



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

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

25 Pa. Code Sections 129.111 and 129.115(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 NO_x?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Is the facility major for VOC?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

FACILITY INFORMATION						
Facility Name	Jeraco Enterprises Inc.					
Permit Number	49-00014	PF ID if known				
Address Line1	135 Sodom Rd.					
Address Line2						
City	Milton	State	PA	Zip	17847	
Municipality	Milton Borough			County	Northumberland Co	
OWNER INFORMATION						
Owner	Gary Fawcett					
Address Line1	135 Sodom Rd.					
Address Line2						
City	Milton	State	PA	Zip	17847	
Email	nancy@jeraco.com			Phone	570-742-9688	
CONTACT INFORMATION						
Permit Contact Name	Nancy Fawcett					
Permit Contact Title						
Address Line	135 Sodom Rd.					
City	Milton	State	PA	Zip	17847	
Email	nancy@jeraco.com			Phone	570-742-9688	

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?
031	8 Heaters				Yes
101A	Spray Up & Clean Up	Process			Yes
102A	Surface Coating & Clean Up	Process			Yes
203	Surface Coating Booth 3	Process			Yes
204	Surface Coating Booth 4	Process			Yes
205	Surface Coating Booth 5	Process			Yes
103 B	Resin Storage Tank	Tank			Yes
P104	Various Clean Up and Misc. VOC	Process			Yes

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)
031	8 Heaters	< 2.7	No	Work Practice according to 129.112 (c) (2)	
101A	Spray Up & Clean Up	63	No	Updated RACT Analysis (Attached)	
102A, 203, 204, 205	Surface Coating and Clean Up	50.2	Yes	129.52d – already listed in permit	129.52d
103B	Resin Storage Tank		Yes	129.57 – already listed in permit	129.57
P104	Various Cleanup & Storage	< 2.7	No	Work Practice according to 129.112	

RACT Analysis Jeraco Enterprises, Inc. Spray Lay-Up Operations

The following report will look at all the available control options for Resin Spray Lay-Up Operations at Jeraco Enterprises and determine the cost effectiveness and feasibility of each option. The following options will be evaluated:

1. Add-on Controls
2. Pollution Prevention Methods

The resin spray-up operation at Jeraco consists of a partially enclosed spray booth, non-atomized spray guns, filters, exhaust fans, and stack. The materials utilized in the process are styrene containing resins and gel coats, glass fibers, and voc containing catalysts. For the purpose of this RACT analysis, since styrene is the major VOC in the process, only the effectiveness of styrene removal and the associated costs of styrene removal for each control are considered.

ADD-ON CONTROLS

Currently, the ventilation for the spray booth captures and exhausts emissions from the resin and gel coat spray operations through the stack. The current spray booth does not meet Method 204 for total enclosure. There are two issues to regard when considering total enclosure for this process. The first is the likelihood of exceeding OSHA allowable exposures limits inside a fully enclosed booth without increasing the exhaust flow rates. The second is the cost of evaluating the dozens of different enclosure systems that could be designed. For the purposes of this report for add-on controls, conservative estimates are being made without regard to Method 204 and without changes to any of the equipment at the facility. The rationale is to determine if perfect capture would result in cost effective add-on controls. If not, further investigation into full enclosures is not warranted.

The following available add-on control technologies will be evaluated in this report (must be commercially available to be considered):

1. Absorption
2. Adsorption
3. Biofiltration
4. Thermal Oxidation
5. Innovative Control Technologies

The control technologies are discussed below. A cost analysis will only be conducted on the controls that are deemed feasible options.

1. ABSORPTION

A gas absorption system utilizes a mass transfer process in which one or more soluble pollutants in the exhaust stream are separated from the exhaust air by selective dissolution in an absorption liquid. The absorption liquid is usually a dilute aqueous solution of an acidic or basic treatment chemical in water.

