)
- VCAPCD Rule 74.10 – Components at Crude Oil and Natural Gas Production and Processing Facilities (3/10/98)
- CARB Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities
- 40 CFR Part 60 Subpart OOOOa
- EPA 2016 Control Technologies Guidelines (CTG) for the Oil and Natural Gas Industry (EPA-453/B-16-001)
- District Permit Requirements

Summary:

The District's preliminary BARCT analysis in 2018 identified potential control options that may be more stringent than current rule requirements:

- Other air districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. As part of this analysis, state and federal regulations were also reviewed. The analysis concluded that some LDAR regulations appeared to have more stringent requirements applicable to certain categories covered by Rule 4409.

Conclusion:

While District Rule 4409 has required the implementation of stringent LDAR programs that have resulted in significant reductions in VOC emissions, the District will begin a rule making process in 2020 to explore opportunities to enhance the stringency of the rule and ensure the continued implementation of BARCT by determining the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts of the source categories subject to Rule 4409. This effort is supported by the District's attached 2019 BARCT Rule Analysis.

2019 BARCT Rule Analysis

Rule 4409
Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities

Engineer: **Dustin Brown, Sr. AQE**
Reviewed By: **Errol Villegas, Permit Services Manager**
Date: **December 26, 2019**

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4409 – Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities determined that there may be potentially more stringent requirements in similar rules from other districts than the requirements from District's Rule 4409. This document performs a refined and more

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

in-depth analysis to determine if the existing SJVAPCD Rule 4409 satisfies BARCT requirements or if amendments to the rule may be necessary to ensure BARCT requirements are met.

DISCUSSION

District Rule 4409 applies to the following source categories:

> *Components containing or contacting VOC streams at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.*

The purpose of this rule is to limit VOC emissions from components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities. The rule further defines a component (which includes, but is not limited to) as "any valve, fitting, threaded connection, pump, compressor, pressure relief device, pipe, polished rod."

FURTHER BARCT ANALYSIS

In the 2018 preliminary analyses of District Rule 4409, it was determined that there were other district rules and various federal and state requirements that may have leak detection and repair thresholds that are more stringent than current rule requirements.

1. RULE SURVEY

1.1. District Rule(s)

SJVAPCD Rule 4409 (4/20/05)

	SJVAPCD
Applicability	Leaking components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.
Requirements	Leak detection and repair program required for controlling leaks with specific thresholds, repair timetables, number of allowable leaks for compliance, administrative recordkeeping. Leak repair threshold for valves/connections/flanges/pipes/pumps/compressors/polished rod stuffing boxes/others: - 1,000 ppmv liquid service - 2,000 ppmv gas service Leak repair threshold for pressure relief devices: - 200 ppmv liquid service - 400 ppmv gas service

1.2. Bay Area AQMD Rule(s)

BAAQMD Regulation 8 Rule 18 (Equipment Leaks) (12/16/15)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Leaking components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.	Equipment leaks at petroleum refineries, chemical plants, bulk plants and bulk terminals including, but not limited to: valves, connectors, pumps, compressors, pressure relief devices, diaphragms, hatches, sight-glasses, fittings, sampling ports, meters, pipes, and vessels.	BAAQMD Reg 8 Rule 18 applies to source categories different from those covered by Rule 4409. District Rules 4455 (refineries/chemical plants), Rule 4623 (organic liquid storage), and Rule 4624 (Transfer of Organic Liquid) apply to the same source categories as BAAQMD Reg 8 Rule 18. As such, the requirements of Rule 4409 are not directly comparable to BAAQMD Reg 8, Rule 18 for specific categories of sources.

The Bay Area AQMD Regulation 8 Rule 18 for equipment leaks does not contain requirements for the source categories subject to Rule 4409.

1.3. South Coast AQMD Rule(s)

SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants) (2/6/09)

	SJVAPCD	SCAQMD	Conclusion
Applicability	Leaking components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.	This rule applies to components at refineries, chemical plants, lubricating oil and grease re-refiners, marine terminals, oil and gas production fields, natural gas processing plants, and pipeline transfer stations.	In addition to the source categories subject to Rule 4409, SCAQMD Rule 1173 also applies to source categories different from those covered by Rule 4409. District Rules 4455 (refineries/chemical plants), Rule 4623 (organic liquid storage), and Rule 4624 (transfer of organic liquid) apply to the additional

			source categories subject to SCAQMD Rule 1173.
Requirements	Minor leak repair threshold for valves/connections/ flanges /pipes/pumps/ compressors /polished rod stuffing boxes /others: - 1,000 ppmv liquid service - 2,000 ppmv gas service Minor leak repair threshold for pressure relief devices: - 200 ppmv liquid service - 400 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - 1,000/2,000 -10,000 ppmv, 7 days - 10,000 -50,000 ppmv, 3 days - >50,000 ppmv, 2 days - Liquid, 2 days - PRD, 400 – 10,000 ppmv, 7 days For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	Valves/connections/flanges/pipes/ pumps/compressors/polished rod stuffing boxes/others: - 500 ppmv vapor, gas, light liquid - 100 ppmv heavy liquid Leak repair time: - 100 – 500 ppmv vapor, gas, light liquid – 7 days - 100 -500 ppmv heavy liquid – 7 days - Any leak 10,000 – 25,000 ppmv - 2 days - Pressure relief device 200 – 25,000 ppmv - 2 days - Any leak > 25,000 ppmv - 1 day - Heavy liquid > 500 ppmv -1 day - Light liquid >3 drops/min - 1 day Replace excessively leaking components (5 repair actions) or parts for LL > 3 drops/min, any > 10,000 ppmv, PRD > 200 ppmv with BACT or BARCT or vent it to an air pollution control device approved by the Executive Officer	SCAQMD has more stringent leak repair thresholds and repair times than District Rule 4409 Additionally, the SCAQMD rule has LDAR requirements for heavy liquids. Rule 4409 provides an exemption for components in heavy liquid service. Both rules require retrofit requirement for excessively leaking components

1.4. Sacramento Metropolitan AQMD Rule(s)

The Sacramento Metropolitan AQMD does not have any rules for equipment leaks.

1.5. Ventura County APCD Rule(s)

VCAPCD Rule 74.10 (Components at Crude Oil and Natural Gas Production and Processing Facilities) (3/10/98)

	SJVAPCD	VCAPCD	Conclusion
Applicability	Leaking components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.	Crude oil and gas production facilities, pipeline transfer stations, and natural gas processing facilities.	VCAPCD rule applies to similar source categories as Rule 4409.
Requirements	Minor leak repair threshold for valves/connections/ flanges /pipes/pumps/ compressors /polished rod stuffing boxes /others: - 1,000 ppmv liquid service - 2,000 ppmv gas service Minor leak repair threshold for pressure relief devices: - 200 ppmv liquid service - 400 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - 1,000/2,000 -10,000 ppmv, 7 days - 10,000 -50,000 ppmv, 3 days - >50,000 ppmv, 2 days - Liquid, 2 days - PRD, 400 – 10,000 ppmv, 7 days For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	Leak threshold: 1,000 ppmv Minor liquid leak – 3 drops/min Major liquid leak – continuous flow Leak Repair Time: - Gas leak 1,000 -10,000 ppmv - 14 days - Gas leak 10,000 -50,000 ppmv- 5 days - Gas leak > 50,000 ppmv – 1 day - Minor Liquid leak - 2 days - Major Liquid leak - 1 day If leaks are excessive, replace compressor seal, pump seal, or pressure relief device or retrofit the leaking component with Best Available Control Technology (BACT) equipment, for major gas leak or minor liquid leak from critical equipment replace or retrofit with BACT <10% VOC exemption	VCAPCD has more stringent leak repair thresholds for one category and less stringent or equivalent thresholds for the other categories specified in Rule 4409. Leak repair time periods are generally less stringent. Both rules have retrofit requirements for excessively leaking components and have < 10% VOC exemption

1.6. Rule Survey Conclusion

As presented above, SCAQMD Rule 1173 generally has more stringent leak repair thresholds and repair times than District Rule 4409.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

There are gas processing plants (which are subject to Rule 4409) in the District that have a leak repair threshold of 100 ppmv for valves, flanges, etc. and 500 ppmv for pump and compressor seals due to BACT requirements. Further, there are refineries (not subject to Rule 4409, but are subject to Rule 4455) that have similar leak repair thresholds due to BACT requirements.

This level of control is being readily complied with at gas processing plants. However, there are no oil/gas production facilities that are subject to these low leak repair thresholds.

2.2. State Regulations – ATCMs and other rules

There is no ATCM that applies to the same equipment as Rule 4409.

On March 23, 2017, CARB adopted a new rule to reduce greenhouse gas emissions from oil and gas operations (Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities). While the rule targets methane emissions reductions, it has a collateral benefit of reducing VOC emissions from leaking components as well.

The CARB rule imposes equipment standards on several different types of equipment and imposes leak detection and repair requirements on all equipment used in the subject industry types. The leak detection and repair requirements began on January 1, 2018. The leak repair thresholds are lower effective January 1, 2020.

Below is a comparison of Rule 4409 requirements to the January 1, 2020 leak detection and repair requirements of the CARB rule.

	SJVAPCD	CARB rule	Conclusion
Applicability	Components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.	Onshore and offshore crude oil or natural gas production, Crude oil, condensate, and produced water separation and storage,	The CARB rule applies to oil and gas production and handling facilities, similar to Rule 4409. The CARB rule also applies to facilities handling natural gas

		Natural gas underground storage, Natural gas gathering and boosting stations, Natural gas processing plants; and, Natural gas transmission compressor stations.	(which is primarily methane and not a VOC) that are not subject to Rule 4409.
Requirements	Minor leak repair threshold for valves/connections/ flanges /pipes/pumps/ compressors /polished rod stuffing boxes /others: - 1,000 ppmv liquid service - 2,000 ppmv gas service Minor leak repair threshold for pressure relief devices: - 200 ppmv liquid service - 400 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - 2000 -10,000 ppmv, 7 days - 10,000 -50,000 ppmv, 3 days - >50,000 ppmv, 2 days - Liquid, 2 days - PRD, 400 – 10,000 ppmv, 7 days For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	Leak repair threshold: - 1,000 ppmv Leak repair time: - 1,000 – 9,999 ppmv, 14 days - 10,000 – 49,000 ppmv, 5 days - >50,000 ppmv, 2 days For components that have had 5 repair actions with 12 months must be replaced.	The CARB rule has more stringent leak repair thresholds for one category and less stringent or equivalent thresholds for the other categories specified in Rule 4409. The leak repair times in the CARB rule are generally less stringent than Rule 4409.

2.3. Federal Regulations – CFR and Control Technique Guidance document

NSPS Subpart OOOOa

40 CFR Subpart OOOOa Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced after September 18, 2015 imposes equipment standards on several different types of new/modified/reconstructed equipment and imposes leak detection and repair requirements such equipment. It is important to note that NSPS subpart OOOOa is not a retrofit requirement for existing, unmodified equipment.

The Subpart OOOOa includes design standards for some component types, e.g. pumps and compressors, and leak detection and repair requirements. The following table only compares the leak detection and repair requirements of Rule 4409 with those contained in NSPS Subpart OOOOa.

Below is a comparison of Rule 4409 requirements to the leak detection and repair requirements Subpart OOOOa.

	SJVAPCD	NSPS Subpart OOOOa LDAR requirements	Conclusion
Applicability	Components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.	Components at well sites and compressor stations	NSPS Subpart OOOOa applies only to new and modified equipment at oil/gas facilities, where Rule 4409 applies to existing and new equipment at oil/gas facilities. As such, Rule 4409 applicability is broader than NSPS Subpart OOOOa.
Requirements	Minor leak repair threshold for valves/connections/ flanges /pipes/pumps/ compressors /polished rod stuffing boxes /others: - 1,000 ppmv liquid service - 2,000 ppmv gas service Minor leak repair threshold for pressure relief devices: - 200 ppmv liquid service - 400 ppmv gas service Major leak threshold for all:	Leak repair thresholds Well/compressor sites: - 500 ppmv Gas processing plants: Pumps in light liquid service: - 2,000 ppmv Compressors: - 500 ppmv Pressure relief devices:	In general, the leak repair thresholds in NSPS Subpart OOOOa are more stringent than in Rule 4409 for new and modified equipment, only.

	10,000 ppmv Leak repair time: - 2000 -10,000 ppmv, 7 days - 10,000 -50,000 ppmv, 3 days - >50,000 ppmv, 2 days - Liquid, 2 days - PRD, 400 – 10,000 ppmv, 7 days For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	- 500 ppmv Valves: - 500 ppmv Pumps in heavy liquid service: - 10,000 ppmv	

EPA 2016 Control Technologies Guidelines (CTG) for the Oil and Natural Gas Industry (EPA-453/B-16-001)

In 2016 EPA adopted a CTG addressing fugitive emissions in the oil and gas industry. It is important to note though that in March 2018 EPA proposed to withdraw this CTG, but has not taken final action on it as of July 2020.

The CTG includes design standards for some component types, e.g. pumps and compressors, and leak detection and repair requirements. The following table only compares the leak detection and repair requirements of Rule 4409 with those contained in the CTG.

	SJVAPCD	CTG	Conclusion
Applicability	Components at light crude oil production facilities, natural gas production facilities, and natural gas processing facilities.	Equipment used in the oil and gas industry	Rule 4409 and the CTG apply to similar source categories.
Requirements	Minor leak repair threshold for valves/connections/ flanges /pipes/pumps/ compressors /polished rod stuffing boxes /others: - 1,000 ppmv liquid service - 2,000 ppmv gas service Minor leak repair threshold for pressure relief devices:	Leak repair thresholds Well/compressor sites: - 500 ppmv Gas processing plants: Pumps in light liquid service: - 2,000 ppmv	In general, the leak repair thresholds in the CTG are more stringent than in Rule 4409.

	- 200 ppmv liquid service - 400 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - 2000 -10,000 ppmv, 7 days - 10,000 -50,000 ppmv, 3 days - >50,000 ppmv, 2 days - Liquid, 2 days - PRD, 400 – 10,000 ppmv, 7 days For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	Compressors: - 500 ppmv Pressure relief devices: - 500 ppmv Valves: - 500 ppmv Pumps in heavy liquid service: - 10,000 ppmv	

2.4. Other Control Technology Conclusion

As presented above, the leak detection and repair thresholds contained in several District permits, SCAQMD Rule 1173, and various federal and state requirements may have more stringent leak detection and repair thresholds for certain categories subject to Rule 4409.

