AECOM
625 West Ridge Pike, Suite E-100
Conshohocken, PA 19428
610.234.5402 tel

December 16, 2022

Regional Program Manager
PA Department of Environmental Protection
Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18711-0790

Subject: VOC RACT 3 Proposal Submission
Victaulic Company – Alburtis Facility
Alburtis Borough, Lehigh County, PA
Title V Operating Permit No. 39-00069

Dear Sir / Madam:

On behalf of Victaulic Company (Victaulic), AECOM Technical Services, Inc. (AECOM) has prepared this submission to satisfy the requirements of 25 Pa. Code 129.96-129.100, *Additional RACT Requirements for Major Sources of NOx and VOCs* for Victaulic's Alburtis Facility located at 8023 Quarry Road, Alburtis, PA 18011-9529. The Alburtis facility is a major source of VOCs and currently operates under Title V Operating Permit 39-00069.

On October 24, 2016 Victaulic submitted a "VOC RACT 2 Proposal" which documented the costs associated with installing VOC controls on source ID's 104 (Pouring / Casting Operations (P005)) and, 106 (Sand Handling System (P007)). These two sources were both over the VOC RACT threshold and did not have a promulgated presumptive RACT.

As documented in the October 24, 2016 submittal (included as Attachment B), these two VOC sources consist of high flow, low mass emissions consisting of a multitude of VOC species. These types of streams are generally treated by thermal oxidation or carbon adsorption. Furthermore, as described in their submittal, controlling VOC emission from 104 and 106 would require additional particulate control prior to the VOC control. There are additional significant capital and technological considerations described in the October 24, 2016 submittal; however, the conclusion of that submittal was that there are no control technologies available that are cost effective assuming a RACT benchmark of $7,000 or less per ton of VOC removed.

Since that October 24, 2016 submittal, there have been no modifications to these sources and no other changes to the facility that would significantly impact (i.e. reduce) the costs associated with the procurement and installation of VOC controls. Victaulic had utilized a cost adjustment factor based on inflation from the Federal Bureau of Labor Statistics (BLS) from 1998 (when the US EPA published its cost estimation tool for the installation of emissions controls) to 2016. This escalation factor was $1.46 (2016) / $1.00 (1998). Currently, this escalation factor is $1.84 (2022 – October)/ $1.00. Furthermore, the cost of labor has also increased a commensurate factor according to similar BLS data. As a result, Victaulic asserts that its previous RACT II evaluation and conclusions are still valid and that there are no additional VOC controls that can be installed

This submittal includes this cover letter along with the following:

- Attachment A – Responsible Official Certification;
- Attachment B – October 24, 2016 RACT II Submittal;
- Attachment C – RACT III Submittal.

AECOM
625 West Ridge Pike, Suite E-100
Conshohocken, PA 19428
610.234.5402 tel

If you have any questions on this application, please do not hesitate to contact Kevin Voit at 610-529-0613 or Kraig Hume, Global Environmental Manager for Victaulic at Kraig.Hume@victualic.com or 610-559-3476

Sincerely,

Kevin Voit
Manager, Air Permitting and Compliance Services
kevin.voit@aecom.com

Attachment A – Responsible Official Certification

VOC RACT 3 Proposal Submission
Victaulic Company – Alburtis Facility
Alburtis Borough, Lehigh County, PA
Title V Operating Permit No. 39-00069

Certification of Truth, Accuracy and Completeness by a Responsible Official

I certify that, subject to the penalties of Title 18 Pa. C.S.A. Section 4904 and 35 P.S. Section 4009(b)(2), I am the responsible official having primary responsibility for the design and operation of the facilities to which this submittal applies and that the information provided in this application is true, accurate, and complete to the best of my knowledge, information, and belief formed after reasonable inquiry.

(Signed) DocuSigned by: Pete Zelesnikar 920DBD1871CB40C... Date: 12/16/2022

Name (Typed): Pete Zelesnikar Title: Lehigh Valley Foundries Manager

Telephone: (610) 559-3405

Email: pete.zelesnikar@victaulic.com

Attachment B – Previous RACT II Submittal

October 24, 2016

Regional Air Program Manager
PA Department of Environmental Protection
Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18711-0790

VIA CERTIFIED MAIL 7011 2970 0001 8743 6318

Re: VOC RACT 2 Proposal Submission
Victaulic Company - Alburtis Facility
Alburtis Borough, Lehigh County, Pennsylvania
Title V Operating Permit No. 39-00069

Dear Sir/Madam:

Victaulic Company (Victaulic) has prepared this submission to satisfy the requirements of 25 Pa. Code §§129.96-129.100, *Additional RACT Requirements for Major Sources of NOx and VOCs* for its Victaulic Company-Alburtis Facility located at 8023 Quarry Road, Alburtis, PA 18011. The Alburtis Facility is a major source of volatile organic compounds (VOCs) and currently operates under Title V Operating Permit 39-00069.

The Alburtis Facility manufactures ductile iron pipe fittings with functions including a foundry, surface coating, and distribution operations. Along with the VOC sources subject to 25 Pa. Code §129.99(d) (RACT 2 Proposal), there are other VOC sources that either are not applicable since the source's potential to emit is less than 1 tpy (e.g., 103: Inoculation (P003)) or are subject to and comply with 25 Pa. Code §129.52 (e.g., 108: Paint Dip Operation (2 Tanks)(P009)). The remainder of this document will address the sources subject to the RACT 2 Proposal requirements.

Sources Subject to Alternative RACT Requirements & their Permit Limits/Capacity

Source ID	Source Name	Capacity	Operating Hours
104	Pouring/ Casting Operations (P005)	12 tons of metal/ hour	8,760 hours/year
106	Sand Handling System (P007)		

Physical Description of Sources Subject to Alternative RACT Requirements

- *104: Pouring/Casting Operations (P005) – SCC 3-04-003-20*
  The source of VOCs is the volatilization of organic materials contained within the casting sand and cores. The VOCs are liberated the moment the 2700°F molten iron is poured into the sand mold. The Alburtis Foundry has two (2) separate sand molding machines, two (2) Disamatic molding machines. Each sand molding machine has one (1) pouring zone for a facility total of two (2) pouring zones.

4901 Kesslersville Road
Easton, PA 18040 USA

610-559-3300
610-250-8817 (fax)

Particulate matter emissions from the Pouring/Casting Operations source are currently ducted to one of two (2) large baghouses. The combined exhaust volume is approximately 15,000 cubic feet per minute to exhaust the Pouring/Casting Operations. Due to the particulate loading from this source, the RACT analysis will include the installation of a dedicated baghouse to prevent fouling of the VOC control devise.

- *106: Sand Handling System (P007) – SCC 3-04-003-31*
  The source of the VOCs in the casting shake-out area is the continued volatilization of organic material from the time the molten iron is poured into the sand mold. Once poured on one of the two (2) molding lines, the castings cool and are conveyed to one of two (2) Didion rotary drum shake-out units where the sand is tumbled away from the iron castings.

  Particulate matter emissions from the Sand Handling System source are currently ducted to one of two (2) large baghouses. The combined exhaust volume is approximately 43,770 cubic feet per minute to exhaust the Sand Handling System. Due to the particulate loading from this source, the RACT analysis will include the installation of a dedicated baghouse to prevent fouling of the VOC control devise.

Actual & Potential VOC Emissions of Source Subject to Alternative RACT Requirements

Source ID	Source Name	2015 Actual VOC Emissions	Potential to Emit Emissions
104	Pouring/ Casting Operations (P005)	3.37 tpy	7.36 tpy
106	Sand Handling System (P007)	1.18 tpy	63.07 tpy

RACT Analysis of Sources Subject to Alternative RACT Requirements

As described above, the VOC sources to be controlled consist of high flow, low mass emissions consisting of a multitude of volatile organic species. Due to these overall characteristics, control technologies that are generally employed to successfully treat low-concentration VOC air streams are thermal oxidation and carbon adsorption.