Absorption has several important practical limitations as an effective VOC control technology. If the VOC pollutant is insoluble in water or has very low solubility, most of VOC would pass untreated through the scrubbing tower and escape to the atmosphere. If on-site treatment and regeneration are not possible, then disposal or off-site regeneration of the adsorption liquid would be required. This becomes a logistical nightmare and is a prohibitively expensive method for treating large exhaust airflows. Finally, if the VOC pollutant is discharge in large dilute exhaust streams, then very large scrubber towers and treatment tanks are needed to capture and remove the dilute concentrations of VOC.

The water solubility of styrene is only about 0.3% by weight, which is very slight. Hence, styrene vapor cannot be effectively captured by any absorption method using aqueous solutions. Further, styrene will not form a solid reaction byproduct with common aqueous acidic or basic treatment

solutions, so practical on-site regeneration of the absorption liquid is not possible. Finally, the combined exhaust flow rate would require an excessively large scrubber tower and treatment tank.

Therefore, absorption is not a technically feasible option due to the low solubility of styrene, the difficulties associated with practical on-site regeneration of the absorption liquid, and the extremely large equipment sizes needed to control the large, dilute exhaust stream at the Jeraco plant.

2. Adsorption

An adsorption system utilizes a mass transfer process involving interactions between gaseous pollutants and solid phase sorbent media. The gas phase is captured on the solid phase by physical or chemical adsorption mechanisms. Most VOC adsorption systems use activated carbon as the solid phase, although a few systems use silica gels, diatomaceous earth, alumina, synthetic zeolites, special polymer materials, or other proprietary media substances.

There are many factors and components to adsorption. For additional information and details on the entire process please see *Feasibility and Cost of the Capture and Control of Hazardous Air Pollutant Emissions from the Open Molding of Reinforced Plastic Composites* by Robert A. Haberlein, PH.D, QEP.

The feasibility of Adsorption comes down to the options for disposing of or recycling the desorbed organic compounds.

- a. Onsite destruction - is the preferred option for the desorbed organic compounds. Ideally, the desorbed organic is consumed in a small oxidizer unit (this is the arrangement used in the hybrid preconcentration oxidation process). This process would require extensive equipment, and high energy usage to achieve destruction of the emissions.
- b. Recovery and reuse in process - is not a practical option at the Jeraco plant. Ideally, the recovered styrene monomer liquid might be returned to the supplier for reuse, which would yield a recovery credit that could be applied to the cost of the control system. The cost of waste disposal would also be avoided. However, this “recycling” approach is not feasible for the following reasons:
 - i. Jeraco purchases “ready-to-use” gel coat and resin materials from their material supplier, who must guarantee the performance of the supplied materials. The supplier has no use for recovered styrene monomer.
 - ii. Styrene recovered from the adsorber would be contaminated with water, dirt, dust, and other organic chemicals. The amount of water contamination will be significant, and would probably render the recovered styrene unusable for any purpose whatsoever. Filtering, separating, and purifying the recovered styrene might be possible, but the extraordinary cost of these extra chemical-processing steps would be prohibitive.
 - iii. The recovered styrene liquid cannot be returned to the suppliers for reuse, because manufacturers only use pure styrene as a feedstock to produce resin materials.
- c. Recovery and offsite destruction - is more difficult and costly, because the recovered liquid VOC mixture must be packaged, stored, and shipped to an offsite hazardous waste treatment facility for final disposal or destruction. The liquid VOC mixture would require special hazardous waste handling procedures, a special hazardous waste storage area, and a considerable amount of paperwork and reporting at significant additional expense. This option also increases the risk of spillage at the site or during transport to the final treatment facility.

The many components and the infeasible options for the desorbed materials make Adsorption an infeasible control option.