3. OTHER DISTRICT RULES SUBJECT TO LDAR REQUIREMENTS

In addition to Rule 4409, other District rules that were also identified as needing further BARCT analysis have leak detection and repair (LDAR) requirements. District Rule 4454 (Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants), District Rule 4623 (Storage of Organic Liquids), District Rule 4624 (Transfer of Organic Liquids), and District Rule 4401 (Steam-Enhanced Crude Oil Production Wells) were all identified to need further analysis as part of these AB 617 efforts. Initially, as identified in the table below[2], Rules 4623 and 4624 were scheduled for further BARCT analysis in 2020 and Rule 4401 in 2021.

As a part of the current further BARCT analysis, District staff assessed LDAR requirements for all five District Rules (4409, 4455, 4623, 4624, and 4401), and compared those requirements to other air district, state, and federal requirements for similar source categories. Based on this review, the District determined that in order to

[2] From the Expedited BARCT Implementation Schedule adopted by the Governing Board (12/20/2018). http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/December/final/13.pdf

properly evaluate all the varying LDAR requirements currently contained within each of these five rules, a broader rule making effort is required consisting of a refined LDAR analysis of the five affected rules and an associated cost-effectiveness analysis of any potential LDAR enhancements. In addition, since the five affected District rules have similar but not identical LDAR requirements, by conducting an overall LDAR assessment for the five rules at once, the District will be able to ensure consistency and clarity of the District's findings.

As presented in the table below, the BARCT schedule commits to any necessary rulemaking between 2020 and 2022. According to the discussion above, the rulemaking process for the five rules will start in 2020, consistent with the schedule for Rules 4409 and 4455, while being in advance of the timeline identified for Rules 4623, 4624, and 4401. Overall, this combined analysis will allow the District to streamline the LDAR assessment of the five rules, while expediting the rulemaking efforts for three of the five rules (Rules 4623, 4624, and 4401).

Rule	Title	BARCT Determination Status	BARCT Determination Schedule	BARCT Rulemaking Schedule (if necessary)
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	Scheduled	2019	2020
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants	Scheduled	2019	2020
4623	Storage of Organic Liquids	Scheduled	2020	2021
4624	Transfer of Organic Liquid	Scheduled	2020	2021
4401	Steam-Enhanced Crude Oil Production Wells	Scheduled	2021	2022

CONCLUSION

In conclusion, the BARCT analysis demonstrates that other regulations have more stringent LDAR requirements. Therefore, a rule making process will start in 2020 to establish BARCT for source categories subject to the LDAR requirements of Rule 4409. Similar BARCT analyses also demonstrate that other regulations have more stringent requirements than District Rules 4455, 4623, 4624, and 4401. Therefore, in order to address LDAR requirements consistently across the five District rules (4409, 4455, 4623, 4624, and 4401) the District will conduct a concurrent rule development process for these five rules.

The rule development process of District Rules 4409, 4455, 4623, 4624, and 4401 will evaluate the potentially more stringent LDAR requirements that have been identified and review existing rule exemptions to determine the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 12/26/2019

District Rule 4455

Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants

Applicability and Purpose:

District Rule 4455 applies to the following source categories:

Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.

The purpose of this rule is to limit VOC emissions from leaking components at petroleum refineries, gas liquids processing facilities, and chemical plants. This rule defines a component (which includes, but is not limited to) as "any valve, fitting, threaded connection, pump, compressor, pressure relief device, pipe, flange, process drain, sealing mechanism, hatch, sight-glass, meter or seal fluid system in VOC service."

Benchmarks Evaluated:

- BAAQMD Regulation 8 Rule 18 – Equipment Leaks (12/16/15)
- SCAQMD Rule 1173 – Control Of Volatile Organic Compound Leaks and Releases From Components at Petroleum Facilities And Chemical Plants (2/6/09)
- SMAQMD Rule 443 Leaks from Synthetic Organic Chemical and Polymer Manufacturing (6/5/79)
- VCAPCD Rule 74.7 Fugitive Emissions of reactive Organic Compounds (ROC) at Petroleum refineries and Chemical Plants (10/10/95)
- 40 CFR Part 60, Subpart GGGa
- District Permit Requirements

Summary:

The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements:

- Other Districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. As part of this analysis, state and federal regulations were also reviewed. The analysis concluded that some LDAR regulations appeared to have more stringent requirements applicable to certain categories covered by Rule 4455.

Conclusion:

While District Rule 4455 has required the implementation of stringent LDAR programs that have resulted in significant reductions in VOC emissions, the District will begin a rule making process in 2020 to explore opportunities to enhance the stringency of the rule and ensure the continued implementation of BARCT by determining the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts of the source categories subject to Rule 4455. This effort is supported by the District's attached 2019 BARCT Rule Analysis.

2019 BARCT Rule Analysis

Rule 4455
Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants

Engineer: **Dustin Brown, Sr. AQE**
Reviewed By: **Errol Villegas, Permit Services Manager**
Date: **December 26, 2019**

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4455 – Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants (see Attachment A) concluded that there may be potentially more stringent requirements in similar rules from other districts than the requirements from District Rule 4455. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4455 satisfies BARCT requirements or if amendments to the rules are needed to ensure BARCT requirements are met.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

In the 2018 preliminary analysis of Rule 4455 other Districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. In addition, state and federal regulations were reviewed and it was found that there were some regulations that appeared to have more stringent requirements applicable to the source categories covered by District Rule 4455. Therefore, further analysis was necessary to determine if these other requirements could establish BARCT for these source categories.

DISCUSSION

District Rule 4455 applies to the following source categories:

> *Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants*.

The purpose of this rule is to limit VOC emissions from leaking components at petroleum refineries, gas liquids processing facilities, and chemical plants. This rule defines a component (which includes, but is not limited to) as "any valve, fitting, threaded connection, pump, compressor, pressure relief device, pipe, flange, process drain, sealing mechanism, hatch, sight-glass, meter or seal fluid system in VOC service."

FURTHER BARCT ANALYSIS

In the 2018 preliminary analyses of District Rule 4455, it was determined that there were other district rules (SCAQMD and BAAQMD) and various federal and state requirements that may have leak repair thresholds that are more stringent than current rule requirements.

1. RULE SURVEY

1.1. District Rule(s)

SJVAPCD Rule 4454 (4/20/05)

	SJVAPCD
Applicability	Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.
Requirements	Leak detection and repair program required for controlling leaks with specific thresholds, repair timetables, number of allowable leaks for compliance, administrative recordkeeping. Leak repair threshold for valves/connections/flanges/pipes/pumps/compressors/polished rod stuffing boxes/others: - 100 – 500 ppmv liquid service - 200 – 1,000 ppmv gas service Leak repair threshold for pressure relief devices: - 100 ppmv liquid service - 200 ppmv gas service

1.2. Bay Area AQMD Rule(s)

BAAQMD Regulation 8 Rule 18 (Equipment Leaks) (12/16/15)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.	Equipment leaks at petroleum refineries, chemical plants, bulk plants and bulk terminals including, but not limited to: valves, connectors, pumps, compressors, pressure relief devices, diaphragms, hatches, sight-glasses, fittings, sampling ports, meters, pipes, and vessels.	BAAQMD Reg 8 Rule 18 applies to more source categories than those covered by District Rule 4455 (refineries/chemical plants). District Rule 4623 (organic liquid storage), and Rule 4624 (Transfer of Organic Liquid) apply to the same source categories as BAAQMD Reg 8 Rule 18. As such, the requirements of Rule 4455 are not directly comparable to BAAQMD Reg 8, Rule 18 for specific categories of sources.

			However, as both rules address equipment leaks, a comparison of these rules will be performed.
Requirements	Minor leak repair threshold for valves/connections/flanges/: - 200 ppmv liquid service - 400 ppmv gas service Minor leak repair threshold for pumps/compressors/others: - 500 ppmv liquid service - 1,000 ppmv gas service Minor leak repair threshold for PRDs: - 100 ppmv liquid service - 200 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - Minor gas leak, 7 days - 10,000 -50,000 ppmv, 3 days - > 50,000 ppmv 2 days - Minor liquid leak, 3 days, - Major liquid leak, 2 days. For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	Valve/Connector leak repair threshold: 100 ppmv Pump/Compressor/PRD leak repair threshold: 500 ppmv Leak repair time: 7 day, 15 days or 7 days (APCO inspected) for PRD	BAAQMD has lower leak repair thresholds except for PRDs However, BAAQMD has no requirement to replace/control components that are found to have repeated leaks at high levels.

1.3. South Coast AQMD Rule(s)

SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants*)* (2/6/09)

	SJVAPCD	SCAQMD	Conclusion
Applicability	Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.	This rule applies to components at refineries, chemical plants, lubricating oil and grease re-refiners, marine terminals, oil and gas production fields, natural gas processing plants, and pipeline transfer stations.	In addition to the source categories subject to Rule 4455, SCAQMD Rule 1173 also applies to source categories different from those covered by Rule 4455. District Rules 4409 (crude oil/natural gas plants), Rule 4623 (organic liquid storage), and Rule 4624 (transfer of organic liquid) apply to the additional source categories subject to SCAQMD Rule 1173.
Requirements	Minor leak repair threshold for valves/connections/flanges/: - 200 ppmv liquid service - 400 ppmv gas service Minor leak repair threshold for pumps/compressors/others: - 500 ppmv liquid service - 1,000 ppmv gas service Minor leak repair threshold for PRDs: - 100 ppmv liquid service - 200 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - Minor gas leak, 7 days - 10,000 -50,000 ppmv, 3 days - > 50,000 ppmv 2 days - Minor liquid leak, 3 days, - Major liquid leak, 2 days.	Valves/connections/flanges/pipes/ pumps/compressors/polished rod stuffing boxes/others: - 500 ppmv vapor, gas, light liquid - 100 ppmv heavy liquid Leak repair time: - 100 – 500 ppmv vapor, gas, light liquid – 7 days - 100 -500 ppmv heavy liquid – 7 days - Any leak 10,000 – 25,000 ppmv - 2 days - Pressure relief device 200 – 25,000 ppmv - 2 days - Any leak > 25,000 ppmv - 1 day - Heavy liquid > 500 ppmv -1 day - Light liquid >3 drops/min - 1 day Replace excessively leaking components (5 repair actions) or parts for LL > 3 drops/min, any > 10,000 ppmv, PRD > 200 ppmv with BACT or BARCT or vent it to	SCAQMD has marginally lower leak repair thresholds, except for PRDs Bothth rules require retrofit requirement for excessively leaking components

	For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	an air pollution control device approved by the Executive Officer	

1.4 Sacramento Metropolitan AQMD Rule(s)

SMAQMD Rule 443 (Leaks from Synthetic Organic Chemical and Polymer Manufacturing) (6/5/79)

	SJVAPCD	SMAQMD	Conclusion
Applicability	Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.	Limit VOC emissions from Synthetic Organic Chemical and Polymer Manufacturing facilities	SMAQMD Rule 443 applies to few categories covered by District Rule 4455 (refineries/chemical plants). However, as both rules address leaks from chemical plants, a comparison of these rules will be performed.
Requirements	Minor leak repair threshold for valves/connections/flanges/: - 200 ppmv liquid service - 400 ppmv gas service Minor leak repair threshold for pumps/compressors/others: - 500 ppmv liquid service - 1,000 ppmv gas service Minor leak repair threshold for PRDs: - 100 ppmv liquid service - 200 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - Minor gas leak, 7 days - 10,000 -50,000 ppmv, 3 days - > 50,000 ppmv 2 days - Minor liquid leak, 3 days,	Leak threshold of: - Liquid: 3 drops/minute, - Gas: 10,000 ppmv, - Visible mist	SJVAPCD has lower leak repair thresholds

	- Major liquid leak, 2 days. For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation		

1.5 Ventura County APCD Rule(s)

VCAPCD Rule 74.7 (Fugitive Emissions of Reactive Organic Compounds (Roc) at Petroleum Refineries and Chemical Plants) (10/10/95)

	SJVAPCD	VCAPCD	Conclusion
Applicability	Components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.	Rule applies to Chemical Pants and Petroleum Refineries.	Similar applicability
Requirements	Minor leak repair threshold for valves/connections/flanges/: - 200 ppmv liquid service - 400 ppmv gas service Minor leak repair threshold for pumps/compressors/others: - 500 ppmv liquid service - 1,000 ppmv gas service Minor leak repair threshold for PRDs: - 100 ppmv liquid service - 200 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - Minor gas leak, 7 days - 10,000 -50,000 ppmv, 3 days - > 50,000 ppmv 2 days - Minor liquid leak, 3 days, - Major liquid leak, 2 days.	Leak threshold of: - Liquid: 3 drops/minute - Gas: 1,000 ppmv	SJVAPCD generally has lower leak repair thresholds

	For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation		

1.6 Rule Survey Conclusion

As presented above, the BAAQMD and SCAQMD rules have lower leak repair thresholds for certain categories subject to Rule 4454.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

The District has a total of 4 refineries, only two of which are currently in operation.

Certain new/modified units at refineries in the District refineries have BACT leak repair thresholds from BACT guidelines 7.2.2 and 7.2.3 of:

- 100 ppmv for valves, flanges, and connectors, and
- 500 ppmv for compressors and pumps

These leak repair thresholds are being achieved in practice.

2.2. State Regulations – ATCMs or other regulations

No state regulations are applicable for this source category.

2.3. Federal Regulations – CFRs

40 CFR Part 60, Subpart GGGa, Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006 (Amended June 2, 2008)

	SJVAPCD	NSPS Subpart GGGa	Conclusion
Applicability	This rule shall apply to components containing or contacting VOC at petroleum refineries, gas liquids processing facilities, and chemical plants.	This subpart has equipment leak requirements for equipment at refineries constructed, reconstructed or modified alter 11/7/06	SJVAPCD has broader applicability at it applies to all equipment at refineries, not only new/reconstructed/modified equipment

Requirements	Minor leak repair threshold for valves/connections/ flanges: - 200 ppmv liquid service - 400 ppmv gas service Minor leak repair threshold for pumps/compressors/others: - 500 ppmv liquid service - 1,000 ppmv gas service Minor leak repair threshold for PRDs: - 100 ppmv liquid service - 200 ppmv gas service Major leak threshold for all: 10,000 ppmv Leak repair time: - Minor gas leak, 7 days - 10,000 -50,000 ppmv, 3 days - > 50,000 ppmv 2 days - Minor liquid leak, 3 days, - Major liquid leak, 2 days. For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	Leak repair thresholds: Valves: - 500 ppmv Compressors: - 500 ppmv (or specified design criteria) Light liquid pumps: - 2,000 ppmv Gas PRVs: - 500 ppmv Heavy liquid pumps/valves/connectors: - 10,000 ppmv Heavy liquid and light liquid PRVs: - 10,000 ppmv:	NSPS Subpart GGGa only applies to new/reconstructed/modified equipment and it has higher leak repair thresholds than Rule 4455 (that applies to more total equipment). Therefore Subpart GGGa is overall less stringent than Rule 4455.