As described above, 104: Pouring/Casting Operations and 106: Sand Handling System are exhausted to two (2) dust collectors, which also control other non-applicable sources. Prior to VOC removal using the identified technologies, primary treatment of these streams for particulate matter would be required to prevent fouling and malfunction. For the purpose of this evaluation, it is assumed that a new dedicated pulse-jet, modular collector would be provided to the RACT-applicable sources prior to VOC control, as the alternative (providing VOC control for all the collectors' exhaust volume) would be unnecessary, impractical, and more costly on a capital and operating basis.

Some other key assumptions made in the control technology evaluation are as follows:

- Even though the facility currently has effective particulate matter control, the existing hoods and capture systems are not designed for VOC capture. The capture efficiencies have never been determined as it relates to VOCs. Thus, 90% capture efficiency of VOCs was assumed for the evaluation.
- For the thermal oxidation control technology, a 99% destruction efficiency was assumed. Various heat recovery scenarios (0%, 35%, 50%, and 70%) were evaluated.

- For the carbon adsorption control technology, an 85% adsorption efficiency was assumed.
- The baghouse designs were based on Victaulic's current standardized approach of modular design, bag type and size, and an air-to-cloth ratio of 4. Waste disposal and utility costs were not accounted in the cost estimates, because these were assumed to be already incurred through existing baghouse collection systems.
- For the thermal oxidation control technology where annual costs were evaluated at the various heat recovery rates, a 1-to-1 cost savings was conservatively assumed for each BTU recovered.
- No costs associated with building modifications or site preparations were included.

Attachments A and B detail the capital and annual costs, as well as the VOC reduction cost rates associated with thermal oxidation and carbon adsorption control technologies, respectively. Below is a summary of the RACT Analysis for both control technologies; only the thermal oxidation 0% and 70% heat recovery scenarios are presented. As can be seen, none of the control technologies are cost effective assuming a RACT benchmark of $7,000 or less per ton of VOC removed.

Summary of VOC RACT Analysis

Control Technology	Potential Emissions	Overall Control Efficiency *(Capture x Control)*	Emissions After Control	Annualized Cost ($/year) *(Capital + Operating)*	Cost Effectiveness ($/ton of VOC reduced)
104: Pouring/Casting Operations (P005)					
Thermal Oxidation – 0% Heat Recovery	7.36 tpy	89.1%	0.80 tpy	$2,966,000	$452,000
Thermal Oxidation – 70% Heat Recovery		89.1%	0.80 tpy	$533,000	$81,000
Carbon Adsorption		76.5%	1.73 tpy	$3,402,000	$604,000
106: Sand Handling System (P007)					
Thermal Oxidation – 0% Heat Recovery	63.07 tpy	89.1%	6.87 tpy	$7,855,000	$140,000
Thermal Oxidation – 70% Heat Recovery		89.1%	6.87 tpy	$2,857,000	$51,000
Carbon Adsorption		76.5%	14.82 tpy	$8,803,000	$182,000

Should you have any questions, please do not hesitate to contact me at (610) 559-3476 or kraig.hume@victaulic.com.

Sincerely,

Kraig L. Hume, CHMM
Manager, Environmental Engineering

Attachment A: Thermal Oxidizer
Attachment B: Carbon Adsorption

cc: Rocco Bara, Victaulic-Alburtis Facility Plant Manager

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Attachment A-Thermal Oxidation

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-1
Thermal Oxidation
Cost Summary

Total Thermal Oxidizer Installed Cost Estimate		
Technology Description:	Thermal Oxidizer	
Category		**Cost**
0% Heat Recovery		
Sand Handling (SH)	$	356,772
Casting Pouring (CP)	$	277,245
35% Heat Recovery		
Sand Handling (SH)	$	598,397
Casting Pouring (CP)	$	452,531
50% Heat Recovery		
Sand Handling (SH)	$	692,059
Casting Pouring (CP)	$	529,394
70% Heat Recovery		
Sand Handling (SH)	$	864,111
Casting Pouring (CP)	$	661,147

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-2
Thermal Oxidation
Cost Summary

Total Dust Collector Installed Cost Estimate		
Technology Description:	Dust Collector	
Category		**Cost**
0% Heat Recovery		
Sand Handling (SH)	$	544,009
Casting Pouring (CP)	$	189,356
35% Heat Recovery		
Sand Handling (SH)	$	544,009
Casting Pouring (CP)	$	189,356
50% Heat Recovery		
Sand Handling (SH)	$	544,009
Casting Pouring (CP)	$	189,356
70% Heat Recovery		
Sand Handling (SH)	$	544,009
Casting Pouring (CP)	$	189,356

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-3
Thermal Oxidation
Cost Summary

Annual Cost Estimate		
Technology Description:	Thermal Oxidizer & Dust Collector	
Category		**Cost**
0% Heat Recovery		
Sand Handling (SH)	$	7,855,315
Casting Pouring (CP)	$	2,966,066
35% Heat Recovery		
Sand Handling (SH)	$	5,356,618
Casting Pouring (CP)	$	2,123,046
50% Heat Recovery		
Sand Handling (SH)	$	4,281,163
Casting Pouring (CP)	$	1,761,012
70% Heat Recovery		
Sand Handling (SH)	$	2,856,564
Casting Pouring (CP)	$	532,892

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-4
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Technology Description:	Thermal Oxidizer & Dust Collector	
Category	**Cost of Control ($/ton)**	
0% Heat Recovery		
Sand Handling (SH)	$	139,786
Casting Pouring (CP)	$	452,299
35% Heat Recovery		
Sand Handling (SH)	$	95,321
Casting Pouring (CP)	$	323,746
50% Heat Recovery		
Sand Handling (SH)	$	76,184
Casting Pouring (CP)	$	268,539
70% Heat Recovery		
Sand Handling (SH)	$	50,833
Casting Pouring (CP)	$	81,261

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-5
Thermal Oxidation
Cost Summary

Installed Cost Estimate[(1)(2)]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 0% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	45,404		
Heat Recovery (%):	0		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 221,597**
Thermal Oxidizer (EC)			**$ 187,794**
Intrumentation	10%	EC	$ 18,779
Sales Tax	3%	EC	$ 5,634
Freight	5%	EC	$ 9,390
Direct Installation Costs (DIC)			**$ 66,479**
Foundations and supports	8%	PEC	$ 17,728
Handling and erection	14%	PEC	$ 31,024
Electrical	4%	PEC	$ 8,864
Piping	2%	PEC	$ 4,432
Insulation for ductwork	1%	PEC	$ 2,216
Painting	1%	PEC	$ 2,216
Indirect Installation Costs (IIC)			**$ 68,695**
Engineering	10%	PEC	$ 22,160
Construction and field expenses	5%	PEC	$ 11,080
Contractor fees	10%	PEC	$ 22,160
Start-up	2%	PEC	$ 4,432
Performance test	1%	PEC	$ 2,216
Contingencies	3%	PEC	$ 6,648
Total Capital Investment (PEC + DIC + IIC)			**$ 356,772**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-6
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 0% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	734,000		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	299,100		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 7,423,924**
Operating Labor			
Operator	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Utilities			
Natural Gas	-	-	$ 7,340,000
Electricity	-	-	$ 20,937
Indirect Annual Costs (IAC)			**$ 95,233**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 7,135
Property Taxes	1% of Total Capital Investment	-	$ 3,568
Insurance	1% of Total Capital Investment	-	$ 3,568
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$ 43,169