3. Biofiltration

Biofiltration employs living microbes, such as bacteria and slimes that first digest and then ultimately metabolize VOC vapors into CO₂ and H₂O. Biofiltration works best for exhaust streams with the following characteristics:

- a. Exhaust streams with low organic concentrations, or organic compounds with low toxicity to prevent poisoning of the microbes.
- b. Ambient exhaust temperature ranging from 10 to 43°C (50 to 110°F), which prevents chilling or overheating of the microbes.
- c. Water-soluble organic compounds that are readily accessible to the microbes.

Biofiltration is not a feasible control option because of the low solubility of styrene vapor in water. It would prove to be ineffective.

4. Thermal Oxidation

Thermal oxidation involves the high temperature destruction of an organic compound into the combustion byproducts carbon dioxide (CO₂) and water vapor (H₂O).

The performance of an oxidizer is commonly characterized by three important parameters known as the "Three T's

- a. Temperature - the oxidation reaction rate is accelerated at elevated temperatures. Higher temperatures cause faster oxidation rates and higher destruction efficiencies.
- b. Time - in order for the oxidation reaction to occur, the exhaust must remain at the reaction temperature for a minimum amount of time, called the "residence" or "retention" time. Greater destruction efficiencies result from longer residence times. Note that the temperature and time are inversely proportional (although nonlinear) to each other in determining destruction efficiency.
- c. Turbulence - is required to ensure that the exhaust is well mixed throughout the incineration chamber. Otherwise, a portion of the exhaust could pass through the chamber without adequate oxidation. Note that turbulence is not directly related to either temperature or time, but is a necessary condition for high destruction efficiency.

An oxidizer system may be characterized according to two different classification schemes:

Oxidation process - either classified as "Thermal" or "Catalytic"

Heat energy recovery method - either classified as "Recuperative" or "Regenerative"

These two different classification schemes result in four possible system types:

- A. Recuperative Thermal Oxidation - A recuperative thermal oxidizer uses a heat exchanger to transfer the thermal energy from the oxidizer exhaust to the inlet stream. In this application, the heat exchanger normally consists of relatively thin metallic surfaces that serve to physically separate the two flow streams, yet still efficiently transfer the heat energy. These thin metallic surfaces are prone to mechanical and thermal damage at elevated temperatures, so a recuperative oxidizer is usually limited to chamber temperatures less than 1,600°F.
- B. Regenerative Thermal Oxidation - A regenerative thermal oxidizer (RTO) cycles the heat energy back and forth between the two streams using an arrangement of thermal masses. The equipment is designed so that the hot exhaust gas heats a storage mass, usually a heat-resistant ceramic material, as the gas exits the very hot oxidation

chamber. Once this storage mass has reached a preset temperature, the exhaust flow is redirected and the relatively cool VOC-laden plant exhaust flows through the heated mass. The energy stored in the thermal mass then heats the plant exhaust before it enters the oxidation chamber. As much as 95% of the thermal energy can be recovered and reused in this manner.

- C. Recuperative Catalytic Oxidation - combines the features of catalytic oxidation with recuperative heat recovery by incorporating a heat exchanger to transfer thermal energy from the oxidizer outlet stream to the inlet stream. The heat exchanger normally consists of relatively thin metallic surfaces that serve to separate physically the two flow streams yet still transfer the heat energy between the streams. These thin metallic surfaces are prone to mechanical and thermal damage at elevated temperatures, so a recuperative catalytic oxidizer is usually limited to chamber temperatures less than 1,600°F
- D. Recuperative Catalytic Oxidation - combines the features of catalytic oxidation with the benefits of regenerative heat recovery. A RCO is very similar to a typical RTO unit, except that small layer or a fine coating of catalyst is added to the thermal regeneration masses. The catalyst allows the peak oxidation temperature to be lowered without adversely affecting the destruction efficiency.

No special technical problems are expected with the use of thermal oxidizers, therefore a cost analysis for the implementation of thermal oxidizers at Jeraco will be performed.