2.4. Other Control Technology Conclusion

As presented above, the requirements contained in several District permits, BAAQMD Reg 8 Rule 18 and SCAQMD Rule 1173, may have more stringent leak detection and repair thresholds for certain categories subject to Rule 4455.

3. OTHER DISTRICT RULES SUBJECT TO LDAR REQUIREMENTS

In addition to Rule 4454, other District rules that were also identified as needing further BARCT analysis have leak detection and repair (LDAR) requirements. District Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities), District Rule 4623 (Storage of Organic Liquids), District Rule 4624 (Transfer of Organic Liquids), and District Rule 4401 (Steam-Enhanced Crude Oil Production Wells) were all identified to need further

analysis as part of these AB 617 efforts. Initially, as identified in the table below[2], Rules 4623 and 4624 were scheduled for further BARCT analysis in 2020 and Rule 4401 in 2021.

As a part of the current further BARCT analysis, District staff assessed LDAR requirements for all five District Rules (4409, 4455, 4623, 4624, and 4401), and compared those requirements to other air district, state, and federal requirements for similar source categories. Based on this review, the District determined that in order to properly evaluate all the varying LDAR requirements currently contained within each of these five rules, a broader rule making effort is required consisting of a refined LDAR analysis of the five affected rules and an associated cost-effectiveness analysis of any potential LDAR enhancements. In addition, since the five affected District rules have similar but not identical LDAR requirements, by conducting an overall LDAR assessment for the five rules at once, the District will be able to ensure consistency and clarity of the District's findings.

As presented in the table below, the BARCT schedule commits to any necessary rulemaking between 2020 and 2022. According to the discussion above, the rulemaking process for the five rules will start in 2020, consistent with the schedule for Rules 4409 and 4455, while being in advance of the timeline identified for Rules 4623, 4624, and 4401. Overall, this combined analysis will allow the District to streamline the LDAR assessment of the five rules, while expediting the rulemaking efforts for three of the five rules (Rules 4623, 4624, and 4401).

Rule	Title	BARCT Determination Status	BARCT Determination Schedule	BARCT Rulemaking Schedule (if necessary)
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	Scheduled	2019	2020
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants	Scheduled	2019	2020
4623	Storage of Organic Liquids	Scheduled	2020	2021
4624	Transfer of Organic Liquid	Scheduled	2020	2021
4401	Steam-Enhanced Crude Oil Production Wells	Scheduled	2021	2022

[2] From the Expedited BARCT Implementation Schedule adopted by the Governing Board (12/20/2018). http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/December/final/13.pdf

CONCLUSION

In conclusion, the BARCT analysis demonstrates that other regulations have more stringent LDAR requirements. Therefore, a rule making process will start in 2020 to establish BARCT for source categories subject to the LDAR requirements of Rule 4455. Similar BARCT analyses also demonstrate that other regulations have more stringent requirements than District Rules 4409, 4623, 4624, and 4401. Therefore, in order to address LDAR requirements consistently across the five District rules (4409, 4455, 4623, 4624, and 4401) the District will conduct a concurrent rule development process for these five rules.

The rule development process of District Rules 4409, 4455, 4623, 4624, and 4401 will evaluate the potentially more stringent LDAR requirements that have been identified and review existing rule exemptions to determine the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 06/01/20

District Rule 4623

Storage of Organic Liquids

Applicability and Purpose:

District Rule 4623 applies to the following source categories:

Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.

The purpose of this rule is to limit volatile organic compound (VOC) emissions from the storage of organic liquids.

Benchmarks Evaluated:

- BAAQMD Regulation 8 Rule 5 – Storage of Organic Liquids (10/18/06)
- BAAQMD Regulation 8 Rule 18 – Equipment Leaks (12/16/15)
- SCAQMD Rule 463 – Organic Liquid Storage (11/04/11)
- SCAQMD Rule 1173 – Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants (2/6/09)
- VCAPCD Rule 71.2 – Storage of Reactive Organic Compound Liquids (09/26/89)
- VCAPCD Rule 74.10 –Components at Crude Oil and Natural Gas Production and Processing Facilities (3/10/98)
- SMAQMD Rule 446 – Storage of Petroleum Products (11/16/93)
- CARB Subarticle 13: Greenhouse Gas Emissions Standards for Crude Oil and Natural Gas Facilities
- 40 CFR Part 60 Subpart K, Ka, Kb, BBBBBB
- EPA 2016 Control Technology Guideline for the Oil and Gas Industry (EPA-453/B-16-001)
- District Permit Requirements

Summary:

The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements:

- Other air districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. As part of this analysis, state and federal regulations were also reviewed. The analysis concluded that some LDAR regulations appeared to have more stringent requirements applicable to the source categories covered by Rules 4623.

Conclusion:

While District Rule 4623 has required the implementation of stringent LDAR programs that have resulted in significant reductions in VOC emissions, the District will begin a rule making process in 2020 to explore opportunities to enhance the stringency of the rule and ensure the continued implementation of BARCT by determining the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts of the source categories subject to Rule 4623. This effort is supported by the District's attached 2020 BARCT Rule Analysis.

2020 BARCT Rule Analysis

Rule 4623
Storage of Organic Liquids

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Date: **June 1, 2020**

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4623 – Storage of Organic Liquids determined that there may be potentially more stringent requirements in similar rules from other districts than the requirements from District's Rule 4623. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4623 satisfies BARCT requirements or if amendments to the rule may be necessary to ensure BARCT requirements are met.

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

DISCUSSION

District Rule 4623 applies to the following source categories:

> *Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.*

The purpose of this rule is to limit VOC emissions from organic liquid storage tanks.

FURTHER BARCT ANALYSIS

In the 2018 preliminary analyses of District Rule 4623, it was determined that there were other district rules and various federal and state requirements that may have leak detection and repair thresholds that are more stringent than current rule requirements.

1. RULE SURVEY

1.1. District Rule(s)

SJVAPCD Rule 4623 (5/19/05)

	SJVAPCD
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.
Requirements	**1) Organic Liquid Storage Tank** **Group A with tank capacity 1,100 to 19,800 gallons:** – TVP ≥ 0.5 psia to < 1.5 psia Equipped with pressure-vacuum relief valve (PVRV) set to within 10% of maximum allowable working pressure, internal floating roof (IFR), external floating roof (EFR), or vapor recovery system (VRS) with 95% control efficiency – TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% – TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 19,800 to 39,600 gallons:** – TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% – TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% – TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95%

Group C with tank capacity > 39,600 gallons:

- TVP ≥ 0.5 psia to < 1.5 psia
  Equipped with IFR, EFR, or VRS with CE of 95%

- TVP ≥ 1.5 psia to < 11 psia
  Equipped with IFR, EFR, or VRS with CE of 95%

- TVP ≥ 11.0 psia
  Pressure vessel or equipped a VRS with CE of 95%

2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>

Group A with tank capacity 1,100 to 39,600 gallons:

- TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day
  Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency

- TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day
  Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%

- TVP ≥ 11.0 psia
  Pressure vessel or equipped a VRS with CE of 95%

Group B with tank capacity > 39,600 gallons:

- TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day
  Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency

- TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day
  Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%

- TVP ≥ 11.0 psia
  Pressure vessel or equipped a VRS with CE of 95%

Rule Requirement Reference:

<u>Pressure-Vacuum Relief Valve (PVRV) requirements (section 5.2):</u>

- Set to within 10% of the maximum allowable working pressure of the tank. The PVRV shall be permanently labeled with the operating pressure settings

<u>External Floating Roof (EFR) requirements (section 5.3):</u>

- Equipped with a floating roof consisting of a pan type that is installed before 12/20/2001, pontoon-type, or double-deck type cover, that rests on the surface of the liquid contents; and

- Equipped with a closure device between the tank shell & roof edge consisting of two seals, one above the other; the one below shall be referred to as the primary seal, and the one above shall be referred to as the secondary seal.

	– Approved seal designs: o Published in 40 CFR Part 60, Subpart Kb §60.114(b) o Welded tanks with primary metallic-shoe type seal (section 5.3.2.1) o Riveted tank with primary metallic-shoe type seal (section 5.3.2.2) o Tanks with primary resilient toroid seal (section 5.3.2.3) o Republic Fabricators, model Weather Guard Seal (section 5.3.2.4.1) o HMT, model Dual/Multi Blade Wiper Seals (section 5.3.2.4.2) <u>Internal Floating Roof (IFR) requirements (section 5.4):</u> – Equipped with seals that meet EFR requirements, except for metallic-shoe-type seals requirement of one end of the shoe extends into the stored liquid & the other end extends a minimum vertical distance of 24 inches above the stored liquid surface – Approved seal designs: o Ultraflote, model Single Ultraseal (section 5.4.2.1) o Ultraflote, model Dual Ultraseal (section 5.4.2.2) o Altech, model Double Wiper Seal (section 5.4.2.2) <u>Vapor Recovery Systems (VRS) requirements (section 5.6):</u> – Consist of a closed system that collects all VOCs from the storage tank, and a VOC control device. The VRS shall be maintained in a leak-free condition, without gas leak (> 10,000 ppmv, as methane) or liquid leak (dripping of organic liquid > 3 drops/min). VOC control device shall be: o A condensation or vapor return system that connects to one of the following: a gas processing plant, a field gas pipeline, a pipeline distributing Public Utility Commission quality gas for sale, an injection well for disposal of vapors as approved by the California Dept. of Conservation, Division of Oil Gas, and Geothermal Resources, OR o Control device that reduces the inlet VOC emissions by at least 95% by weight as determined by the following test methods: EPA Method 18, EPA Method 25, or EPA Method 25A <u>Pressure Vessel requirements (section 3.24):</u> – Tank, reservoir, or container that is capable of maintaining working pressures sufficient to prevent organic liquid loss or VOC loss to the atmosphere at all time.

1.2. Bay Area AQMD Rule(s)

BAAQMD Regulation 8 Rule 5 (Storage of Organic Liquids) (10/18/06)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Tanks with capacity of 264 gallons or greater storing organic liquids	Similar applicability; BAAQMD rule covers storage tanks with capacity down to 264 gallons.
Requirements	**1) Organic Liquid Storage Tank** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95%	**Organic Liquid Storage Tanks** **Tank capacity ≥ 264 to ≤ 9,906 gallons:** - TVP > 0.5 psia to ≤ 1.5 psia Submerged fill pipe - TVP > 1.5 psia to < 11 psia Submerged fill pipe (underground tank or non-gasoline tank), pressure vacuum valve (PVV) set to either at least 90% of the tank's maximum allowable working pressure or at least 0.5 psig, internal (IFR) or external floating roof (EFR) - TVP ≥ 11.0 psia Pressure tank or approved emission control system (AECS) with control efficiency of 95% **Tank capacity > 9,906 to < 19,803 gallons:** - TVP > 0.5 psia to ≤ 1.5 psia Submerged fill pipe - TVP > 1.5 psia to < 11 psia Submerged fill pipe (underground tank), PVV set to either at least 90% of the tank's max pressure or at least 0.5 psig, IFR or EFR - TVP ≥ 11.0 psia Pressure tank or AECS with CE of 95%	For tanks with similar capacity, District rule is as stringent as this regulation.

	Group B with tank capacity > 19,800 to 39,600 gallons: - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%	**Tank capacity ≥ 19,803 to < 39,626 gallons:** - TVP > 0.5 psia to ≤ 1.5 psia Submerged fill pipe - TVP > 1.5 psia to < 11 psia IFR or EFR - TVP ≥ 11.0 psia Pressure tank or AECS with CE of 95% **Tank capacity ≥ 39,626 gallons:** - TVP > 0.5 psia to ≤ 1.5 psia IFR or EFR - TVP > 1.5 psia to < 11 psia IFR or EFR - TVP ≥ 11.0 psia Pressure tank or AECS with CE of 95% **Rule Requirement Reference:** <u>Submerged Fill Pipe requirements (section 8-5-302)</u> - Fill from top, totally submerged when liquid level is 6 in. from the bottom of the tank. - Fill from side, totally submerged when liquid level is 18 in. from the bottom of the tank. <u>Pressure Vacuum Valve (PVV) requirements (section 8-5-303)</u> - PVV set to either at least 90% of the tank's max pressure or at least 0.5 psig <u>External Floating Roof (EFR) requirements (section 8-5-304)</u> - Equipped with primary and secondary seals that meets requirements in sections 8-5-320 & 8-5-321	

	- TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95%	<u>Internal Floating Roof (IFR) requirements (section 8-5-305)</u> - Equipped with primary and secondary seals that meets requirements in sections 8-5-320 & 8-5-321 <u>Approved Emission Control System (AECS) requirements (section 8-5-306)</u> - Control efficiency at least 95% - Gas tight on cover, piping, valves & fittings <u>Pressure Tanks requirements (section 8-5-307)</u> - Must maintain working pressure sufficient at all times to prevent organic vapor or gas loss to the atmosphere	

BAAQMD Regulation 8 Rule 18 (Equipment Leaks) (12/16/15)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Leaking components at any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored and any associated VOC collection and control systems.	Equipment leaks at petroleum refineries, chemical plants, bulk plants and bulk terminals including, but not limited to: valves, connectors, pumps, compressors, pressure relief devices, diaphragms, hatches, sight-glasses, fittings, sampling ports, meters, pipes, and vessels.	BAAQMD Reg 8 Rule 18 applies to Rule 4623 (organic liquid storage) as both rules address equipment leaks
Requirements	**Leak Definition** <u>Liquid leak threshold</u>: drips liquid at a rate of more than three drops per minute <u>Gas leak threshold:</u> 10,000 ppmv	**Leak Definition** Valve/Connector leak repair threshold: 100 ppmv Pump/Compressor/PRD leak repair threshold: 500 ppmv	BAAQMD has lower leak repair thresholds except for PRDs BAAQMD has less stringent repair times.

	Leak Repair Time liquid leak >3 to <30 drops per min: 24 hrs liquid leak >30 drops per min: 8 hrs Gas Leak: 8 hrs	**Leak Repair Time** 7 day, 15 days or 7 days (APCO inspected) for PRD	

1.3. South Coast AQMD Rule(s)

SCAQMD Rule 463 (Organic Liquid Storage) (11/4/11)

	SJVAPCD	SCAQMD	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Any tank with a capacity of 251 gallons or greater in which any organic liquid is placed, held, or stored.	Similar applicability; SCAQMD rule covers storage tanks with capacity down to 251 gallons.
Requirements	**1) Organic Liquid Storage Tank** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group B with tank capacity > 19,800 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95%	**Aboveground stationary tank** **Tank capacity ≥ 251 to ≤ 19,815 gallons of gasoline:** - Equipped with pressure vacuum valve (PVV) set to within 10% of max allowable working pressure, or vapor recovery system (VRS) with control efficiency of 95% **Tank capacity > 19,815 gallons of organic liquid:** - TVP ≥ 1.5 psia Pressure tank OR equipped with external floating roof (EFR), internal floating roof (IFR), or VRS with CE of 95% **Tank capacity ≥ 39,630 gallons of organic liquid:** - TVP ≥ 0.5 psia Pressure tank OR equipped with EFR, IFR, or VRS with CE of 95%	For tanks with similar capacity, District rule is as stringent as this regulation.

	- TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day	**Rule Requirement Reference:** <u>Pressure Vacuum Valve (PVV) requirements (section (c)(1)(D))</u> - PVV set to within 10% of max allowable working pressure <u>External Floating Roof (EFR) requirements (section (c)(1))</u> - Equipped with primary and secondary seals that meets requirements in section (c)(1)(C) <u>Internal Floating Roof (IFR) requirements (section (c)(2))</u> - Equipped with primary and secondary seals that meets requirements in section (c)(1)(C) <u>Vapor Recovery System (VRS) requirements (section (c)(3))</u> - Control efficiency at least 95% - Vapor tight on cover, piping, valves & fittings <u>Pressure Tanks requirements (section (c))</u> - Must maintain working pressure sufficient at all times to prevent organic vapor or gas loss to the atmosphere	

	Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95%		

SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants*)* (2/6/09)

	SJVAPCD	SCAQMD	Conclusion
Applicability	Leaking components at any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored and any associated VOC collection and control systems.	This rule applies to components at refineries, chemical plants, lubricating oil and grease re-refiners, marine terminals, oil and gas production fields, natural gas processing plants, and pipeline transfer stations.	Both rules address equipment leaks at oil and gas production operations.
Requirements	**Leak Definition** Liquid leak threshold: drips liquid at a rate of more than three drops per minute Gas leak threshold: 10,000 ppmv **Leak Repair Time** liquid leak >3 to <30 drops per min: 24 hrs liquid leak >30 drops per min: 8 hrs Gas Leak: 8 hrs	**Leak Definition** Valves/connections/flanges /pipes/pumps/compressors /polished rod stuffing boxes/others: 500 ppmv vapor, gas, light liquid 100 ppmv heavy liquid **Leak Repair Time** 100 – 500 ppmv vapor, gas, light liquid – 7 days 100 -500 ppmv heavy liquid – 7 days Any leak 10,000 – 25,000 ppmv - 2 days Pressure relief device 200 – 25,000 ppmv 2 days Any leak > 25,000 ppmv - 1 day Heavy liquid > 500 ppmv - 1 day Light liquid >3 drops/min - 1 day	The SCAQMD Rule has more stringent leak repair thresholds and repair times, except for PRD, than District Rule 4623 Additionally, the SCAQMD rule has lower LDAR requirements for all heavy liquids. The SCAQMD rule requires retrofit requirement for excessively

		Replace excessively leaking components (5 repair actions) or parts for LL > 3 drops/min, any > 10,000 ppmv, PRD > 200 ppmv with BACT or BARCT or vent it to an air pollution control device approved by the Executive Officer	leaking components

1.4. Sacramento Metropolitan AQMD Rule(s)

SMAQMD Rule 446 (Storage of Petroleum Products) (11/16/1993)

	SJVAPCD	SMAQMD	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	**Stationary Container** **Capacity > 40,000 gallons:**	Similar applicability; District rule covers storage tanks with capacity down to 1,100 gallons.
Requirements	**1) Organic Liquid Storage Tank** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group B with tank capacity > 19,800 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95%	**Stationary Container** **Capacity > 40,000 gallons:** - Pressure tank or equipped with floating roof, internal floating roof, or vapor recovery system with control efficiency of 95% **Rule Requirement Reference:** Pressure Vacuum Valve (PVV) requirements (section 314.3) - PVV set to within 10% of max allowable working pressure Floating Roof (FR) requirements (section 311) - Equipped with primary and secondary seals that meets requirements in sections 314 thru 317 Internal Floating Roof (IFR) requirements (section 312) – Equipped with primary and secondary seals that meets	For tanks with similar capacity, District rule is as stringent as this regulation.

	- TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day	requirements in sections 314 thru 317 <u>Vapor Recovery System (VRS) requirements (section 313)</u> - Control efficiency at least 95% - Vapor tight on cover, piping, valves & fittings <u>Pressure Tanks requirements (section 301.1)</u> - Must maintain working pressure sufficient at all times to prevent organic vapor or gas loss to the atmosphere	

	Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95%		

1.5. Ventura County APCD Rule(s)

VCAPCD Rule 71.2 (Storage of Reactive Organic Compound Liquids) (9/26/89)

	SJVAPCD	VCAPCD	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	**Crude Oil or Reactive Organic Compound (ROC) Liquid Storage Tank** **Tank capacity ≤ 40,000 gallons:** - Crude oil or ROC liquids **Aboveground tank capacity ≥ 10,000 to < 20,000 gallons:** - Crude oil and ROC liquids with modified RVP ≥ 1.5 psia **Tank capacity ≥ 20,000 to < 40,000 gallons:** - Crude oil and ROC liquids with modified RVP ≥ 1.5 psia **Tank capacity > 40,000 gallons:** - Crude oil and ROC liquids with modified RVP ≥ 0.5 psia **Storage of crude oil and ROC liquids with modified RVP ≥ 11 psia**	Similar applicability; District rule covers storage tanks with capacity down to 1,100 gallons.

Requirements	**1) <u>Organic Liquid Storage Tank</u>** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group B with tank capacity > 19,800 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95%	**<u>Crude Oil or Reactive Organic Compound (ROC) Liquid Storage Tank</u>** **Tank capacity ≤ 40,000 gallons:** - Crude oil or ROC liquids Equipped with a submerged fill pill, external floating roof (EFR), internal floating roof (IFR), or vapor recovery system (VRS) with control efficiency of 95% **Aboveground tank capacity ≥ 10,000 to < 20,000 gallons:** - Crude oil and ROC liquids with modified RVP ≥ 1.5 psia Equipped with a pressure vacuum valve (PVV) set to at least 90% of the tank's maximum safe pressure and vacuum, EFR, IFR, or VRS with CE of 95% **Tank capacity ≥ 20,000 to < 40,000 gallons:** - Crude oil and ROC liquids with modified RVP ≥ 1.5 psia Equipped with EFR, IFR, or VRS with CE of 95% **Tank capacity ≥ 40,000 gallons:** - Crude oil and ROC liquids with modified RVP ≥ 0.5 psia Equipped with EFR, IFR, or VRS with CE of 95% **Storage of crude oil and ROC liquids with modified RVP ≥ 11 psia** – Pressure tank or equipped with VRS with CE of 95% **Rule Requirement Reference:** <u>Pressure Vacuum Valve (PVV) requirements (section C.3.c)</u> - PVV set to within 10% of max allowable working pressure	For tanks with similar capacity, District rule are as stringent as this regulation.

	2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u> **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%	<u>External Floating Roof (EFR) requirements (section C.1)</u> - Equipped with primary and secondary seals that meets requirements in sections D and E <u>Internal Floating Roof (IFR) requirements (section C.2)</u> - Equipped with primary and secondary seals that meets requirements in sections D and F <u>Vapor Recovery System (VRS) requirements (section C.3)</u> - Control efficiency at least 95% - Vapor tight on cover, piping, valves & fittings <u>Pressure Tanks requirements (section B.5.a)</u> - Maintaining working pressure sufficient at all times to prevent organic vapor loss to the atmosphere	

VCAPCD Rule 74.10 Components at Crude Oil and Natural Gas Production and Processing Facilities (3/10/98)

	SJVAPCD	VCAPCD	Conclusion
Applicability	Leaking components at any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed,	Crude oil and gas production facilities, pipeline transfer stations, and natural gas processing facilities.	VCAPCD rule applies to similar source categories as Rule 4623.

	held, or stored and any associated VOC collection and control systems.		
Requirements	**Leak Definition** Liquid leak threshold: drips liquid at a rate of more than three drops per minute Gas leak threshold: 10,000 ppmv **Leak Repair Time** liquid leak >3 to <30 drops per min: 24 hrs liquid leak >30 drops per min: 8 hrs Gas Leak: 8 hrs	**Leak Definition** Leak threshold: 1,000 ppmv Minor liquid leak – 3 drops/min Major liquid leak – continuous flow **Leak Repair Time** - Gas leak 1,000 -10,000 ppmv - 14 days - Gas leak 10,000 -50,000 ppmv- 5 days - Gas leak > 50,000 ppmv – 1 day - Minor Liquid leak - 2 days - Major Liquid leak - 1 day If leaks are excessive, replace compressor seal, pump seal, or pressure relief device or retrofit the leaking component with Best Available Control Technology (BACT) equipment, for major gas leak or minor liquid leak from critical equipment replace or retrofit with BACT <10% VOC exemption	VCAPCD has more stringent leak repair thresholds than Rule 4623. VCAPCD leak repair time periods are generally less stringent. Both rules have retrofit requirements for excessively leaking components and have < 10% VOC exemption

1.6. Rule Survey Conclusion

As presented above, the BAAQMD Regulation 8 Rule 18, and SCAQMD Rule 1173, have more stringent leak repair thresholds and repair times than Rule 4623. VCAPCD Rule 74.10 is slightly more stringent than Rule 4623.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

In a review of District Permits, no organic liquid storage tank permits were located that had more stringent requirements than the vapor recovery system as defined in Section 5.6 and the inspection and repair requirements of Rule 4623.

2.2. State Regulations – ATCMs and other rules

There is no ATCM that applies to the same equipment as Rule 4623.

On March 23, 2017 CARB adopted a new rule to reduce greenhouse gas emissions from oil and gas operations (Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities). While the rule targets methane emissions reductions, it has a collateral benefit of reducing VOC emissions from leaking components as well.

The CARB rule imposes equipment standards on several different types of equipment and imposes leak detection and repair requirements on all equipment used in the subject industry types. The leak detection and repair requirements began on January 1, 2018. The leak repair thresholds are lower effective January 1, 2020.

Below is a comparison of Rule 4623 requirements to the January 1, 2020 leak detection and repair requirements of the CARB rule.

	SJVAPCD	CARB rule	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Onshore and offshore crude oil or natural gas production, Crude oil, condensate, and produced water separation and storage, Natural gas underground storage, Natural gas gathering and boosting stations, Natural gas processing plants; and, Natural gas transmission compressor stations.	The CARB rule applies to oil and gas production and handling facilities, including storage tanks. They have the similar applicability.
Requirements	**Leak Definition** Liquid leak threshold: drips liquid at a rate of more than three drops per minute Gas leak threshold: 10,000 ppmv	**Leak Repair Threshold** 1,000 ppmv **Leak Repair Time** 1,000 – 9,999 ppmv – 14 days 10,000 – 49,000 ppmv – 5 days >50,000 ppmv – 2 days	In general, the leak repair thresholds in the CARB rule are more stringent than in Rule 4623. The leak repair times in the CARB rule are generally less stringent than Rule 4623.

	Leak Repair Time liquid leak >3 to <30 drops per min: 24 hrs liquid leak >30 drops per min: 8 hrs Gas Leak: 8 hrs	For components that have had 5 repair actions with 12 months must be replaced.	

2.3. Federal Regulations – CFR and Control Technique Guidance document

NSPS Subpart K-Standards of Performance for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After June 11, 1973, and Prior to May 19, 1978

	SJVAPCD	40 CFR Part 60 Subpart K	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Storage vessel for petroleum liquids which has a storage capacity: - Capacity > 40,000 to ≤ 65,000 gallons, and commences construction or modification after March 8, 1974 and prior to May 19, 1978 - Capacity > 65,000 gallons and commences construction or modification after June 11, 1973, and prior to May 19, 1978	Similar applicability; District rule covers storage tanks with capacity down to 1,100 gallons.
Requirements	**1) <u>Organic Liquid Storage Tank</u>** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group B with tank capacity > 19,800 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia	**Requirements** - TVP ≥ 1.5 psia to ≤ 11.1 psia Equipped with a floating roof, a vapor recovery system (VRS), or their equivalents - TVP > 11.1 psia Equipped with a VRS or its equivalent **Requirement Reference** <u>Floating Roof (§60.111(j)):</u> - A storage vessel cover consisting of a double deck, pontoon single deck, internal floating cover or covered floating roof, which resets upon & is supported by the petroleum liquid being contained, and is equipped with a closure seal or seals to close the space	For tanks with similar capacity, District rule is as stringent as this regulation.

	Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95%	between the roof edge and tank wall. <u>Vapor Recovery System (§60.111(k)):</u> A vapor gathering system capable of collecting all hydrocarbon vapors & gases discharged from the storage vessel & a vapor disposal system capable of processing such hydrocarbon vapors and gases so as to prevent their emission to the atmosphere.	

	Group B with tank capacity > 39,600 gallons: - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%		

NSPS Subpart Ka- Standards of Performance for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984

	SJVAPCD	40 CFR Part 60 Subpart Ka	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Storage vessel with a storage capacity > 40,000 gallons that is used to store petroleum liquids for which construction is commenced after May 19, 1978.	Similar applicability; District rule covers storage tanks with capacity down to 1,100 gallons.
Requirements	**1) <u>Organic Liquid Storage Tank</u>** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95%	**Requirements** - TVP ≥ 1.5 psia to ≤ 11.1 psia Equipped with an external floating roof (EFR), internal floating roof (IFR), a vapor recovery system (VRS) with control efficiency of 95%, or an equivalent system. - TVP > 11.1 psia Equipped with a VRS with CE of 95% **Requirement Reference** <u>External Floating Roof (EFR) (§60.112a(a)(1)):</u> - Consisting of a pontoon-type/double-deck-type cover that	For tanks with similar capacity, District rule is as stringent as this regulation.

	Group B with tank capacity > 19,800 to 39,600 gallons: - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95%	rests on the surface of the liquid contents & is equipped with a closure device between the tank wall & the roof edge. The closure device is to consist of two seals, one above the other. The lower seal is referred to as the primary seal and the upper seal is referred to as the secondary seal. <u>Internal Floating Roof (IFR) (§60.112a(a)(2)):</u> - Equipped with a closure device between the tank wall & the roof edge. The closure device is same as EFR above. <u>Vapor Recovery System (VRS) (§60.112a(a)(3)):</u> - A system which collects all VOC vapors & gases discharged from the storage vessel, and a vapor return or disposal system which is designed to process such VOC vapors and gases so as to reduce their emission to the atmosphere by at least 95% by weight.	