Total Annual Costs (DAC + IAC)	**$ 7,519,157**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-7
Thermal Oxidation
Cost Summary

Installed Cost Estimate[(1)(2)(3)]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 0% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	43,770			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**248,406**
Fabric Filter System (EC)				**$210,506**
Fabric Filter with Insulation				$185,406
Bags & Cages				$25,100
Auxilary Equipment				
Intrumentation	10%	EC	$	21,100
Sales Tax	3%	EC	$	6,300
Freight	5%	EC	$	10,500
Direct Installation Costs (DC)			**$**	**183,820**
Foundations and supports	4%	PEC	$	9,936
Handling and erection	50%	PEC	$	124,203
Electrical	8%	PEC	$	19,872
Piping	1%	PEC	$	2,484
Insulation for ductwork	7%	PEC	$	17,388
Painting	4%	PEC	$	9,936
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**111,783**
Engineering	10%	PEC	$	24,841
Construction and field expenses	20%	PEC	$	49,681
Contractor fees	10%	PEC	$	24,841
Start-up	1%	PEC	$	2,484
Performance test	1%	PEC	$	2,484
Contingencies	3%	PEC	$	7,452
Total Capital Investment (PEC + DC + IC)			**$**	**544,009**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-8
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 0% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**174,187**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	5,020
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**161,972**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	10,880
Property Taxes	1% of Total Capital Investment	-	$	5,440
Insurance	1% of Total Capital Investment	-	$	5,440
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	38,711
Total Annual Costs (DAC + IAC)			**$**	**336,158**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-9
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Sand Handling - 0% Recovery	
Design Inputs:		
VOC Controlled (tons):	57	
Dust Collector		
Annual Cost ($) [1]	$	336,158
Thermal Oxidizer		
Annual Cost ($) [1]	$	7,519,157
Total		
Annual Cost ($) [1]	$	7,855,315
Cost of Control ($/ton)	$	139,786

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-10
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 35% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	45,404		
Heat Recovery (%):	35		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 371,675**
Thermal Oxidizer (EC)			**$ 314,979**
Intrumentation	10%	EC	$ 31,498
Sales Tax	3%	EC	$ 9,449
Freight	5%	EC	$ 15,749
Direct Installation Costs (DIC)			**$ 111,503**
Foundations and supports	8%	PEC	$ 29,734
Handling and erection	14%	PEC	$ 52,035
Electrical	4%	PEC	$ 14,867
Piping	2%	PEC	$ 7,434
Insulation for ductwork	1%	PEC	$ 3,717
Painting	1%	PEC	$ 3,717
Indirect Installation Costs (IIC)			**$ 115,219**
Engineering	10%	PEC	$ 37,168
Construction and field expenses	5%	PEC	$ 18,584
Contractor fees	10%	PEC	$ 37,168
Start-up	2%	PEC	$ 7,434
Performance test	1%	PEC	$ 3,717
Contingencies	3%	PEC	$ 11,150
Total Capital Investment (PEC + DIC + IIC)			**$ 598,397**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-11
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 35% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	477,100		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	747,700		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 4,886,326**
Operating Labor			
Operator	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Utilities			
Natural Gas	-	-	$ 4,771,000
Electricity	-	-	$ 52,339
Indirect Annual Costs (IAC)			**$ 134,134**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 11,968
Property Taxes	1% of Total Capital Investment	-	$ 5,984
Insurance	1% of Total Capital Investment	-	$ 5,984
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$ 72,406
Total Annual Costs (DAC + IAC)			**$ 5,020,460**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-12
Thermal Oxidation
Cost Summary

Installed Cost Estimate[(1)(2)(3)]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 35% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	43,770			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**248,406**
Fabric Filter System (EC)				**$210,506**
Fabric Filter with Insulation				$185,406
Bags & Cages				$25,100
Auxilary Equipment				
Intrumentation	10%	EC	$	21,100
Sales Tax	3%	EC	$	6,300
Freight	5%	EC	$	10,500
Direct Installation Costs (DC)			**$**	**183,820**
Foundations and supports	4%	PEC	$	9,936
Handling and erection	50%	PEC	$	124,203
Electrical	8%	PEC	$	19,872
Piping	1%	PEC	$	2,484
Insulation for ductwork	7%	PEC	$	17,388
Painting	4%	PEC	$	9,936
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**111,783**
Engineering	10%	PEC	$	24,841
Construction and field expenses	20%	PEC	$	49,681
Contractor fees	10%	PEC	$	24,841
Start-up	1%	PEC	$	2,484
Performance test	1%	PEC	$	2,484
Contingencies	3%	PEC	$	7,452
Total Capital Investment (PEC + DC + IC)			**$**	**544,009**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-13
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 35% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**174,187**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	5,020
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**161,972**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	10,880
Property Taxes	1% of Total Capital Investment	-	$	5,440
Insurance	1% of Total Capital Investment	-	$	5,440
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	38,711
Total Annual Costs (DAC + IAC)			**$**	**336,158**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-14
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Sand Handling - 35% Recovery	
Design Inputs:		
VOC Controlled (tons):	57	
Dust Collector		
Annual Cost ($) [1]	$	336,158
Thermal Oxidizer		
Annual Cost ($) [1]	$	5,020,460
Total		
Annual Cost ($) [1]	$	5,356,618
Cost of Control ($/ton)	$	95,321

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-15
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 50% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	45,404		
Heat Recovery (%):	50		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 429,850**
Thermal Oxidizer (EC)			**$ 364,280**
Intrumentation	10%	EC	$ 36,428
Sales Tax	3%	EC	$ 10,928
Freight	5%	EC	$ 18,214
Direct Installation Costs (DIC)			**$ 128,955**
Foundations and supports	8%	PEC	$ 34,388
Handling and erection	14%	PEC	$ 60,179
Electrical	4%	PEC	$ 17,194
Piping	2%	PEC	$ 8,597
Insulation for ductwork	1%	PEC	$ 4,299
Painting	1%	PEC	$ 4,299
Indirect Installation Costs (IIC)			**$ 133,254**
Engineering	10%	PEC	$ 42,985
Construction and field expenses	5%	PEC	$ 21,493
Contractor fees	10%	PEC	$ 42,985
Start-up	2%	PEC	$ 8,597
Performance test	1%	PEC	$ 4,299
Contingencies	3%	PEC	$ 12,896
Total Capital Investment (PEC + DIC + IIC)			**$ 692,059**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-16
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 50% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	367,000		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	897,200		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 3,795,791**
Operating Labor			
Operator	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Utilities			
Natural Gas	-	-	$ 3,670,000
Electricity	-	-	$ 62,804
Indirect Annual Costs (IAC)			**$ 149,214**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 13,841
Property Taxes	1% of Total Capital Investment	-	$ 6,921
Insurance	1% of Total Capital Investment	-	$ 6,921
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$ 83,739

Total Annual Costs (DAC + IAC)	**$ 3,945,005**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-17
Thermal Oxidation
Cost Summary