There are four distinct problems concerning the implementation of catalytic oxidation:

- A. Catalyst Deactivation - refers to the steady deterioration in destruction efficiency caused by the deactivation of the reactive sites on the surface of the catalyst. The transient nature of the catalytic effect requires careful system design and periodic replacement of the catalyst media. The catalyst in most systems is replaced every three to five years. Due to the unpredictable nature of the catalyst performance, continuous emissions monitoring may also be required by some regulatory agencies to verify the effectiveness of the catalyst.
- B. Catalyst poisoning caused the failure of the catalytic oxidizer unit in the Polyad preconcentrator system at the American Standard fiberglass bathware plant. Weatherly, the manufacturer of the Polyad system, had actual laboratory evidence that proved the catalyst poison was elemental silicon. A second replacement catalytic oxidizer unit also failed, and this second catalytic oxidizer was finally replaced with a thermal oxidizer in January 2000. This experience should serve as a clear warning regarding the long-term performance of catalytic oxidizers at reinforced plastic composite plants.

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- C. Catalyst Plugging - involves the small openings in the catalyst bed that can become plugged with foreign matter entrained into the exhaust stream. Coarse filters can easily remove large resin aerosols. However, the tiny aerosols cause the problem, not the large aerosols. A thicker filter pad of the same filter media generally does not significantly increase the collection efficiency of the tiny aerosols. A different media (much finer and more expensive) is needed instead. Indeed, any common filter media, no matter how thick cannot effectively collect the very tiny aerosol droplets. These tiny aerosols require a more sophisticated collection device. The filter pad installation at many plants is often "casual," resulting in gaps and holes, but this is a common problem and would be very difficult to avoid in practice. A completely different filter system and/or media would be needed to ensure a more "formal" installation.
- D. Cost of Prefiltration - the most frequent solution proposed to prevent catalytic poisoning (and also biofilter and adsorber plugging) is a high-efficiency prefiltration system. If properly designed and maintained, such a prefiltration system could probably solve these problems. However, the cost of a high-efficiency filtration system can be great for large and dirty air streams, which are common at many fiberglass operations.

The Dürr preconcentrator system at Aker Plastics in West Virginia includes an extensive prefiltration system to prevent the plugging and deactivation of the activated charcoal sorbent beds. The annual cost to replace the filters in this 180,000 cfm system was about \$30,000 in 1998.

The problems associated with catalytic oxidation makes this control option infeasible for Jeraco and therefore no cost analysis will be performed.

5. Innovative Control Technologies

- a. Condensation - separates VOC vapor components from the exhaust air by forcing the VOC vapor to undergo a phase change from a gas to liquid. This phase change is accomplished by an increase in gas pressure, a reduction in gas temperature, or both. Refrigeration equipment or liquid nitrogen is typically used to lower the temperature of the exhaust stream to below the dew point (saturation temperature) of the VOC vapors in the exhaust stream. The VOC vapor condenses to a liquid, and the condensate is collected and either reused or destroyed.

Condensation is a mature control technology that can effectively remove high concentration VOC vapors from a small exhaust flow that has negligible moisture content. According to the EPA, condensation is usually successful for VOC concentrations above 5,000 parts per million volumetric (ppmv) and flow rates below 2,000 scfm. The Jeraco plant has a greater exhaust flow rate, a much lower styrene concentration in the exhaust, and substantial amounts of water vapor in the exhaust stream. Air with a 50% relative humidity and 25-ppmv styrene concentration has an average ratio of about 50 parts of water vapor to 1 part of styrene vapor. For these reasons, condensation is not a practical control technology for controlling styrene emissions at Jeraco.

- b. Flares - are a traditional control technology that uses an open flame to dispose of waste gases during normal operations and emergencies. Exhaust gas that has a heating value less than 300 Btu/ft³ is not assured of achieving a high destruction of 98% or more. At the Jeraco plant, the heating value of the exhaust stream is over 1,000 times less than the acceptable threshold for flares (at least 1.0 Btu/ft³). Therefore, flare technology is not suitable for controlling the exhaust stream from the Jeraco plant.