	Group B with tank capacity > 39,600 gallons: - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%		

NSPS Subpart Kb- Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

	SJVAPCD	40 CFR Part 60 Subpart Kb	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Storage vessel with a storage capacity > 19,813 gallons (75 m^3) that is used to store volatile organic liquid (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984.	Similar applicability; District rule covers storage tanks with capacity down to 1,100 gallons.
Requirements	**1) <u>Organic Liquid Storage Tank</u>** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95%	**Tank capacity ≥ 39,890 gallons (151 m^3)** - TVP ≥ 0.75 psia (5.2 kPa) to < 11.1 psia (76.6 kPa) Equipped with an internal floating roof (IFR), external floating roof (EFR), a closed vent system and control device with control efficiency of 95%, or an equivalent system. **Tank capacity ≥ 19,813 gallons (75 m^3) to < 39,890 gallons (151 m^3)** - TVP ≥ 4 psia (27.6 kPa) to < 11.1 psia (76.6 kPa)	For tanks with similar capacity, District rule is as stringent as this regulation.

	Group B with tank capacity > 19,800 to 39,600 gallons: - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%	Equipped with an IFR, EFR, a closed vent system and control device with CE of 95%, or an equivalent system. **Tank capacity ≥ 19,813 gallons (75 m^3)** - TVP ≥ 11.1 psia (76.6 kPa) Equipped with a closed vent system and control device with control efficiency of 95%, or an equivalent system. **Requirement Reference** <u>Internal Floating Roof (IFR) (§60.112b(a)(1)(ii)):</u> - Equipped with one of the following closure devices between the wall of the storage vessel & the edge of the internal floating roof: – A liquid-mounted seal – Two seals mounted one above the other, the lower seal may be vapor-mounted, but both must be continuous – A mechanical shoe seal <u>External Floating Roof (EFR) (§60.112b(a)(2)):</u> - Consisting of a pontoon-type/double-deck-type cover that rests on the surface of the liquid contents & is equipped with a closure device between the wall of the storage vessel & the roof edge. The closure device is to consist of two seals, one above the other. The lower seal is referred to as the primary seal and the upper seal is referred to as the secondary seal. <u>A closed vented system and control device (§60.112a(a)(3)):</u> - A closed vented system which collects all VOC vapors & gases discharged from the storage vessel. A control device which is designed & operated to reduce VOC emission by 95% or greater.	

	- TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%		

NESHAPS Subpart BBBBBB- Gasoline Distribution Facilities (Bulk Gasoline Terminal and Pipeline Breakout Stations

	SJVAPCD	40 CFR Part 63 Subpart BBBBBB	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Gasoline storage tank at bulk gasoline terminal, pipeline breakout station, pipeline pumping station, & bulk gasoline plant – *Area Source of HAP Emissions*	Similar applicability; District rule covers storage tanks with capacity down to 1,100 gallons.
Requirements	**1) Organic Liquid Storage Tank** **Group A with tank capacity 1,100 to 19,800 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia	**Tank capacity < 19,813 gallons (75 m^3) (Table 1, item 1(i))** - Equipped with a fixed roof & maintain all openings in a closed position at all times when not in use **Tank capacity < 39,890 gallons (151 m^3) and throughput < 480 gal/day (Table 1, item 1(ii))** - Equipped with a fixed roof & maintain all openings in a closed position at all times when not in use	For tanks with similar capacity, District rule is as stringent as this regulation.

	Pressure vessel or equipped with VRS with CE of 95% **Group B with tank capacity > 19,800 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with PVRV set within 10% max pressure, IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **Group C with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 1.5 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 1.5 psia to < 11 psia Equipped with IFR, EFR, or VRS with CE of 95% - TVP ≥ 11.0 psia Pressure vessel or equipped with VRS with CE of 95% **2) <u>Crude oil storage tanks in Crude Oil Production with an average daily throughput < 6,000 barrels from all operations within the county</u>** **Group A with tank capacity 1,100 to 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%	**Tank capacity ≥ 19,813 gallons (75 m^3) & not meeting criteria specified in item1 above:** - Equipped with a closed vent system and control device with control efficiency of 95% - Equipped with internal floating roof (IFR), external floating roof (EFR) **Requirement Reference** <u>Internal Floating Roof (IFR) (§63 Subpart 6B, Table 1, item 2(b))</u> - According requirements in §60.112b(a)(1), except the secondary seal requirements under §60.112b(a)(1)(ii)(B) <u>External Floating Roof (EFR) (§63 Subpart 6B, Table 1, item 2(c))</u> - According requirements in §60.112b(a)(2), except the secondary seal requirements under §60.112b(a)(2)(ii) <u>A closed vent system and control device (§63 Subpart 6B, Table 1, item 2(a))</u> - Reduce emissions of total organic HAP or TOC by 95% by weight with a control device specified in §60.112b(a)(3)	

	- TVP ≥ 11.0 psia Pressure vessel or equipped a VRS with CE of 95% **Group B with tank capacity > 39,600 gallons:** - TVP ≥ 0.5 psia to < 11 psia with throughput of > 50 to < 150 barrel/day Equipped with PVRV set to within 10% of max pressure, IFR, EFR, or VRS with 95% control efficiency - TVP ≥ 1.5 psia to < 11 psia with throughput ≥ 150 barrel/day Equipped with PVRV set to within 10% max pressure, IFR, EFR, or VRS with CE of 95%		

EPA 2016 Control Technologies Guidelines (CTG) for the Oil and Natural Gas Industry (EPA-453/B-16-001)

In 2016 EPA adopted a CTG addressing fugitive emissions in the oil and gas industry. It is important to note though that in March 2018 EPA proposed to withdraw this CTG, but has not taken final action on it as of July 2020.

The CTG includes design standards for some component types, e.g. pumps and compressors, and leak detection and repair requirements. The following table only compares the leak detection and repair requirements of Rule 4623 with those contained in the CTG.

	SJVAPCD	CTG	Conclusion
Applicability	Any tank with a capacity of 1,100 gallons or greater in which any organic liquid is placed, held, or stored.	Equipment used in the oil and gas industry	Rule 4623 and the CTG apply to similar source categories.
Requirements	**Leak Definition** <u>Liquid leak threshold</u>: drips liquid at a rate of more than three drops per minute <u>Gas leak threshold:</u> 10,000 ppmv **Leak Repair Time**	**Leak Repair Thresholds** - Well/compressor sites: 500 ppmv - Gas processing plants: - Pumps in light liquid service: 2,000 ppmv - Compressors: 500 ppmv	In general, the leak repair thresholds in the CTG are more stringent than in Rule 4623.

	- liquid leak >3 to <30 drops per min: 24 hrs - liquid leak >30 drops per min: 8 hrs - Gas Leak: 8 hrs	- Pressure relief devices: 500 ppmv - Valves: 500 ppmv - Pumps in heavy liquid service: 10,000 ppmv	

2.4. Other Control Technology Conclusion

As presented above, requirements contained in several District permits, BAAQMD Regulation 8 Rule 18, SCAQMD Rule 1173, and various federal and state regulations may have lower leak detection and repair thresholds for certain categories subject to Rule 4623.

3. OTHER DISTRICT RULES SUBJECT TO LDAR REQUIREMENTS

In addition to Rule 4623, other District rules that were also identified as needing further BARCT analysis have leak detection and repair (LDAR) requirements. District Rule 4454 (Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants), District Rule 4401 (Steam Enhanced Crude Oil Production Wells), District Rule 4624 (Transfer of Organic Liquids), and District Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities) were all identified to need further analysis as part of these AB 617 efforts. Initially, as identified in the table below[2], Rules 4623 and 4624 were scheduled for further BARCT analysis in 2020 and Rule 4401 in 2021.

As a part of the current further BARCT analysis, District staff assessed LDAR requirements for all five District Rules (4409, 4455, 4623, 4624, and 4401), and compared those requirements to other air district, state, and federal requirements for similar source categories. Based on this review, the District determined that in order to properly evaluate all the varying LDAR requirements currently contained within each of these five rules, a broader rule making effort is required consisting of a refined LDAR analysis of the five affected rules and an associated cost-effectiveness analysis of any potential LDAR enhancements. In addition, since the five affected District rules have similar but not identical LDAR requirements, by conducting an overall LDAR assessment for the five rules at once, the District will be able to ensure consistency and clarity of the District's findings.

As presented in the table below, the BARCT schedule commits to any necessary rulemaking between 2020 and 2022. According to the discussion above, the rulemaking process for the five rules will start in 2020, consistent with the schedule for Rules 4409 and 4455, while being in advance of the timeline identified for Rules 4623, 4624, and 4401. Overall, this combined analysis will allow the District to streamline the

[2] From the Expedited BARCT Implementation Schedule adopted by the Governing Board (12/20/2018). http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/December/final/13.pdf

LDAR assessment of the five rules, while expediting the rulemaking efforts for three of the five rules (Rules 4623, 4624, and 4401).

Rule	Title	BARCT Determination Status	BARCT Determination Schedule	BARCT Rulemaking Schedule (if necessary)
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	Scheduled	2019	2020
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants	Scheduled	2019	2020
4623	Storage of Organic Liquids	Scheduled	2020	2021
4624	Transfer of Organic Liquid	Scheduled	2020	2021
4401	Steam-Enhanced Crude Oil Production Wells	Scheduled	2021	2022

CONCLUSION

In conclusion, the BARCT analysis demonstrates that other regulations have more stringent LDAR requirements. Therefore, a rule making process will start in 2020 to establish BARCT for source categories subject to the LDAR requirements of Rule 4623. Similar BARCT analyses also demonstrate that other regulations have more stringent requirements than District Rules 4455, 4623, 4624, 4409,and 4401. Therefore, in order to address LDAR requirements consistently across the five District rules (4409, 4455, 4623, 4624, and 4401) the District will conduct a concurrent rule development process for these five rules.

The rule development process of District Rules 4409, 4455, 4623, 4624, and 4401 will evaluate the potentially more stringent LDAR requirements that have been identified and review existing rule exemptions to determine the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 06/01/20

District Rule 4624

Transfer of Organic Liquids

Applicability and Purpose:

District Rule 4624 applies to the following source categories:

Any organic liquid transfer facilities as defined in the rule.

The purpose of this rule is to limit volatile organic compound (VOC) emissions from the transfer of organic liquids.

Benchmarks Evaluated:

- BAAQMD Regulation 8 Rule 6 – Organic Liquid Bulk Terminals and Bulk Plants (4/24/18)
- BAAQMD Regulation 8 Rule 33 – Gasoline Bulk Terminals and Gasoline Cargo Tanks (4/24/18)
- BAAQMD Regulation 8 Rule 18 – Equipment Leaks (12/16/15)
- SCAQMD Rule 462 – Organic Liquid Loading (5/17/99)
- SCAQMD Rule 1173 – Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants (2/6/09)
- VCAPCD Rule 71.3 –Transfer of Reactive Organic Compound Liquids (6/16/92)
- VCAPCD Rule 74.10 –Components at Crude Oil and Natural Gas Production and Processing Facilities (3/10/98)
- SMAQMD Rule 447 – Organic Liquid Loading (4/2/98)
- CARB Subarticle 13: Greenhouse Gas Emissions Standards for Crude Oil and Natural Gas Facilities
- 40 CFR Part 60 Subpart XX
- 40 CFR Part 63 Subpart BBBBBB, EEEE
- EPA 2016 Control Technology Guideline for the Oil and Gas Industry (EPA-453/B-16-001)
- District Permit Requirements

Summary:

The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements:

- Other air districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. As part of this analysis, state and federal regulations were also reviewed. The analysis concluded that some LDAR regulations appeared to have more stringent requirements applicable to the source categories covered by Rules 4623.

Conclusion:

While District Rule 4624 has required the implementation of stringent LDAR programs that have resulted in significant reductions in VOC emissions, the District will begin a rule making process in 2020 to explore opportunities to enhance the stringency of the rule and ensure the continued implementation of BARCT by determining the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts of the source categories subject to Rule 4624. This effort is supported by the District's attached 2020 BARCT Rule Analysis.

2020 BARCT Rule Analysis

Rule 4624
Storage of Organic Liquids

Engineer: Dan Klevann, Sr. AQE
Reviewed By: Leonard Scandura, Permit Services Manager
Date: June 1, 2020

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4624 – Transfer of Organic Liquids determined that there may be potentially more stringent requirements in similar rules from other districts than the requirements from District's Rule 4624. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4624 satisfies BARCT requirements or if amendments to the rule may be necessary to ensure BARCT requirements are met.

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

DISCUSSION

District Rule 4624 applies to the following source categories:

Any organic liquid transfer facilities as defined in the rule.

The purpose of this rule is to limit volatile organic compound (VOC) emissions from the transfer of organic liquids.

FURTHER BARCT ANALYSIS

In the 2018 preliminary analyses of District Rule 4624, it was determined that there were other district rules and various federal and state requirements that may have leak detection and repair thresholds that are more stringent than current rule requirements.

1. RULE SURVEY

1.1. District Rule(s)

SJVAPCD Rule 4624 (12/20/07)

	SJVAPCD
Applicability	Class 1 organic liquid transfer facility: - Transferring ≥ 20K gal/day of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Transferring ≥ 4K but < 20K gal/ay of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Note: Rule 4624, section 3.20 defines organic liquid as any liquid which contains VOCs and has a TVP of 1.5 psia or greater at the storage container's max organic liquid storage temperature. Clean produced water, as defined by Rule 1020, and other types of liquids that contain no more than 35 milligrams of VOC per liter, shall not be considered to be an organic liquid.
Requirements	Class 1 organic liquid transfer facility: - 0.08 lb-VOC/K gal of organic liquid transferred, and use one of the following systems: o Bottom loading; o VOC vented to – a vapor collection & control system (VCCS); – a fixed roof container that meets the control requirements specified in Rule 4623; – a floating roof container that meets the control requirements specified in Rule 4623;

	– a pressure vessel equipped with an APCO-approved vapor recovery system (VRS) that meets the control requirements specified in Rule 4623; – a closed VOC emission control system Class 2 organic liquid transfer facility: - 95% controlled and use one of the following systems: o Bottom loading & equipped with a VCCS and the vapors from loading the tank truck, trailer, or railroad tank car shall be routed to the VCCS; o VOC vented to – a VCCS; – a fixed roof container that meets the control requirements specified in Rule 4623; – a floating roof container that meets the control requirements specified in Rule 4623; – a pressure vessel equipped with an APCO-approved VRS that meets the control requirements specified in Rule 4623; – a closed VOC emission control system

1.2. Bay Area AQMD Rule(s)

BAAQMD Regulation 8 Rule 6 (Organic Liquid Bulk Terminals and Bulk Plants) (4/24/18)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Bulk Plant (non-gasoline) - Annual throughput ≤ 6M gallons of organic liquids with TVP at least 0.5 psia Bulk Terminal (non-gasoline) - Annual throughput > 6M gallons of organic liquids with TVP at least 0.5 psia	District rule applies to organic liquids (both gasoline & non-gasoline) transfer facilities.