Installed Cost Estimate[(1)(2)(3)]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 50% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	43,770			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**248,406**
Fabric Filter System (EC)				**$210,506**
Fabric Filter with Insulation				$185,406
Bags & Cages				$25,100
Auxilary Equipment				
Intrumentation	10%	EC	$	21,100
Sales Tax	3%	EC	$	6,300
Freight	5%	EC	$	10,500
Direct Installation Costs (DC)			**$**	**183,820**
Foundations and supports	4%	PEC	$	9,936
Handling and erection	50%	PEC	$	124,203
Electrical	8%	PEC	$	19,872
Piping	1%	PEC	$	2,484
Insulation for ductwork	7%	PEC	$	17,388
Painting	4%	PEC	$	9,936
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**111,783**
Engineering	10%	PEC	$	24,841
Construction and field expenses	20%	PEC	$	49,681
Contractor fees	10%	PEC	$	24,841
Start-up	1%	PEC	$	2,484
Performance test	1%	PEC	$	2,484
Contingencies	3%	PEC	$	7,452
Total Capital Investment (PEC + DC + IC)			**$**	**544,009**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-18
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 50% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**174,187**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	5,020
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**161,972**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	10,880
Property Taxes	1% of Total Capital Investment	-	$	5,440
Insurance	1% of Total Capital Investment	-	$	5,440
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	38,711
Total Annual Costs (DAC + IAC)			**$**	**336,158**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-19
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Sand Handling - 50% Recovery	
Design Inputs:		
VOC Controlled (tons):	57	
Dust Collector		
Annual Cost ($) [1]	$	336,158
Thermal Oxidizer		
Annual Cost ($) [1]	$	3,945,005
Total		
Annual Cost ($) [1]	$	4,281,163
Cost of Control ($/ton)	$	76,184

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-20
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 70% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	45,404		
Heat Recovery (%):	70		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 536,715**
Thermal Oxidizer (EC)			**$ 454,843**
Intrumentation	10%	EC	$ 45,484
Sales Tax	3%	EC	$ 13,645
Freight	5%	EC	$ 22,742
Direct Installation Costs (DIC)			**$ 161,014**
Foundations and supports	8%	PEC	$ 42,937
Handling and erection	14%	PEC	$ 75,140
Electrical	4%	PEC	$ 21,469
Piping	2%	PEC	$ 10,734
Insulation for ductwork	1%	PEC	$ 5,367
Painting	1%	PEC	$ 5,367
Indirect Installation Costs (IIC)			**$ 166,382**
Engineering	10%	PEC	$ 53,671
Construction and field expenses	5%	PEC	$ 26,836
Contractor fees	10%	PEC	$ 53,671
Start-up	2%	PEC	$ 10,734
Performance test	1%	PEC	$ 5,367
Contingencies	3%	PEC	$ 16,101
Total Capital Investment (PEC + DIC + IIC)			**$ 864,111**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-21
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Sand Handling - 70% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	220,200		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	1,121,500		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost		Cost
Direct Annual Costs (DAC)			**$**	**2,343,492**
Operating Labor				
Operator	0.5 hr/shift	$34.30/hr	$	18,779
Supervisor	15% of operator	-	$	2,817
Maintenance				
Labor	0.5 hr/shift	$37.80/hr	$	20,696
Materials	100% of maintenance labor	-	$	20,696
Utilities				
Natural Gas	-	-	$	2,202,000
Electricity	-	-	$	78,505
Indirect Annual Costs (IAC)			**$**	**176,914**
Overhead	60% of Operating and Maintenance	-	$	37,792
Administrative Charges	2% of Total Capital Investment	-	$	17,282
Property Taxes	1% of Total Capital Investment	-	$	8,641
Insurance	1% of Total Capital Investment	-	$	8,641
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$	104,558

Total Annual Costs (DAC + IAC)	**$ 2,520,406**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-22
Thermal Oxidation
Cost Summary

Installed Cost Estimate[(1)(2)(3)]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 70% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	43,770			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**248,406**
Fabric Filter System (EC)				**$210,506**
Fabric Filter with Insulation				$185,406
Bags & Cages				$25,100
Auxilary Equipment				
Intrumentation	10%	EC	$	21,100
Sales Tax	3%	EC	$	6,300
Freight	5%	EC	$	10,500
Direct Installation Costs (DC)			**$**	**183,820**
Foundations and supports	4%	PEC	$	9,936
Handling and erection	50%	PEC	$	124,203
Electrical	8%	PEC	$	19,872
Piping	1%	PEC	$	2,484
Insulation for ductwork	7%	PEC	$	17,388
Painting	4%	PEC	$	9,936
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**111,783**
Engineering	10%	PEC	$	24,841
Construction and field expenses	20%	PEC	$	49,681
Contractor fees	10%	PEC	$	24,841
Start-up	1%	PEC	$	2,484
Performance test	1%	PEC	$	2,484
Contingencies	3%	PEC	$	7,452
Total Capital Investment (PEC + DC + IC)			**$**	**544,009**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-23
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling - 70% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**174,187**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	5,020
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**161,972**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	10,880
Property Taxes	1% of Total Capital Investment	-	$	5,440
Insurance	1% of Total Capital Investment	-	$	5,440
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	38,711
Total Annual Costs (DAC + IAC)			**$**	**336,158**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-24
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Sand Handling - 70% Recovery	
Design Inputs:		
VOC Controlled (tons):	57	
Dust Collector		
Annual Cost ($) [1]	$	336,158
Thermal Oxidizer		
Annual Cost ($) [1]	$	2,520,406
Total		
Annual Cost ($) [1]	$	2,856,564
Cost of Control ($/ton)	$	50,833

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-25
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 0% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	15,560		
Heat Recovery (%):	0		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 172,202**
Thermal Oxidizer (EC)			**$ 145,934**
Intrumentation	10%	EC	$ 14,593
Sales Tax	3%	EC	$ 4,378
Freight	5%	EC	$ 7,297
Direct Installation Costs (DIC)			**$ 51,660**
Foundations and supports	8%	PEC	$ 13,776
Handling and erection	14%	PEC	$ 24,108
Electrical	4%	PEC	$ 6,888
Piping	2%	PEC	$ 3,444
Insulation for ductwork	1%	PEC	$ 1,722
Painting	1%	PEC	$ 1,722
Indirect Installation Costs (IIC)			**$ 53,383**
Engineering	10%	PEC	$ 17,220
Construction and field expenses	5%	PEC	$ 8,610
Contractor fees	10%	PEC	$ 17,220
Start-up	2%	PEC	$ 3,444
Performance test	1%	PEC	$ 1,722
Contingencies	3%	PEC	$ 5,166
Total Capital Investment (PEC + DIC + IIC)			**$ 277,245**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-26
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 0% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	252,000		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	102,500		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 2,590,162**
Operating Labor			
Operator	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Utilities			
Natural Gas	-	-	$ 2,520,000
Electricity	-	-	$ 7,175
Indirect Annual Costs (IAC)			**$ 82,429**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 5,545
Property Taxes	1% of Total Capital Investment	-	$ 2,772
Insurance	1% of Total Capital Investment	-	$ 2,772
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$ 33,547
Total Annual Costs (DAC + IAC)			**$ 2,672,591**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-27
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2][3]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 0% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	15,000			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**86,464**
Fabric Filter System (EC)				**$73,264**
Fabric Filter with Insulation				$64,464
Bags & Cages				$8,800
Auxilary Equipment				
Intrumentation	10%	EC	$	7,300
Sales Tax	3%	EC	$	2,200
Freight	5%	EC	$	3,700
Direct Installation Costs (DC)			**$**	**63,983**
Foundations and supports	4%	PEC	$	3,459
Handling and erection	50%	PEC	$	43,232
Electrical	8%	PEC	$	6,917
Piping	1%	PEC	$	865
Insulation for ductwork	7%	PEC	$	6,052
Painting	4%	PEC	$	3,459
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**38,909**
Engineering	10%	PEC	$	8,646
Construction and field expenses	20%	PEC	$	17,293
Contractor fees	10%	PEC	$	8,646
Start-up	1%	PEC	$	865
Performance test	1%	PEC	$	865
Contingencies	3%	PEC	$	2,594
Total Capital Investment (PEC + DC + IC)			**$**	**189,356**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-28
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 0% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**170,927**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	1,760
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**122,549**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	3,787
Property Taxes	1% of Total Capital Investment	-	$	1,894
Insurance	1% of Total Capital Investment	-	$	1,894
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	13,474
Total Annual Costs (DAC + IAC)			**$**	**293,475**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-29
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Casting Pouring - 0% Recovery	
Design Inputs:		
VOC Controlled (tons):	7	
Dust Collector		
Annual Cost ($) [1]	$	293,475
Thermal Oxidizer		
Annual Cost ($) [1]	$	2,672,591
Total		
Annual Cost ($) [1]	$	2,966,066
Cost of Control ($/ton)	$	452,299