- c. Flameless thermal oxidation (FTO) - achieves uniform thermal oxidation of chlorinated VOC and VOC using a heated packed-bed reactor typically filled with saddle- and spherical-shaped inert ceramic pieces. The oxidation of organic compounds takes place in a uniform thermal reaction zone contained in the packed bed of an inert ceramic matrix typically maintained at temperatures of 1,600 to 1,850°F. The FTO design eliminates problems of temperature gradients, mixing, and resulting formation of secondary pollutants. The large thermal mass of the inert ceramic matrix enables it to store or release large amounts of heat without rapid changes in temperature and provides flame suppression within the FTO reactor.

However, the fuel content in the exhaust stream at the Jeraco Plant would be much too low to make the FTO system economically feasible.

After careful analysis of each available add-on control, the two feasible options for Jeraco are traditional thermal oxidation and regenerative thermal oxidation (RTO). Although traditional thermal oxidation is commercially proven, the cost would far exceed that of the lesser expensive regenerative thermal oxidation (RTO). Therefore cost analysis was only conducted for RTO. This cost analysis shows that the use of thermal oxidation is cost prohibitive for Jeraco. Please see the attached analysis.

POLLUTION PREVENTION METHODS

The MACT for Reinforced Plastics Composites deemed add-on controls cost prohibitive for most of the industry. In lieu of add-on controls the rule implements pollution prevention methods. Currently, Jeraco's permit requires the facility be in compliance with all applicable components of MACT. This includes the following:

- a. Resin and Gel coat in use at the source cannot exceed the MACT emission limit. This requires that all gel coat used must contain no more than 37% HAP and any resin used shall not exceed a 36% HAP content.
- b. All resin and gel coat containers must remain covered with no visible gaps unless adding material for mixing.

Although MACT does not require the use of non-atomized application, the current permit for Jeraco requires the use of non-atomized spray apparatus. This is currently the most advanced technology for reducing emissions from equipment.

SUMMARY

The Total Capital Investment (TCI) for add-on controls at Jeraco would be excessive at over \$800,000 and the cost effective values are infeasible at \$12,159 per ton. Remember that this is a conservative estimate and that the cost analysis was performed without considering Method 204. When considering Method 204 the cost per ton would increase dramatically.

Given the cost effectiveness and feasibility of add-on controls, the only reasonably achievable control technology at Jeraco is pollution prevention practices. The facility will continue to meet the required HAP limitations for gel coat and resin. The facility will also evaluate new materials that may become available to determine if emissions can be reduced from material options. The facility is also using the best available spray technology but will continue to evaluate feasible equipment options if they become available and testing shows a likelihood of reducing emissions. The facility will follow all work practice standards required by MACT subpart WWWW. Jeraco will maintain the filters in the spray booth according to manufacturer's standards and permit requirements to ensure maximum filtration for capturing and exhausting emissions from the source.

Jeraco will reevaluate the RACT as necessary when new technologies become available.

**Cost Analysis for RTO System
For Spray Lay-Up Operations
Jeraco Enterprises**

Total Capital Investment (@24,727 scfm) ¹ :	\$865,340
Amortized Capital Cost ¹ :	\$197,792
Electricity ² :	\$118,359
Fuel ² :	\$367,253
Indirect Operating Costs ³ :	\$ 52,000
Total Annual Cost:	<hr/> \$735,404
Total Source PTE:	63 tpy
Capture and Control Efficiency:	96 %
Annual Emissions Reduction:	60.48 tpy
Control Cost Effectiveness	\$12,159/ton

¹ Calculations taken from the attached Air Pollution Control Technology Fact Sheet for RTO from EPA

² Based on current utility rates in Pennsylvania

³Overhead, Taxes, Insurance, Admin