Requirements	Class 1 facility (daily throughput ≥ 20 K gal) - Equipped with a VCCS - Bottom fill loading - VOC limit of 0.08 lb/K gal Class 2 facility (daily throughput ≥ 4K gal & < 20K gal) - Equipped with a VCCS with CE of 95% - Bottom fill loading	Bulk Plant (non-gasoline): - Equipped with vapor recovery equipment (VRE) & VOC emission ≤ 0.35 lb/K gal of organic liquid loaded - Bottom loading with submerged fill pipe & VOC emission ≤ 0.35 lb/K gal of organic liquid loaded Bulk Terminal (non-gasoline): - Equipped with vapor control system with VOC emission ≤ 0.17 lb/K gal of organic liquid loaded	District rule are as stringent as or more stringent than this regulation.

BAAQMD Regulation 8 Rule 33 (Gasoline Bulk Terminals and Gasoline Cargo Tanks) (4/24/18)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Gasoline bulk terminals & gasoline cargo tanks	Same applicability
Requirements	Class 1 facility (daily throughput ≥ 20 K gal) - Equipped with a VCCS - Bottom fill loading - VOC limit of 0.08 lb/K gal Class 2 facility (daily throughput ≥ 4K gal & < 20K gal) - Equipped with a VCCS with CE of 95% - Bottom fill loading	Equipped with CARB certified VRS & bottom loading. VOC emissions from the VRS shall not greater than 0.04 lb/K gal of organic liquid transferred	BAAQMD rule has more stringent VOC emissions limit.

BAAQMD Regulation 8 Rule 18 (Equipment Leaks) (12/16/15)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Leaking components at organic liquid transfer equipment and any associated VOC collection and control systems.	Equipment leaks at petroleum refineries, chemical plants, bulk plants and bulk terminals including, but not limited to: valves, connectors, pumps, compressors, pressure relief devices, diaphragms, hatches, sight-glasses, fittings, sampling ports, meters, pipes, and vessels.	Rule 4624 (Transfer of Organic Liquid) apply to the same source categories as BAAQMD Reg 8 Rule 18.
Requirements	**Leak Definition** Liquid leak threshold: - Drips liquid at a rate of more than three drops per minute Gas leak threshold: - Organic lliquid storage- 1,000 ppmv - Gasoline storage – 10,000 ppmv **Leak Repair Time** - Liquid leak >3 drops per min: 72 hrs - Gas Leak: 72 hrs	**Leak Repair Thresholds** - Valve/Connector: 100 ppmv - Pump/Compressor/PRD: 500 ppmv **Leak Repair Time** - 7 day, 15 days or 7 days (APCO inspected) for PRD	BAAQMD has lower leak repair thresholds except for PRDs BAAQMD has less stringent repair times.

1.3. South Coast AQMD Rule(s)

SCAQMD Rule 462 (Organic Liquid Loading) (5/17/99)

	SJVAPCD	SCAQMD	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP of ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility:	Class A facility: - Daily throughput ≥ 20K gal of organic liquids into any tank truck, trailers, or railroad tank car Class B facility:	Similar applicability

	- Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP of ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	- (A) constructed before 1/9/76 with daily throughput > 4K gal & ≤ 20K gal of organic liquids, into any tank truck, trailers, or railroad tank car - (B) constructed before 1/9/76 with daily throughput ≤ 4K gal but annual throughput ≤ 500K gal of organic liquids, into any tank truck, trailers, or railroad tank car - (C) constructed after 1/9/76 with daily throughput ≤ 20K gal of organic liquids, into any tank truck, trailers, or railroad tank car Class C facility: - Constructed before 1/8/76 with daily throughput < 4K gal & annual throughput ≤ 500K gal of organic liquids, into any tank truck, trailers, or railroad tank car	
Requirements	Class 1 facility (daily throughput ≥ 20 K gal) - Equipped with a VCCS - Bottom fill loading - VOC limit of 0.08 lb/K gal Class 2 facility (daily throughput ≥ 4K gal & < 20K gal) - Equipped with a VCCS with CE of 95% - Bottom fill loading	Class A facility (daily throughput ≥ 20 K gal) - Equipped with CARB certified VRS with CE of 90% - bottom fill loading - VOC limit of 0.08 lb/K gal Class B facility (daily throughput < 20 K gal) - Equipped with CARB certified VRS with CE of 90% - Bottom fill loading Class C facility (throughput < 4K gal/day & < 500K gal/year) - Submerged fill loading or bottom loading	District rule are as stringent as or more stringent than this regulation.

SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants*)* (2/6/09)

	SJVAPCD	SCAQMD	Conclusion
Applicability	Leaking components at organic liquid transfer equipment and any associated VOC collection and control systems.	This rule applies to components at refineries, chemical plants, lubricating oil and grease re-refiners, marine terminals, oil and gas production fields, natural gas processing plants, and pipeline transfer stations.	Both rules address equipment leaks at transfer equipment.
Requirements	**Leak Definition** Liquid leak threshold: - Drips liquid at a rate of more than three drops per minute Gas leak threshold: - Organic lliquid storage- 1,000 ppmv - Gasoline storage – 10,000 ppmv **Leak Repair Time** - Liquid leak >3 drops per min: 72 hrs - Gas Leak: 72 hrs	**Leak Repair Thresholds** Valves/connections/flanges /pipes/pumps/compressors /polished rod stuffing boxes/others: - 500 ppmv vapor, gas, light liquid - 100 ppmv heavy liquid **Leak Repair Time** - 100 – 500 ppmv vapor, gas, light liquid – 7 days - 100 -500 ppmv heavy liquid – 7 days - Any leak 10,000 – 25,000 ppmv - 2 days - Pressure relief device 200 – 25,000 ppmv 2 days - Any leak > 25,000 ppmv - 1 day - Heavy liquid > 500 ppmv - 1 day - Light liquid >3 drops/min - 1 day Replace excessively leaking components (5 repair actions) or parts for LL > 3 drops/min, any > 10,000 ppmv, PRD > 200 ppmv with BACT or BARCT or vent it to an air pollution control device approved by the Executive Officer	The SCAQMD Rule has more stringent leak repair thresholds, than District Rule 4624 The SCAQMD rule requires retrofit requirement for excessively leaking components

1.4. Sacramento Metropolitan AQMD Rule(s)

SMAQMD Rule 447 (Organic Liquid Loading) (4/2/98)

	SJVAPCD	SMAQMD	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP of ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Bulk Plant - Received organic liquid from a refinery or bulk terminal by tank truck Bulk Terminal - Received organic liquid from the refinery by means other than truck	Similar applicability
Requirements	Class 1 facility (daily throughput ≥ 20 K gal) - Equipped with a VCCS - Bottom fill loading - VOC limit of 0.08 lb/K gal Class 2 facility (daily throughput ≥ 4K gal & < 20K gal) - Equipped with a VCCS with CE of 95% - Bottom fill loading	Bulk Plant: - VOC emission ≤ 0.6 lb/K gal of organic liquid loaded Bulk Terminal: - VOC emission ≤ 0.08 lb/K gal of organic liquid loaded	District rule are as stringent as or more stringent than this regulation

1.5. Ventura County APCD Rule(s)

VCAPCD Rule 71.3 (Transfer of Reactive Organic Compound Liquids) (6/16/92)

	SJVAPCD	VCAPCD	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Loading facility ≥ 20K gal/day of reactive organic compound (ROC) liquid with a MRVP of ≥ 1.5 psia, or with ≥ 150K gal/yr of ROC liquid with a MRVP of ≥ 0.5 psia	Similar applicability
Requirements	Class 1 facility (daily throughput ≥ 20 K gal) - Equipped with a VCCS - Bottom fill loading - VOC limit of 0.08 lb/K gal Class 2 facility (daily throughput ≥ 4K gal & < 20K gal) - Equipped with a VCCS with CE of 95% - Bottom fill loading	Loading facility equipped with VRS with CE of 90%, and bottom-loaded filling	District rule are as stringent as or more stringent than this regulation

VCAPCD Rule 74.10 (Components at Crude Oil and Natural Gas Production and Processing Facilities) (3/10/98)

	SJVAPCD	VCAPCD	Conclusion
Applicability	Leaking components at organic liquid transfer equipment and any associated VOC collection and control systems.	Crude oil and gas production facilities, pipeline transfer stations, and natural gas processing facilities.	VCAPCD rule applies to similar source categories as Rule 4624.
Requirements	**Leak Definition** Liquid leak threshold: - Drips liquid at a rate of more than three drops per minute Gas leak threshold: - Organic lliquid storage- 1,000 ppmv - Gasoline storage – 10,000 ppmv **Leak Repair Time** - liquid leak >3 drops per min: 72 hrs - Gas Leak: 72 hrs	**Leak Thresholds** - 1,000 ppmv - Minor liquid leak – 3 drops/min - Major liquid leak – continuous flow **Leak Repair Time** - Gas leak 1,000 -10,000 ppmv - 14 days - Gas leak 10,000 -50,000 ppmv - 5 days - Gas leak > 50,000 ppmv - 1 day - Minor Liquid leak - 2 days - Major Liquid leak - 1 day If leaks are excessive, replace compressor seal, pump seal, or pressure relief device or retrofit the leaking component with Best Available Control Technology (BACT) equipment, for major gas leak or minor liquid leak from critical equipment replace or retrofit with BACT <10% VOC exemption	VCAPCD has more stringent leak repair thresholds than Rule 4624. Leak repair time periods are generally less stringent. Both rules have retrofit requirements for excessively leaking components and have < 10% VOC exemption

1.6. Rule Survey Conclusion

As presented above, the BAAQMD Regulation 8 Rule 33 has more stringent emission limits. Also BAAQMDRegulation 8 Rule 18, and SCAQMD Rule 1173, have more stringent leak repair thresholds and repair times than Rule 4624. VCAPCD Rule 74.10 leak thresholds are slightly more stringent than Rule 4624.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

In a review of District Permits, no organic liquid transfer permits were located that had more stringent requirements than the vapor recovery system as defined in Section 5.4 and the inspection and repair requirements of Rule 4624.

2.2. State Regulations – ATCMs and other rules

There is one ATCM that applies to the same equipment as Rule 4624.

CARB Title 17, Div. 3, Ch. 1, Subchapter 8, Article 1

	Requirements
Applicability	- Gasoline Bulk Plants - Gasoline Bulk Terminals

Requirements	Gasoline Bulk Plants
	
	- Equipped with a VRS certified under Vapor Recovery Certification Procedure CP-202:
	  ○ CE of 90%;
	  ○ VOC limit of 0.84 lb/K gal loaded
	
	Gasoline Bulk Terminals
	
	- Equipped with a VRS certified under Vapor Recovery Certification Procedure CP-203:
	  ○ CE of 96.5%;
	  ○ VOC limit of 0.29 lb/K gal loaded

On March 23, 2017 CARB adopted a new rule to reduce greenhouse gas emissions from oil and gas operations (Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities). While the rule

targets methane emissions reductions, it has a collateral benefit of reducing VOC emissions from leaking components as well.

The CARB rule imposes equipment standards on several different types of equipment and imposes leak detection and repair requirements on all equipment used in the subject industry types. The leak detection and repair requirements began on January 1, 2018. The leak repair thresholds are lower effective January 1, 2020.

Below is a comparison of Rule 4623 requirements to the January 1, 2020 leak detection and repair requirements of the CARB rule.

	SJVAPCD	CARB rule	Conclusion
Applicability	Leaking components at organic liquid transfer equipment and any associated VOC collection and control systems.	Onshore and offshore crude oil or natural gas production, Crude oil, condensate, and produced water separation and storage, Natural gas underground storage, Natural gas gathering and boosting stations, Natural gas processing plants; and, Natural gas transmission compressor stations.	The CARB rule applies to oil and gas production and handling facilities, including storage tanks. They have the similar applicability.
Requirements	**Leak Definition** <u>Liquid leak threshold</u>: - Drips liquid at a rate of more than three drops per minute <u>Gas leak threshold:</u> - Organic lliquid storage- 1,000 ppmv - Gasoline storage – 10,000 ppmv **Leak Repair Time** - liquid leak >3 drops per min: 72 hrs - Gas Leak: 72 hrs	**Leak Repair Threshold** - 1,000 ppmv **Leak Repair Time** - 1,000 – 9,999 ppmv – 14 days - 10,000 – 49,000 ppmv – 5 days - >50,000 ppmv – 2 days For components that have had 5 repair actions with 12 months must be replaced.	In general, the leak repair thresholds in the CARB rule are more stringent than in Rule 4623. The leak repair times in the CARB rule are generally less stringent than Rule 4623.

2.3. Federal Regulations – CFR and Control Technique Guidance document

40 CFR Part 60 Subpart XX – Standards of Performance for Bulk Gasoline Terminals

	SJVAPCD	40 CFR Part 60 Subpart XX	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Transfer racks at a bulk gasoline terminal, which deliver liquid products into gasoline tank trucks and that commenced construction or modification after December 17, 1980.	Similar applicability.
Requirements	Class 1 facility (daily throughput ≥ 20 K gal) - Equipped with a VCCS - Bottom fill loading - VOC limit of 0.08 lb/K gal Class 2 facility (daily throughput ≥ 4K gal & < 20K gal) - Equipped with a VCCS with CE of 95% - Bottom fill loading	- Loading rack equipped with a vapor recovery system (VRS) - VOC limit of 0.67 lb/K gal loaded	District Rule 4624 is more stringent than the NSPS.

40 CFR Part 63 Subpart BBBBBB – Gasoline Distribution Facilities (Bulk Gasoline Terminal and Pipeline Breakout Stations

	SJVAPCD	40 CFR Part 63 Subpart BBBBBB	Conclusion
Applicability	Class 1 organic liquid transfer facility: - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility: - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Transfer racks at bulk gasoline terminal, pipeline breakout station, pipeline pumping station, & bulk gasoline plant – *Area Source of HAP emissions*	Similar applicability.

Requirements	Class 1 facility (daily throughput ≥ 20 K gal)
	
	- Equipped with a VCCS
	- bottom fill loading
	- VOC limit of 0.08 lb/K gal
	
	Class 2 facility (daily throughput ≥ 4K gal & < 20K gal)
	
	- Equipped with a VCCS with CE of 95%
	- bottom fill loading
	–
		Bulk Gasoline Terminal
		
		- Throughput ≥ 250K gal/day (Table 2, item 1):
		  ○ Loading rack equipped with a VRS
		  ○ VOC limit of 0.67 lb/K gal loaded
		
		- Throughput < 250K gal/day (Table 2, item 2):
		  ○ Use submerged filling with a submerged fill pipe that is no more than 6 inches from the bottom of the cargo tank
			District Rule 4624 is more stringent than the NESHAPS.