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-30
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]				
Technology Description:	Thermal Oxidizer			
Process Description:	Casting Pouring - 35% Recovery			
Design Inputs:				
Volumetric flowrate (scfm): (500 - 50,000)	15,560			
Heat Recovery (%):	35			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**281,075**
Thermal Oxidizer (EC)			**$**	**238,200**
Intrumentation	10%	EC	$	23,820
Sales Tax	3%	EC	$	7,146
Freight	5%	EC	$	11,910
Direct Installation Costs (DIC)			**$**	**84,323**
Foundations and supports	8%	PEC	$	22,486
Handling and erection	14%	PEC	$	39,351
Electrical	4%	PEC	$	11,243
Piping	2%	PEC	$	5,622
Insulation for ductwork	1%	PEC	$	2,811
Painting	1%	PEC	$	2,811
Indirect Installation Costs (IIC)			**$**	**87,133**
Engineering	10%	PEC	$	28,108
Construction and field expenses	5%	PEC	$	14,054
Contractor fees	10%	PEC	$	28,108
Start-up	2%	PEC	$	5,622
Performance test	1%	PEC	$	2,811
Contingencies	3%	PEC	$	8,432
Total Capital Investment (PEC + DIC + IIC)			**$**	**452,531**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-31
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 35% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	163,800		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	256,200		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 1,718,921**
Operating Labor			
Operator	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Utilities			
Natural Gas	-	-	$ 1,638,000
Electricity	-	-	$ 17,934
Indirect Annual Costs (IAC)			**$ 110,650**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 9,051
Property Taxes	1% of Total Capital Investment	-	$ 4,525
Insurance	1% of Total Capital Investment	-	$ 4,525
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$ 54,756

Total Annual Costs (DAC + IAC)	**$ 1,829,571**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-32
Thermal Oxidation
Cost Summary

Installed Cost Estimate[(1)(2)(3)]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 35% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	15,000			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**86,464**
Fabric Filter System (EC)				**$73,264**
Fabric Filter with Insulation				$64,464
Bags & Cages				$8,800
Auxilary Equipment				
Intrumentation	10%	EC	$	7,300
Sales Tax	3%	EC	$	2,200
Freight	5%	EC	$	3,700
Direct Installation Costs (DC)			**$**	**63,983**
Foundations and supports	4%	PEC	$	3,459
Handling and erection	50%	PEC	$	43,232
Electrical	8%	PEC	$	6,917
Piping	1%	PEC	$	865
Insulation for ductwork	7%	PEC	$	6,052
Painting	4%	PEC	$	3,459
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**38,909**
Engineering	10%	PEC	$	8,646
Construction and field expenses	20%	PEC	$	17,293
Contractor fees	10%	PEC	$	8,646
Start-up	1%	PEC	$	865
Performance test	1%	PEC	$	865
Contingencies	3%	PEC	$	2,594
Total Capital Investment (PEC + DC + IC)			**$**	**189,356**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-33
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 35% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**170,927**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	1,760
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**122,549**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	3,787
Property Taxes	1% of Total Capital Investment	-	$	1,894
Insurance	1% of Total Capital Investment	-	$	1,894
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	13,474
Total Annual Costs (DAC + IAC)			**$**	**293,475**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-34
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Casting Pouring - 35% Recovery	
Design Inputs:		
VOC Controlled (tons):	7	
Dust Collector		
Annual Cost ($) [1]	$	293,475
Thermal Oxidizer		
Annual Cost ($) [1]	$	1,829,571
Total		
Annual Cost ($) [1]	$	2,123,046
Cost of Control ($/ton)	$	323,746

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-35
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 50% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	15,560		
Heat Recovery (%):	50		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 328,816**
Thermal Oxidizer (EC)			**$ 278,658**
Intrumentation	10%	EC	$ 27,866
Sales Tax	3%	EC	$ 8,360
Freight	5%	EC	$ 13,933
Direct Installation Costs (DIC)			**$ 98,645**
Foundations and supports	8%	PEC	$ 26,305
Handling and erection	14%	PEC	$ 46,034
Electrical	4%	PEC	$ 13,153
Piping	2%	PEC	$ 6,576
Insulation for ductwork	1%	PEC	$ 3,288
Painting	1%	PEC	$ 3,288
Indirect Installation Costs (IIC)			**$ 101,933**
Engineering	10%	PEC	$ 32,882
Construction and field expenses	5%	PEC	$ 16,441
Contractor fees	10%	PEC	$ 32,882
Start-up	2%	PEC	$ 6,576
Performance test	1%	PEC	$ 3,288
Contingencies	3%	PEC	$ 9,864
Total Capital Investment (PEC + DIC + IIC)			**$ 529,394**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-36
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 50% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	126,000		
Natural Gas Cost ($/MCF)	10.00		
Annual Electrical Consumption (kWh)	307,500		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 1,344,512**
Operating Labor			
Operator	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Utilities			
Natural Gas	-	-	$ 1,260,000
Electricity	-	-	$ 21,525
Indirect Annual Costs (IAC)			**$ 123,025**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 10,588
Property Taxes	1% of Total Capital Investment	-	$ 5,294
Insurance	1% of Total Capital Investment	-	$ 5,294
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$ 64,057

Total Annual Costs (DAC + IAC)	**$ 1,467,537**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-37
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2][3]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 50% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	15,000			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**86,464**
Fabric Filter System (EC)				**$73,264**
Fabric Filter with Insulation				$64,464
Bags & Cages				$8,800
Auxilary Equipment				
Intrumentation	10%	EC	$	7,300
Sales Tax	3%	EC	$	2,200
Freight	5%	EC	$	3,700
Direct Installation Costs (DC)			**$**	**63,983**
Foundations and supports	4%	PEC	$	3,459
Handling and erection	50%	PEC	$	43,232
Electrical	8%	PEC	$	6,917
Piping	1%	PEC	$	865
Insulation for ductwork	7%	PEC	$	6,052
Painting	4%	PEC	$	3,459
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**38,909**
Engineering	10%	PEC	$	8,646
Construction and field expenses	20%	PEC	$	17,293
Contractor fees	10%	PEC	$	8,646
Start-up	1%	PEC	$	865
Performance test	1%	PEC	$	865
Contingencies	3%	PEC	$	2,594
Total Capital Investment (PEC + DC + IC)			**$**	**189,356**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-38
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 50% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**170,927**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	1,760
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**122,549**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	3,787
Property Taxes	1% of Total Capital Investment	-	$	1,894
Insurance	1% of Total Capital Investment	-	$	1,894
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	13,474
Total Annual Costs (DAC + IAC)			**$**	**293,475**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-39
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Casting Pouring - 50% Recovery	
Design Inputs:		
VOC Controlled (tons):	7	
Dust Collector		
Annual Cost ($) [1]	$	293,475
Thermal Oxidizer		
Annual Cost ($) [1]	$	1,467,537
Total		
Annual Cost ($) [1]	$	1,761,012
Cost of Control ($/ton)	$	268,539