40 CFR Part 63 Subpart EEEE – Organic Liquids Distribution (Non-Gasoline

	SJVAPCD	40 CFR Part 63 Subpart EEEE	Conclusion
Applicability	Class 1 organic liquid transfer facility - Daily throughput ≥ 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars. Class 2 organic liquid transfer facility - Daily throughput ≥ 4K gal & < 20K gal of organic liquids with a TVP ≥ 1.5 psia to or from tank trucks, trailers, or railroad tank cars.	Transfer racks at organic liquid distribution (OLD) (non-gasoline) operations – *Major source of HAP emissions* - Existing facility with throughput ≥ 8M gal/yr but < 10M gal/yr (Table 2, item 7) - Existing facility with throughput ≥ 10M gal/yr (Table 2, item 8) - New facility with throughput < 8M gal/yr (Table 2, item 9) - New facility with throughput ≥ 8M gal/yr (Table 2, item 10)	Similar applicability.

Requirements	Class 1 facility (daily throughput ≥ 20 K gal)
	
	- Equipped with a VCCS
	- Bottom fill loading
	- VOC limit of 0.08 lb/K gal
	
	Class 2 facility (daily throughput ≥ 4K gal & < 20K gal)
	
	- Equipped with a VCCS with CE of 95%
	- Bottom fill loading
		Transfer racks
		
		- Existing facility with throughput ≥ 8M gal/yr but < 10M gal/yr (Table 2, item 7):
		  ○ Equipped with a vapor recovery system with CE of 98%, OR
		  ○ Exhaust concentration ≤ 20 ppmv, on a dry basis corrected to 3% O2 for combustion devices using supplemental combustion air, OR
		  ○ During the loading, comply with the work practice standards specified in item 3 of table of this subpart.
		
		- Existing facility with throughput ≥ 10M gal/yr (Table 2, item 8):
		  ○ Equipped with a vapor recovery system with CE of 98%
			In general, NESHAPS requirements are slightly more stringent than the District Rule.

		- New facility with throughput < 8M gal/yr, with loading ≥ 25% by weight & is being loaded into transport vehicle (Table 2, item 9.a): ○ Equipped with a vapor recovery system with CE of 98% - New facility with throughput < 8M gal/yr, with filling a container with capacity ≥ 55 gal (Table 2, item 9.b): ○ Comply with §63.924 – 63.927 of 40 CFR 63, Subpart PP, OR ○ Comply with the work practice standards specified in item 3.a of table 4 to this subpart - New facility with throughput ≥ 8M gal/yr, with filling transport vehicle (Table 2, item 10.a): ○ Equipped with a vapor recovery system with CE of 98% - New facility with throughput ≥ 8M gal/yr, with filling a container with capacity ≥ 55 gal (Table 2, item 10.b): ○ Comply with §63.924 – 63.927 of 40 CFR 63, Subpart PP, OR ○ Comply with the work practice standards specified in item 3.a of table 4 to this subpart.	

EPA 2016 Control Technologies Guidelines (CTG) for the Oil and Natural Gas Industry (EPA-453/B-16-001)

In 2016 EPA adopted a CTG addressing fugitive emissions in the oil and gas industry. It is important to note though that in March 2018 EPA proposed to withdraw this CTG, but has not taken final action on it as of July 2020.

The CTG includes design standards for some component types, e.g. pumps and compressors, and leak detection and repair requirements. The following table only compares the leak detection and repair requirements of Rule 4624 with those contained in the CTG.

	SJVAPCD	CTG	Conclusion
Applicability	Leaking components at organic liquid transfer equipment and any associated VOC collection and control systems.	Equipment used in the oil and gas industry	Rule 4624 and the CTG apply to similar source categories.
Requirements	**Leak Definition** Liquid leak threshold: - Drips liquid at a rate of more than three drops per minute Gas leak threshold: - Organic lliquid storage- 1,000 ppmv - Gasoline storage – 10,000 ppmv **Leak repair time** - liquid leak >3 drops per min: 72 hrs - Gas Leak: 72 hrs	**Leak Repair Thresholds** - Well/compressor sites: 500 ppmv - Gas processing plants: - Pumps in light liquid service: 2,000 ppmv - Compressors: 500 ppmv - Pressure relief devices: 500 ppmv - Valves: 500 ppmv - Pumps in heavy liquid service: 10,000 ppmv	In general, the leak repair thresholds in the CTG are more stringent than in Rule 4624.

2.4. Other Control Technology Conclusion

As presented above, the requirements contained in several District permits, BAAQMD Regulation 8 Rule 12, SCAQMD Rule 1173, and various federal and state regulations may have lower leak detection and repair thresholds for certain categories subject to Rule 4624.

3. OTHER DISTRICT RULES SUBJECT TO LDAR REQUIREMENTS

In addition to Rule 4624, other District rules that were also identified as needing further BARCT analysis have leak detection and repair (LDAR) requirements. District Rule 4454 (Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants), District Rule 4401 (Steam Enhanced Crude Oil Production Wells), District Rule 4623 (Storage of Organic Liquids), and District Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities) were all identified to need further analysis as part of these AB 617 efforts. Initially, as identified in the table below[2], Rules 4623 and 4624 were scheduled for further BARCT analysis in 2020 and Rule 4401 in 2021.

As a part of the current further BARCT analysis, District staff assessed LDAR requirements for all five District Rules (4409, 4455, 4623, 4624, and 4401), and compared those requirements to other air district, state, and federal requirements for similar source categories. Based on this review, the District determined that in order to properly evaluate all the varying LDAR requirements currently contained within each of these five rules, a broader rule making effort is required consisting of a refined LDAR analysis of the five affected rules and an associated cost-effectiveness analysis of any potential LDAR enhancements. In addition, since the five affected District rules have similar but not identical LDAR requirements, by conducting an overall LDAR assessment for the five rules at once, the District will be able to ensure consistency and clarity of the District's findings.

As presented in the table below, the BARCT schedule commits to any necessary rulemaking between 2020 and 2022. According to the discussion above, the rulemaking process for the five rules will start in 2020, consistent with the schedule for Rules 4409 and 4455, while being in advance of the timeline identified for Rules 4623, 4624, and 4401. Overall, this combined analysis will allow the District to streamline the LDAR assessment of the five rules, while expediting the rulemaking efforts for three of the five rules (Rules 4623, 4624, and 4401).

[2] From the Expedited BARCT Implementation Schedule adopted by the Governing Board (12/20/2018). http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/December/final/13.pdf

Rule	Title	BARCT Determination Status	BARCT Determination Schedule	BARCT Rulemaking Schedule (if necessary)
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	Scheduled	2019	2020
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants	Scheduled	2019	2020
4623	Storage of Organic Liquids	Scheduled	2020	2021
4624	Transfer of Organic Liquid	Scheduled	2020	2021
4401	Steam-Enhanced Crude Oil Production Wells	Scheduled	2021	2022

CONCLUSION

In conclusion, the BARCT analysis demonstrates that other regulations have more stringent LDAR requirements. Therefore, a rule making process will start in 2020 to establish BARCT for source categories subject to the LDAR requirements of Rule 4624. Similar BARCT analyses also demonstrate that other regulations have more stringent requirements than District Rules 4455, 4623, 4624, 4409,and 4401. Therefore, in order to address LDAR requirements consistently across the five District rules (4409, 4455, 4623, 4624, and 4401) the District will conduct a concurrent rule development process for these five rules.

The rule development process of District Rules 4409, 4455, 4623, 4624, and 4401 will evaluate the potentially more stringent LDAR requirements that have been identified and review existing rule exemptions to determine the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.

AB 617 Best Available Retrofit Control Technology (BARCT) Analysis

Date Completed: 06/01/20

District Rule 4401

Steam-Enhanced Crude Oil Production Wells

Applicability and Purpose:

District Rule 4401 applies to the following source categories:

All steam-enhanced crude oil production wells and any associated VOC collection and control systems.

The purpose of this rule is to limit volatile organic compound (VOC) emissions from the transfer of steam-enhaced crude oil production wells. The rule further defines a component (which includes, but is not limited to) as "any valve, fitting, threaded connection, pump, compressor, pressure relief device, pipe, polished rod."

Benchmarks Evaluated:

- BAAQMD Regulation 8 Rule 18 – Equipment Leaks (12/16/15)
- SCAQMD Rule 1148 – Thermally Enhanced Oil Recovery Wells (11/5/82)
- SCAQMD Rule 1173 – Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants (2/6/09)
- VCAPCD Rule 74.10 –Components at Crude Oil and Natural Gas Production and Processing Facilities (3/10/98)
- CARB Subarticle 13: Greenhouse Gas Emissions Standards for Crude Oil and Natural Gas Facilities
- 40 CFR Part 60 Subpart OOOOa
- EPA 2016 Control Technology Guideline for the Oil and Gas Industry (EPA-453/B-16-001)
- District Permit Requirements

Summary:

The District's preliminary BARCT analysis identified potential control options that may be more stringent than current rule requirements:

- Other air districts' rules, including Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), and Ventura County APCD (VCAPCD) were reviewed. As part of this analysis, state and federal regulations were also reviewed. The analysis concluded that some LDAR regulations appeared to have more stringent requirements applicable to the source categories covered by Rules 4401.

Conclusion:

While District Rule 4401 has required the implementation of stringent LDAR programs that have resulted in significant reductions in VOC emissions, the District will begin a rule making process in 2020 to explore opportunities to enhance the stringency of the rule and ensure the continued implementation of BARCT by determining the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts of the source categories subject to Rule 4401. This effort is supported by the District's attached 2020 BARCT Rule Analysis.

2020 BARCT Rule Analysis

Rule 4401
Steam-Enhanced Crude Oil Production Wells

Engineer: **Dan Klevann, Sr. AQE**
Reviewed By: **Leonard Scandura, Permit Services Manager**
Date: **June 1, 2020**

INTRODUCTION

In September of 2017, the California State Legislature and Governor passed Assembly Bill 617 (AB 617)[1], Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants. AB 617 requires the California Air Resources Board (ARB) and air districts to develop and implement additional emissions reporting, monitoring, and reduction plans and measures in an effort to reduce air pollution exposure in impacted communities. One requirement of AB617 is for air districts located in non-attainment areas to perform a Best Available Retrofit Control Technology (BARCT) analysis of their existing rules and regulations for all categories of units located at facilities subject to the state Cap-and-Trade program and to propose an expedited schedule for revising rules that are found to not meet BARCT requirements.

Although AB 617 does not specifically define BARCT, California Health and Safety Code (CH&SC) Section 40406 defines BARCT as follows:

> *Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.*

AB 617 further recognizes that "existing law authorizes a district to establish its own best available control technology requirement based upon the consideration of specified factors."

In 2018, a preliminary AB 617 Best Available Retrofit Control Technology (BARCT) analysis of Rule 4401 – Steam-Enhanced Crude Oil Production Wells determined that there may be potentially more stringent requirements in similar rules from other districts than the requirements from District's Rule 4401. This document performs a refined and more in-depth analysis to determine if the existing SJVAPCD Rule 4401 satisfies BARCT requirements or if amendments to the rule may be necessary to ensure BARCT requirements are met.

[1] AB 617, Garcia, C., Chapter 136, Statutes of 2017.

DISCUSSION

District Rule 4401 applies to the following source categories:

> *All steam-enhanced crude oil production wells and any associated VOC collection and control systems.*

The purpose of this rule is to limit VOC emissions from steam-enhanced crude oil production wells.

FURTHER BARCT ANALYSIS

In the 2018 preliminary analyses of District Rule 4401, it was determined that there were other district rules and various federal and state requirements that may have leak detection and repair thresholds that are more stringent than current rule requirements.

1. RULE SURVEY

1.1. District Rule(s)

SJVAPCD Rule 4401 (6/16/11)

	SJVAPCD
Applicability	Leaking components at steam-enhanced crude oil production wells.
Requirements	Leak detection and repair program required for controlling leaks with specific thresholds, repair timetables, number of allowable leaks for compliance, administrative recordkeeping. Leak repair threshold for valves/connections/flanges/pipes/pumps/compressors/polished rod stuffing boxes/others: - 2,000 ppmv gas service Leak repair threshold for pressure relief devices: - 400 ppmv gas service

1.2. Bay Area AQMD Rule(s)

BAAQMD Regulation 8 Rule 18 (Equipment Leaks) (12/16/15)

	SJVAPCD	BAAQMD	Conclusion
Applicability	Leaking components at steam-enhanced crude oil production wells and any associated VOC collection and control systems.	Equipment leaks at petroleum refineries, chemical plants, bulk plants and bulk terminals including, but not limited to: valves, connectors, pumps, compressors, pressure relief devices, diaphragms, hatches, sight-glasses, fittings, sampling ports, meters, pipes, and vessels.	BAAQMD Reg 8 Rule 18 applies to source categories different from those covered by Rule 4401. District Rules 4455 (refineries/chemical plants), Rule 4623 (organic liquid storage), and Rule 4624 (Transfer of Organic Liquid) apply to the same source categories as BAAQMD Reg 8 Rule 18. As such, the requirements of Rule 4401 are not directly comparable to BAAQMD Reg 8, Rule 18 for specific categories of sources.

The Bay Area AQMD Regulation 8 Rule 18 for equipment leaks does not contain requirements for the source categories subject to Rule 4401.

1.3. South Coast AQMD Rule(s)

SCAQMD Rule 1148 (Thermally Enhanced Oil Recovery Wells) (11/5/82)

	SJVAPCD	SCAQMD	Conclusion
Applicability	All steam-enhanced crude oil production wells and any associated VOC collection and control systems.	All steam-enhanced crude oil production wells and any associated VOC collection and control systems.	Same applicability
Requirements	Rule 4401 requires total uncontrolled VOC emissions be reduced by at least 99 percent Rule 4401 requires an operator to maintain an Inspection and Maintenance	Rule 1148 limits ROG emissions from wells to 4.5 pounds per day or less; or If the steam drive wells are connected to a vapor control system, ROG emissions from the control system shall average no	Using CARB's emissions factor for uncontrolled steam drive well of 220 lb-VOC/day, Rule 4401's 99% control (2.2 lb/day) is more stringent than Rule 1148's 4.5 lb/day

	Program on any vapor collection and control system associated with the operation	more than 4.5 pounds per day per connected well.	