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-40
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 70% Recovery		
Design Inputs:			
Volumetric flowrate (scfm): (500 - 50,000)	15,560		
Heat Recovery (%):	70		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 410,651**
Thermal Oxidizer (EC)			**$ 348,009**
Intrumentation	10%	EC	$ 34,801
Sales Tax	3%	EC	$ 10,440
Freight	5%	EC	$ 17,400
Direct Installation Costs (DIC)			**$ 123,195**
Foundations and supports	8%	PEC	$ 32,852
Handling and erection	14%	PEC	$ 57,491
Electrical	4%	PEC	$ 16,426
Piping	2%	PEC	$ 8,213
Insulation for ductwork	1%	PEC	$ 4,107
Painting	1%	PEC	$ 4,107
Indirect Installation Costs (IIC)			**$ 127,302**
Engineering	10%	PEC	$ 41,065
Construction and field expenses	5%	PEC	$ 20,533
Contractor fees	10%	PEC	$ 41,065
Start-up	2%	PEC	$ 8,213
Performance test	1%	PEC	$ 4,107
Contingencies	3%	PEC	$ 12,320
Total Capital Investment (PEC + DIC + IIC)			**$ 661,147**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-41
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Thermal Oxidizer		
Process Description:	Casting Pouring - 70% Recovery		
Design Inputs:			
Annual Natural Gas Consumption (MCF)	75,600		
Natural Gas Cost ($/MCF)	0.07		
Annual Electrical Consumption (kWh)	384,300		
Electrical Cost ($/kWh)	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost		Cost
Direct Annual Costs (DAC)			**$**	**95,180**
Operating Labor				
Operator	0.5 hr/shift	$34.30/hr	$	18,779
Supervisor	15% of operator	-	$	2,817
Maintenance				
Labor	0.5 hr/shift	$37.80/hr	$	20,696
Materials	100% of maintenance labor	-	$	20,696
Utilities				
Natural Gas	-	-	$	5,292
Electricity	-	-	$	26,901
Indirect Annual Costs (IAC)			**$**	**144,237**
Overhead	60% of Operating and Maintenance	-	$	37,792
Administrative Charges	2% of Total Capital Investment	-	$	13,223
Property Taxes	1% of Total Capital Investment	-	$	6,611
Insurance	1% of Total Capital Investment	-	$	6,611
Capital Recovery[3]	CRF*[Total Capital Investment]	-	$	79,999

Total Annual Costs (DAC + IAC)	**$**	**239,417**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 3.2, Chapter 2, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment* life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-42
Thermal Oxidation
Cost Summary

Installed Cost Estimate[1][2][3]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 70% Recovery			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	15,000			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**86,464**
Fabric Filter System (EC)				**$73,264**
Fabric Filter with Insulation				$64,464
Bags & Cages				$8,800
Auxilary Equipment				
Intrumentation	10%	EC	$	7,300
Sales Tax	3%	EC	$	2,200
Freight	5%	EC	$	3,700
Direct Installation Costs (DC)			**$**	**63,983**
Foundations and supports	4%	PEC	$	3,459
Handling and erection	50%	PEC	$	43,232
Electrical	8%	PEC	$	6,917
Piping	1%	PEC	$	865
Insulation for ductwork	7%	PEC	$	6,052
Painting	4%	PEC	$	3,459
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**38,909**
Engineering	10%	PEC	$	8,646
Construction and field expenses	20%	PEC	$	17,293
Contractor fees	10%	PEC	$	8,646
Start-up	1%	PEC	$	865
Performance test	1%	PEC	$	865
Contingencies	3%	PEC	$	2,594
Total Capital Investment (PEC + DC + IC)			**$**	**189,356**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-43
Thermal Oxidation
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring - 70% Recovery			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**170,927**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	1,760
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**122,549**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	3,787
Property Taxes	1% of Total Capital Investment	-	$	1,894
Insurance	1% of Total Capital Investment	-	$	1,894
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	13,474
Total Annual Costs (DAC + IAC)			**$**	**293,475**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment$ life.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table A-44
Thermal Oxidation
Cost Summary

VOC Reduction Cost		
Process Description:	Casting Pouring - 70% Recovery	
Design Inputs:		
VOC Controlled (tons):	7	
Dust Collector		
Annual Cost ($) [1]	$	293,475
Thermal Oxidizer		
Annual Cost ($) [1]	$	239,417
Total		
Annual Cost ($) [1]	$	532,892
Cost of Control ($/ton)	$	81,261

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Attachment B-Carbon Adsorption

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-1
Carbon Adsorption
Cost Summary

Total Carbon Adsorption Installed Cost Estimate

Technology Description:	Carbon Adsorption	
Area		**Cost**
Sand Handling (SH)	$	2,424,862
Casting Pouring (CP)	$	3,807,129

Total Dust Collector Installed Cost Estimate

Technology Description:	Dust Collector	
Area		**Cost**
Sand Handling (SH)	$	544,009
Casting Pouring (CP)	$	189,356

Annual Cost Estimate

Technology Description:	Carbon Adsorption	
Area		**Cost**
Sand Handling (SH)	$	8,803,100
Casting Pouring (CP)	$	3,401,820

VOC Reduction Cost

Technology Description:	Carbon Adsorption	
Area		**Cost of Control ($/ton)**
Sand Handling (SH)	$	182,453
Casting Pouring (CP)	$	604,188

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-2
Carbon Adsorption
Cost Summary

Installed Cost Estimate[(1)(2)]				
Technology Description:	Carbon Adsorber			
Process Description:	Sand Handling (SH)			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	43,770			
Number of Carbon Beds (#):	28			
Length of Bed (in Direction of Flow) (ft)	10			
Bed Shape (Perpendicular to Flow)	Circle			
Diameter (ft)	6			
Carbon Requirement (lbs):	87,100			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**1,506,125**
Carbon Adsorber (EC)			**$**	**1,276,377**
Intrumentation	10%	EC	$	127,638
Sales Tax	3%	EC	$	38,291
Freight	5%	EC	$	63,819
Direct Installation Costs (DC)			**$**	**451,838**
Foundations and supports	8%	PEC	$	120,490
Handling and erection	14%	PEC	$	210,858
Electrical	4%	PEC	$	60,245
Piping	2%	PEC	$	30,123
Insulation for ductwork	1%	PEC	$	15,061
Painting	1%	PEC	$	15,061
Indirect Costs (IC)			**$**	**466,899**
Engineering	10%	PEC	$	150,613
Construction and field expenses	5%	PEC	$	75,306
Contractor fees	10%	PEC	$	150,613
Start-up	2%	PEC	$	30,123
Performance test	1%	PEC	$	15,061
Contingencies	3%	PEC	$	45,184
Total Capital Investment (PEC + DC + IC)			**$**	**2,424,862**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlined in Section 3.1, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1999. These have been adjusted to reflect inflation using a factor of $1.43 (2016) / $1.00 (1999).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-3
Carbon Adsorption
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Carbon Adsorber			
Process Description:	Sand Handling (SH)			
Design Inputs:				
Carbon Usage (lbs)	7,946,800			
Carbon Cost ($/lb)	1.00			
Annual Electrical Consumption (kWh)	413,700			
Electrical Cost ($/kWh)[3]	0.07			
Equipment Life (years)	10			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**8,038,746**
Operating Labor				
Operator[4]	0.5 hr/shift	$34.30/hr	$	18,779
Supervisor	15% of operator	-	$	2,817
Maintenance				
Labor[4]	0.5 hr/shift	$37.80/hr	$	20,696
Materials	100% of maintenance labor	-	$	20,696
Carbon Replacement				
Carbon	-	-	$	7,946,800
Utilities				
Electricity	-	-	$	28,959
Indirect Annual Costs (IAC)			**$**	**428,195**
Overhead	60% of Operating and Maintenance	-	$	37,792
Administrative Charges	2% of Total Capital Investment	-	$	48,497
Property Taxes	1% of Total Capital Investment	-	$	24,249
Insurance	1% of Total Capital Investment	-	$	24,249
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	293,409
Total Annual Costs (DAC + IAC)			**$**	**8,466,942**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlined in Section 3.1, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1999. These have been adjusted to reflect inflation using a factor of $1.43 (2016) / $1.00 (1999).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment\ life$.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-4
Carbon Adsorption
Cost Summary