SCAQMD Rule 1173 (Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants*)* (2/6/09)

	SJVAPCD	SCAQMD	Conclusion
Applicability	This rule applies to All steam-enhanced crude oil production wells and any associated VOC collection and control systems.	This rule applies to components at refineries, chemical plants, lubricating oil and grease re-refiners, marine terminals, oil and gas production fields, natural gas processing plants, and pipeline transfer stations.	In addition to the source categories subject to Rule 4401, SCAQMD Rule 1173 also applies to source categories different from those covered by Rule 4401. District Rules 4455 (refineries/chemical plants), Rule 4409 (light crude oil, natural gas production facilities) Rule 4623 (organic liquid storage), and Rule 4624 (transfer of organic liquid) apply to the additional source categories subject to SCAQMD Rule 1173.
Requirements	Minor liquid leak threshold: drips liquid at a rate of more than three drops per Minute Major Liquid Leak threshold: visible mist or a continuous flow of liquid that is not seal lubricant. Minor gas leak threshold: - Pressure Relif Devices: 400 to 10,000 ppmv - Other components: 2,000 to 10,000 ppmv Major gas leak threshold: - Pressure Relif Devices: > 10,000 ppmv	Valves/connections/flanges/pipes /pumps/compressors/polished rod stuffing boxes/others: - 500 ppmv vapor, gas, light liquid - 100 ppmv heavy liquid Leak repair time: - 100 – 500 ppmv vapor, gas, light liquid – 7 days - 100 -500 ppmv heavy liquid – 7 days - Any leak 10,000 – 25,000 ppmv - 2 days - Pressure relief device 200 – 25,000 ppmv - 2 days - Any leak > 25,000 ppmv - 1 day - Heavy liquid > 500 ppmv -1 day - Light liquid >3 drops/min - 1 day	The SCAQMD Rule has more stringent leak repair thresholds and repair times, except for PRD, than District Rule 4401 Additionally, the SCAQMD rule has lower LDAR requirements for all heavy liquids. The SCAQMD rule requires retrofit requirement for excessively leaking components

	- Other components: > 10,000 ppmv Leak repair times: - Minor liquid leak: 3 days - Major liquid leak: 2 days - Minor gas leak: 14 days - Major Gas Leak ≤ 50,000 ppmv: 2 days - Gas Leak > 50,000 ppmv: 2 days	Replace excessively leaking components (5 repair actions) or parts for LL > 3 drops/min, any > 10,000 ppmv, PRD > 200 ppmv with BACT or BARCT or vent it to an air pollution control device approved by the Executive Officer	

1.4. Sacramento Metropolitan AQMD Rule(s)

The Sacramento Metropolitan AQMD does not have any rules for steam enhanced production wells.

1.5. Ventura County APCD Rule(s)

VCAPCD Rule 74.10 (Components at Crude Oil and Natural Gas Production and Processing Facilities) (3/10/98)

	SJVAPCD	VCAPCD	Conclusion
Applicability	This rule applies to All steam-enhanced crude oil production wells and any associated VOC collection and control systems.	Crude oil and gas production facilities, pipeline transfer stations, and natural gas processing facilities.	VCAPCD rule applies to similar source categories as Rule 4401.
Requirements	Minor leak repair threshold for valves/connections/ flanges /pipes/pumps/ compressors /polished rod stuffing boxes /others: - 2,000 ppmv gas service Minor leak repair threshold for pressure relief devices: - 400 ppmv gas service Major leak threshold for all: - 10,000 ppmv Minor liquid leak threshold: drips liquid at a rate of more than three drops per minute.	Leak threshold: 1,000 ppmv Minor liquid leak – 3 drops/min Major liquid leak – continuous flow Leak Repair Time: - Gas leak 1,000 -10,000 ppmv - 14 days - Gas leak 10,000 -50,000 ppmv- 5 days - Gas leak > 50,000 ppmv – 1 day - Minor Liquid leak - 2 days - Major Liquid leak - 1 day If leaks are excessive, replace compressor seal, pump seal, or	VCAPCD has more stringent leak repair thresholds than Rule 4401. Leak repair time periods are generally less stringent. Both rules have retrofit requirements for excessively

	Major Liquid Leak threshold: visible mist or a continuous flow of liquid that is not seal lubricant. Leak repair time: - 2000 -10,000 ppmv, 7 days - 10,000 -50,000 ppmv, 3 days - >50,000 ppmv, 2 days - Liquid, 2 days - PRD, 400 – 10,000 ppmv, 7 days For components that have had 5 major leaks: replace component, vent component to vapor control system, or remove component from operation	pressure relief device or retrofit the leaking component with Best Available Control Technology (BACT) equipment, for major gas leak or minor liquid leak from critical equipment replace or retrofit with BACT <10% VOC exemption	leaking components and have < 10% VOC exemption

1.6. Rule Survey Conclusion

As presented above, the BAAQMD, and SCAQMD, rules have lower leak repair thresholds and repair times than Rule 4401. VCAPCD's rule is slightly more stringent than Rule 4401.

2. OTHER POTENTIAL RETROFIT CONTROL TECHNOLOGIES/EMISSION LIMITS

2.1. District Permitted Sources

In a review of District Permits, no steam-enhanced crude oil production wells permits were located that had more stringent requirements than the VOC collection and control system as defined in Section 3.0 (minimum of 99% control) and the inspection and repair requirements of Rule 4401.

2.2. State Regulations – ATCMs and other rules

There is no ATCM that applies to the same equipment as Rule 4401.

On March 23, 2017 CARB adopted a new rule to reduce greenhouse gas emissions from oil and gas operations (Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities). While the rule targets methane emissions reductions, it has a collateral benefit of reducing VOC emissions from leaking components as well.

The CARB rule imposes equipment standards on several different types of equipment and imposes leak detection and repair requirements on all equipment used in the subject industry types. The leak detection and repair requirements began on January 1, 2018. The leak repair thresholds are lower effective January 1, 2020.

Below is a comparison of Rule 4401 requirements to the January 1, 2020 leak detection and repair requirements of the CARB rule.

	SJVAPCD	CARB rule	Conclusion
Applicability	This rule applies to All steam-enhanced crude oil production wells and any associated VOC collection and control systems.	Onshore and offshore crude oil or natural gas production, Crude oil, condensate, and produced water separation and storage, Natural gas underground storage, Natural gas gathering and boosting stations, Natural gas processing plants; and, Natural gas transmission compressor stations.	The CARB rule applies to oil and gas production and handling facilities, similar to Rule 4401. The CARB rule also applies to facilities handling natural gas (which is primarily methane and not a VOC) that are not subject to Rule 4401.
Requirements	Minor liquid leak threshold: drips liquid at a rate of more than three drops per Minute Major Liquid Leak threshold: visible mist or a continuous flow of liquid that is not seal lubricant. Minor gas leak threshold: - Pressure Relief Devices: 400 to 10,000 ppmv - Other components: 2,000 to 10,000 ppmv	Leak repair threshold: - 1,000 ppmv Leak repair time: - 1,000 – 9,999 ppmv, 14 days - 10,000 – 49,000 ppmv, 5 days - >50,000 ppmv, 2 days For components that have had 5 repair actions with 12 months must be replaced.	The CARB rule has more stringent leak repair thresholds for all but one category specified in Rule 4401. The leak repair times in the CARB rule are generally less stringent than Rule 4401.

	Major gas leak threshold: - Pressure Relief Devices: > 10,000 ppmv - Other components: > 10,000 ppmv Leak repair time - Minor liquid leak: 3 days - Major liquid leak: 2 days - Minor gas leak: 14 days - Major Gas Leak ≤ 50,000 ppmv: 2 days - Gas Leak > 50,000 ppmv: 2 days		

2.3. Federal Regulations – CFR and Control Technique Guidance document

NSPS Subpart OOOOa

40 CFR Subpart OOOOa Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced after September 18, 2015 imposes equipment standards on several different types of new/modified/reconstructed equipment and imposes leak detection and repair requirements such equipment. It is important to note that NSPS subpart OOOOa is not a retrofit requirement for existing, unmodified equipment.

The Subpart OOOOa includes design standards for some component types, e.g. pumps and compressors, and leak detection and repair requirements. The following table only compares the leak detection and repair requirements of Rule 4401 with those contained in NSPS Subpart OOOOa.

Below is a comparison of Rule 4401 requirements to the leak detection and repair requirements Subpart OOOOa.

	SJVAPCD	NSPS Subpart OOOOa LDAR requirements	Conclusion
Applicability	This rule applies to All steam-enhanced crude oil production wells and any associated VOC collection and control systems.	Components at well sites and compressor stations	NSPS Subpart OOOOa only to new and modified equipment at oil/gas facilities, where Rule 4401 applies to existing and new equipment at oil/gas facilities.

			As such, Rule 4401 applicability is broader than NSPS Subpart OOOOa.
Requirements	Minor liquid leak threshold: drips liquid at a rate of more than three drops per Minute Major Liquid Leak threshold: visible mist or a continuous flow of liquid that is not seal lubricant. Minor gas leak threshold: - Pressure Relief Devices: 400 to 10,000 ppmv - Other components: 2,000 to 10,000 ppmv Major gas leak threshold: - Pressure Relief Devices: > 10,000 ppmv - Other components: > 10,000 ppmv Leak repair time - Minor liquid leak: 3 days - Major liquid leak: 2 days - Minor gas leak: 14 days - Major Gas Leak $\leq$ 50,000 ppmv: 2 days - Gas Leak > 50,000 ppmv: 2 days	Leak repair thresholds Well/compressor sites: - 500 ppmv Gas processing plants: Pumps in light liquid service: - 2,000 ppmv Compressors: - 500 ppmv Pressure relief devices: - 500 ppmv Valves: - 500 ppmv Pumps in heavy liquid service: - 10,000 ppmv	In general, the leak repair thresholds in NSPS Subpart OOOOa are more stringent than in Rule 4401 for new and modified equipment, only.

EPA 2016 Control Technologies Guidelines (CTG) for the Oil and Natural Gas Industry (EPA-453/B-16-001)

In 2016 EPA adopted a CTG addressing fugitive emissions in the oil and gas industry. It is important to note though that in March 2018 EPA proposed to withdraw this CTG, but has not taken final action on it as of July 2020.

The CTG includes design standards for some component types, e.g. pumps and compressors, and leak detection and repair requirements. The following table only compares the leak detection and repair requirements of Rule 4401 with those contained in the CTG.

	SJVAPCD	CTG	Conclusion
Applicability	This rule applies to all steam-enhanced crude oil production wells and any associated VOC collection and control systems.	Equipment used in the oil and gas industry	Rule 4401 and the CTG apply to similar source categories.
Requirements	Minor liquid leak threshold: drips liquid at a rate of more than three drops per Minute Major Liquid Leak threshold: visible mist or a continuous flow of liquid that is not seal lubricant. Minor gas leak threshold: - Pressure Relief Devices: 400 to 10,000 ppmv - Other components: 2,000 to 10,000 ppmv Major gas leak threshold: - Pressure Relief Devices: > 10,000 ppmv - Other components: > 10,000 ppmv Leak repair time - Minor liquid leak: 3 days - Major liquid leak: 2 days - Minor gas leak: 14 days - Major Gas Leak $\leq$ 50,000 ppmv: 2 days - Gas Leak > 50,000 ppmv: 2 days	Leak repair thresholds Well/compressor sites: - 500 ppmv Gas processing plants: Pumps in light liquid service: - 2,000 ppmv Compressors: - 500 ppmv Pressure relief devices: - 500 ppmv Valves: - 500 ppmv Pumps in heavy liquid service: - 10,000 ppmv	In general, the leak repair thresholds in the CTG are more stringent than in Rule 4401.

2.4. Other Control Technology Conclusion

As presented above, the requirements contained in several District permits, SCAQMD Rule 1173, and various federal and state regulations may have more stringent leak detection and repair thresholds for certain categories subject to Rule 4401.

3. OTHER DISTRICT RULES SUBJECT TO LDAR REQUIREMENTS

In addition to Rule 4401, other District rules that were also identified as needing further BARCT analysis have leak detection and repair (LDAR) requirements. District Rule 4454 (Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants), District Rule 4623 (Storage of Organic Liquids), District Rule 4624 (Transfer of Organic Liquids), and District Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities) were all identified to need further analysis as part of these AB 617 efforts. Initially, as identified in the table below[2], Rules 4623 and 4624 were scheduled for further BARCT analysis in 2020 and Rule 4401 in 2021.

As a part of the current further BARCT analysis, District staff assessed LDAR requirements for all five District Rules (4409, 4455, 4623, 4624, and 4401), and compared those requirements to other air district, state, and federal requirements for similar source categories. Based on this review, the District determined that in order to properly evaluate all the varying LDAR requirements currently contained within each of these five rules, a broader rule making effort is required consisting of a refined LDAR analysis of the five affected rules and an associated cost-effectiveness analysis of any potential LDAR enhancements. In addition, since the five affected District rules have similar but not identical LDAR requirements, by conducting an overall LDAR assessment for the five rules at once, the District will be able to ensure consistency and clarity of the District's findings.

As presented in the table below, the BARCT schedule commits to any necessary rulemaking between 2020 and 2022. According to the discussion above, the rulemaking process for the five rules will start in 2020, consistent with the schedule for Rules 4409 and 4455, while being in advance of the timeline identified for Rules 4623, 4624, and 4401. Overall, this combined analysis will allow the District to streamline the LDAR assessment of the five rules, while expediting the rulemaking efforts for three of the five rules (Rules 4623, 4624, and 4401).

Rule	Title	BARCT Determination Status	BARCT Determination Schedule	BARCT Rulemaking Schedule (if necessary)
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	Scheduled	2019	2020
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants	Scheduled	2019	2020

[2] From the Expedited BARCT Implementation Schedule adopted by the Governing Board (12/20/2018). http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/December/final/13.pdf

4623	Storage of Organic Liquids	Scheduled	2020	2021
4624	Transfer of Organic Liquid	Scheduled	2020	2021
4401	Steam-Enhanced Crude Oil Production Wells	Scheduled	2021	2022

CONCLUSION

In conclusion, the BARCT analysis demonstrates that other regulations have more stringent LDAR requirements. Therefore, a rule making process will start in 2020 to establish BARCT for source categories subject to the LDAR requirements of Rule 4401. Similar BARCT analyses also demonstrate that other regulations have more stringent requirements than District Rules 4455, 4623, 4624, and 4409. Therefore, in order to address LDAR requirements consistently across the five District rules (4409, 4455, 4623, 4624, and 4401) the District will conduct a concurrent rule development process for these five rules.

The rule development process of District Rules 4409, 4455, 4623, 4624, and 4401 will evaluate the potentially more stringent LDAR requirements that have been identified and review existing rule exemptions to determine the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source.