Installed Cost Estimate[(1)(2)(3)]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling (SH)			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	43,770			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**248,406**
Fabric Filter System (EC)				**$210,506**
Fabric Filter with Insulation				$185,406
Bags & Cages				$25,100
Auxilary Equipment				
Intrumentation	10%	EC	$	21,100
Sales Tax	3%	EC	$	6,300
Freight	5%	EC	$	10,500
Direct Installation Costs (DC)			**$**	**183,820**
Foundations and supports	4%	PEC	$	9,936
Handling and erection	50%	PEC	$	124,203
Electrical	8%	PEC	$	19,872
Piping	1%	PEC	$	2,484
Insulation for ductwork	7%	PEC	$	17,388
Painting	4%	PEC	$	9,936
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**111,783**
Engineering	10%	PEC	$	24,841
Construction and field expenses	20%	PEC	$	49,681
Contractor fees	10%	PEC	$	24,841
Start-up	1%	PEC	$	2,484
Performance test	1%	PEC	$	2,484
Contingencies	3%	PEC	$	7,452
Total Capital Investment (PEC + DC + IC)			**$**	**544,009**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-5
Carbon Adsorption
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Sand Handling (SH)			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**174,187**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	5,020
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**161,972**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	10,880
Property Taxes	1% of Total Capital Investment	-	$	5,440
Insurance	1% of Total Capital Investment	-	$	5,440
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	38,711
Total Annual Costs (DAC + IAC)			**$**	**336,158**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment life*.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-6
Carbon Adsorption
Cost Summary

VOC Reduction Cost		
Process Description:	Sand Handling (SH)	
Design Inputs:		
VOC Controlled (tons):	57	
Dust Collector		
Annual Cost ($) [(1)]	$	336,158
Carbon Adsorber		
Annual Cost ($) [(1)]	$	8,466,942
Total		
Annual Cost ($) [(1)]	$	8,803,100
Cost of Control ($/ton)	$	182,453

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-7
Carbon Adsorption
Cost Summary

Installed Cost Estimate[1][2]			
Technology Description:	Carbon Adsorber		
Process Description:	Casting Pouring (CP)		
Design Inputs:			
Volumetric flowrate (acfm): (4,000 - 500,000)	15,000		
Number of Carbon Beds (#):	72		
Length of Bed (in Direction of Flow) (ft)	8		
Bed Shape (Perpendicular to Flow)	Circle		
Diameter (ft)	4		
Carbon Requirement (lbs):	26,600		
Category	**Cost Factor**	**Applied to**	**Cost**
Purchased Equipment (PEC)			**$ 2,364,676**
Carbon Adsorber (EC)			**$ 2,003,963**
Intrumentation	10%	EC	$ 200,396
Sales Tax	3%	EC	$ 60,119
Freight	5%	EC	$ 100,198
Direct Installation Costs (DC)			**$ 709,403**
Foundations and supports	8%	PEC	$ 189,174
Handling and erection	14%	PEC	$ 331,055
Electrical	4%	PEC	$ 94,587
Piping	2%	PEC	$ 47,294
Insulation for ductwork	1%	PEC	$ 23,647
Painting	1%	PEC	$ 23,647
Indirect Costs (IC)			**$ 733,050**
Engineering	10%	PEC	$ 236,468
Construction and field expenses	5%	PEC	$ 118,234
Contractor fees	10%	PEC	$ 236,468
Start-up	2%	PEC	$ 47,294
Performance test	1%	PEC	$ 23,647
Contingencies	3%	PEC	$ 70,940
Total Capital Investment (PEC + DC + IC)			**$ 3,807,129**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlined in Section 3.1, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.
2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1999. These have been adjusted to reflect inflation using a factor of $1.43 (2016) / $1.00 (1999).

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-8
Carbon Adsorption
Cost Summary

Annual Cost Estimate[1][2]			
Technology Description:	Carbon Adsorber		
Process Description:	Casting Pouring (CP)		
Design Inputs:			
Carbon Usage (lbs)	2,384,600		
Carbon Cost ($/lb)	1.00		
Annual Electrical Consumption (kWh)	143,100		
Electrical Cost ($/kWh)[3]	0.07		
Equipment Life (years)	10		
Interest Rate (%):	3.625		
Annual Operating Hours (hours)	8,760		

Category	Suggested Factor	Unit Cost	Cost
Direct Annual Costs (DAC)			**$ 2,457,604**
Operating Labor			
Operator[4]	0.5 hr/shift	$34.30/hr	$ 18,779
Supervisor	15% of operator	-	$ 2,817
Maintenance			
Labor[4]	0.5 hr/shift	$37.80/hr	$ 20,696
Materials	100% of maintenance labor	-	$ 20,696
Carbon Replacement			
Carbon	-	-	$ 2,384,600
Utilities			
Electricity	-	-	$ 10,017
Indirect Annual Costs (IAC)			**$ 650,741**
Overhead	60% of Operating and Maintenance	-	$ 37,792
Administrative Charges	2% of Total Capital Investment	-	$ 76,143
Property Taxes	1% of Total Capital Investment	-	$ 38,071
Insurance	1% of Total Capital Investment	-	$ 38,071
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$ 460,663

Total Annual Costs (DAC + IAC)	**$ 3,108,345**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlined in Section 3.1, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1999. These have been adjusted to reflect inflation using a factor of $1.43 (2016) / $1.00 (1999).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where $i = interest$ and $n = equipment\ life$.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-9
Carbon Adsorption
Cost Summary

Installed Cost Estimate[1][2][3]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring (CP)			
Design Inputs:				
Volumetric flowrate (acfm): (4,000 - 500,000)	15,000			
Air to Cloth (A/C) Ratio	4			
Insulated	Yes			
Bag Diameter (in)	6			
Bag Length (ft)	12			
Bag type	Top Bag Removal			
Bag Material	16-oz Polyester			
Category	**Cost Factor**	**Applied to**		**Cost**
Purchased Equipment (PEC)			**$**	**86,464**
Fabric Filter System (EC)				**$73,264**
Fabric Filter with Insulation				$64,464
Bags & Cages				$8,800
Auxilary Equipment				
Intrumentation	10%	EC	$	7,300
Sales Tax	3%	EC	$	2,200
Freight	5%	EC	$	3,700
Direct Installation Costs (DC)			**$**	**63,983**
Foundations and supports	4%	PEC	$	3,459
Handling and erection	50%	PEC	$	43,232
Electrical	8%	PEC	$	6,917
Piping	1%	PEC	$	865
Insulation for ductwork	7%	PEC	$	6,052
Painting	4%	PEC	$	3,459
Site Preparation	LS			
Facilities & Buildings	LS			
Indirect Costs (IC)			**$**	**38,909**
Engineering	10%	PEC	$	8,646
Construction and field expenses	20%	PEC	$	17,293
Contractor fees	10%	PEC	$	8,646
Start-up	1%	PEC	$	865
Performance test	1%	PEC	$	865
Contingencies	3%	PEC	$	2,594
Total Capital Investment (PEC + DC + IC)			**$**	**189,356**

1. Figure 1.9 Equipment costs for pulse-jet filters (modular) from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
2. Table 1.8 Bag Prices for Pulse-Jet, TR polyester bags from "EPA Air Pollution Control Cost Manual," 6th Edition, EPA/452/B-02-001, January 2002, Costs are in Second Quarter 1998 $USA.
3. Average CPI from 1998 is 163.0 and the Average CPI for 2016 first 2 quarters is 238.782 (CPI Detailed Report by U.S. Bureau of Labor Statistics, Table 24 (August 2016)

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-10
Carbon Adsorption
Cost Summary

Annual Cost Estimate[1][2]				
Technology Description:	Continuous, Pulse-Jet (modular)			
Process Description:	Casting Pouring (CP)			
Design Inputs:				
Bag Change Frequency (years)	5			
Annual Electrical Consumption (kWh)	0			
Electrical Cost ($/kWh)[3]	0.00			
Equipment Life (years)	20			
Interest Rate (%):	3.625			
Annual Operating Hours (hours)	8,760			
Category	**Suggested Factor**	**Unit Cost**		**Cost**
Direct Annual Costs (DAC)			**$**	**170,927**
Operating Labor				
Operator[4]	2 hr/shift	$34.30/hr	$	75,117
Supervisor	15% of operator	-	$	11,268
Maintenance				
Labor[4]	1 hr/shift	$37.80/hr	$	41,391
Materials	100% of maintenance labor	-	$	41,391
Bag & Parts Replacement				
Bags & Cages	-	-	$	1,760
Utilities				
Electricity	Already used	-	$	-
Compressed Air	Already used	-	$	-
Waste Disposal	Already used	-	$	-
Indirect Annual Costs (IAC)			**$**	**122,549**
Overhead	60% of Operating and Maintenance	-	$	101,500
Administrative Charges	2% of Total Capital Investment	-	$	3,787
Property Taxes	1% of Total Capital Investment	-	$	1,894
Insurance	1% of Total Capital Investment	-	$	1,894
Capital Recovery[5]	CRF*[Total Capital Investment]	-	$	13,474
Total Annual Costs (DAC + IAC)			**$**	**293,475**

1) Purchases equipment cost, direct installations costs, and indirect installations costs are based on the methodology outlines in Section 6, Chapter 1, of the EPA Air Pollution Control Cost Manual, 6th Edition, 2002.

2) Costs provided in the EPA Air Pollution Control Cost Manual reflected the cost of equipment in 1998. These have been adjusted to reflect inflation using a factor of $1.46 (2016) / $1.00 (1998).

3) Electric costs based on actuals at Alburtis Facility as provided by Facilities Engineering 2016-10-14

4) Labor wages based on actuals at Alburtis Facility as provided by Plant Manager 2016-10-13

5) Capital Recovery Factor (CRF) is calculated by $[i(1+i)^n]/[(1+i)^n - 1]$; where i = *interest* and n = *equipment life*.

Victaulic Company - Alburtis Facility
VOC RACT 2 Evaluation
Table B-11
Carbon Adsorption
Cost Summary

VOC Reduction Cost		
Process Description:	Casting Pouring (CP)	
Design Inputs:		
VOC Controlled (tons):	7	
Dust Collector		
Annual Cost ($) [(1)]	$	293,475
Carbon Adsorber		
Annual Cost ($) [(1)]	$	3,108,345
Total		
Annual Cost ($) [(1)]	$	3,401,820
Cost of Control ($/ton)	$	604,188

(1) Includes recurring annual costs (e.g. maintenance, utilities) and recovery of capital costs

Attachment C – RACT III Submittal

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

CHAPTER 129. STANDARDS FOR SOURCES ADDITIONAL RACT REQUIREMENTS FOR MAJOR SOURCES OF NOx AND VOCs FOR THE 2015 OZONE NAAQS

Written notification, 25 Pa. Code §§129.111 and 129.115(a)

25 Pa. Code Sections 129.111 and129.115(a) require that the owner and operator of an air contamination source subject to the final-form RACT III regulations submit a notification describing how you intend to comply with the final-form RACT III requirements, and other information spelled out in subsection 129.115(a). The owner or operator may use this template to notify DEP. Notification must be submitted in writing or electronically to the appropriate Regional Manager located at the appropriate DEP regional office. In addition to the notification required by §§ 129.111 and 129.115(a), you also need to submit an applicable analysis or RACT determination as per § 129.114(a) or (i).

Is the facility major for NOx?	**Yes ☐ No ☒**
Is the facility major for VOC?	**Yes ☒ No ☐**

FACILITY INFORMATION						
Facility Name	Victaulic Co / Alburtis Facility					
Permit Number	39-00069 **PF ID if known**					
Address Line1	8023 Quarry Road					
Address Line2						
City	Alburtis	**State**	PA	**Zip**	18011	
Municipality	Alburtis Borough		**County**	Lehigh		

OWNER INFORMATION					
Owner	Victaulic Co				
Address Line1	4901 Kesslersville Road				
Address Line2					
City	Easton	**State**	PA	**Zip**	18040-6714
Email		Phone	610-559-3300		

CONTACT INFORMATION					
Permit Contact Name	Kraig L Hume				
Permit Contact Title	Global Environmental Mgr				
Address Line	8023 Quarry Road				
City	Alburtis	**State**	PA	**Zip**	18011
Email	Kraig.Hume@Victualic.com			Phone	610-559-3476

Complete Table 1, including all air contamination sources that commenced operation on or before August 3rd, 2018. Air contamination sources determined to be exempt from permitting requirements also must be included. You may find this information in section A and H of your operating permit.

Table 1 - Source Information

Source ID	Source Name	Make	Model	Physical location of a source (i.e, building#, plant#, etc.)	Was this source subject to RACT II?
101	Charge Handling & Chip Feeding (P001)				No
102	Elec Melting Furnaces (4) (P002)				No
103	Inoculation (P003)				No
104	Pouring / Casting Operations (P005)				Yes
105	Casting Cooling (P006)				No
106	Sand Handing System (P007)				Yes
107	Casting Finishing (P008)				No
108	Paint Dip Operation (2 Tanks) (P009)				No
110	Burn Off Oven				No
111	Shot Blast Machines				No

Complete Table 2 or 3 if the facility is a major NOx or VOC emitting facility. For the column with the title "How do you intend to comply", compliance options are:

- Presumptive RACT requirement under §129.112 (**PRES**),
- Facility-wide averaging (**FAC**) §129.113,
- System-wide averaging (**SYS**) §129.113, or
- Case by case determination §129.114 (**CbC**).

Please provide the applicable subsection if source will comply with the presumptive requirement under §129.112.

Table 2 – Method of RACT III Compliance, NOx

Source ID	Source Name	NOx PTE TPY	Exempt from RACT III (yes or no)	How do you intend to comply? (PRES, CbC, FAC or SYS)	Specific citation of rule if presumptive option is chosen

Please complete Table 3 if the facility is a major VOC emitting facility. Please provide the applicable section if a source is complying with any RACT regulation listed in 25 Pa Code §§ 129.51, 129.52(a)—(k) and Table I categories 1—11, 129.52a—129.52e, 129.54—129.63a, 129.64—129.69, 129.71—129.73, 129.75 129.71—129.75, 129.77 and 129.101—129.107.

Table 3 – Method of RACT III Compliance, VOC

Source ID	Source Name	VOC PTE TPY	Exempt from RACT III (yes or no)	How do you intend to comply?	Specify citation of rule or subject to 25 Pa Code RACT regulation, (list the applicable sections)
104	Poring / Casting Operations (P005)	7.36	No / Subject to RACT II	CbC	N/A
106	Sand Handling System (P007)	63.07	No / Subject to RACT II	CbC	N/A
108	Paint Dip Operation (2 Tanks)(P009)		Yes	Pres	129.52