pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH of PENNSYLVANIA
November 8, 2023

SUBJECT: RACT II Equals RACT III Review Memo
Foam Fabricators, Inc.
South Centre Township, Columbia County
TVOP 19-00002
PFID 1880

TO: Muhammad Q. Zaman MQZ
Environmental Program Manager
Air Quality Program

THROUGH: David M. Shimmel, P.E.
Chief, New Source Review Section
Air Quality Program

Procedural History

As part of the Reasonably Available Control Technology (RACT) regulations codified at 25 Pa. Code §§ 129.111—129.115 (relating to additional RACT requirements for major sources of NOx and VOCs for the 2015 ozone NAAQS) (RACT III), the Pennsylvania Department of Environmental Protection (Department) has established a method under § 129.114(i) (relating to alternative RACT proposal and petition for alternative compliance schedule) for an applicant to demonstrate that the alternative RACT compliance requirements incorporated under § 129.99 (relating to alternative RACT proposal and petition for alternative compliance schedule) (RACT II) for a source that commenced operation on or before October 24, 2016, and which remain in force in the applicable operating permit continue to be RACT under RACT III as long as no modifications or changes were made to the source after October 24, 2016. The date of October 24, 2016, is the date specified in § 129.99(i)(1) by which written RACT proposals to address the 1997 and 2008 8-hour ozone National Ambient Air Quality Standards (NAAQS) were due to the Department or the appropriate approved local air pollution control agency from the owner or operator of an air contamination source located at a major NOx emitting facility or a major VOC emitting facility subject to § 129.96(a) or (b) (relating to applicability).

The procedures to demonstrate that RACT II is RACT III are specified in § 129.114(i)(1)(i), 129.114(i)(1)(ii) and 129.114(i)(2), that is, subsection (i), paragraphs (1) and (2). An applicant may submit an analysis, certified by the responsible official, that the RACT II permit requirements remain RACT for RACT III by following the procedures established under subsection (i), paragraphs (1) and (2).

Paragraph (1) establishes cost effectiveness thresholds of $7,500 per ton of NOx emissions reduced and $12,000 per ton of VOC emissions reduced as ‘‘screening level values’’ to determine the amount of analysis and due diligence that the applicant shall perform if there is no new pollutant specific air cleaning device, air pollution control technology or technique available at the time of submittal of the analysis. Paragraph (1) has two subparagraphs.

Subparagraph (i) under paragraph (1) specifies that the applicant that evaluates and determines that there is no new pollutant specific air cleaning device, air pollution control technology or technique available at the time of submittal of the analysis and that each technically feasible air cleaning device, air pollution control technology or technique evaluated for the alternative RACT requirement or RACT emission limitation approved by the Department (or appropriate approved local air pollution control agency) under § 129.99(e) had a cost effectiveness equal to or greater than $7,500 per ton of NOx emissions reduced or $12,000 per ton of VOC emissions reduced shall include the following information in the analysis:

- A statement that explains how the owner or operator determined that there is no new pollutant specific air cleaning device, air pollution control technology or technique available.
- A list of the technically feasible air cleaning devices, air pollution control technologies or techniques previously evaluated under RACT II.
- A summary of the economic feasibility analysis performed for each technically feasible air cleaning device, air pollution control technology or technique in the previous bullet and the cost effectiveness of each technically feasible air cleaning device, air pollution control technology or technique as submitted previously under RACT II.
- A statement that an evaluation of each economic feasibility analysis summarized in the previous bullet demonstrates that the cost effectiveness remains equal to or greater than $7,500 per ton of NOx emissions reduced or $12,000 per ton of VOC emissions reduced.

Subparagraph (ii) under paragraph (1) specifies that the applicant that evaluates and determines that there is no new pollutant specific air cleaning device, air pollution control technology or technique available at the time of submittal of the analysis and that each technically feasible air cleaning device, air pollution control technology or technique evaluated for the alternative RACT requirement or RACT emission limitation approved by the Department (or appropriate approved local air pollution control agency) under § 129.99(e) had a cost effectiveness less than $7,500 per ton of NO_x emissions reduced or $12,000 per ton of VOC emissions reduced shall include the following information in the analysis:

- A statement that explains how the owner or operator determined that there is no new pollutant specific air cleaning device, air pollution control technology or technique available.
- A list of the technically feasible air cleaning devices, air pollution control technologies or techniques previously evaluated under RACT II.
- A summary of the economic feasibility analysis performed for each technically feasible air cleaning device, air pollution control technology or technique in the previous bullet and the cost effectiveness of each technically feasible air cleaning device, air pollution control technology or technique as submitted previously under RACT II.
- A statement that an evaluation of each economic feasibility analysis summarized in the previous bullet demonstrates that the cost effectiveness remains less than $7,500 per ton of NO_x emissions reduced or $12,000 per ton of VOC emissions reduced.
- A new economic feasibility analysis for each technically feasible air cleaning device, air pollution control technology or technique.

Paragraph (2) establishes the procedures that the applicant that evaluates and determines that there is a new or upgraded pollutant specific air cleaning device, air pollution control technology or technique available at the time of submittal of the analysis shall follow.

- Perform a technical feasibility analysis and an economic feasibility analysis in accordance with § 129.92(b) (relating to RACT proposal requirements).
- Submit that analysis to the Department (or appropriate approved local air pollution control agency) for review and approval.

The applicant shall also provide additional information requested by the Department (or appropriate approved local air pollution control agency) that may be necessary for the evaluation of the analysis submitted under § 129.114(i).

Facility Details

Foam Fabricators, Inc. manufactures custom-shape molded expandable polystyrene (EPS) into products for packing, material handling and structural component uses. These polymeric resins are received in bead form, then expanded and fused into molded product through a series of production steps. The first step in the manufacturing process is to take the bead-like raw material, EPS, which contains pentane (3.87% to 6.00% by weight) as a blowing agent and to feed it into a steam vessel. The steam causes the polystyrene beads to soften and release some of the pentane. The pentane release causes the beads to expand to densities between 1.25 pounds per cubic feet and 4.0 pounds per cubic feet from a bulk density of 40 pounds per cubic feet. The material is then conveyed into large mesh storage bags to stabilize for 12-24 hours. After stabilization, the material is molded in steam chest molds mounted on hydraulic presses. The steam and pressure are used to fuse the beads together into the shape of the mold. After molding, the foam shapes are placed into cardboard boxes and warehoused until they can be shipped out.

The entire abovementioned process at the facility is carried out via the four main existing sources; the pre-expander (Source ID P101), the pre-puff storage (Source ID P103), the molding machines (Source ID P104), and the warehouse (Source ID P105) under the Title V permit 19-00002. Source IDs P101, P103, P104 and P105 are the major sources of VOC emissions at the facility with a combined potential VOC emissions limit of 85 tons per year (tpy) pursuant to BAT provisions established via plan approval 19-00002A. The individual process phases have no emission limits as the overall start-to-finish molding process is limited to the 85 tpy of VOC emissions. The major VOC emission is pentane which arises from the use of EPS resins.

Foam Fabricators is major for VOCs and not major for NOx. Therefore, no NOx RACT III analysis was completed by Foam Fabricators.

The facility last received a full compliance evaluation on September 14, 2023, with no violations noted.

There have been no modifications or changes made to the individual sources/process phases nor to the overall production process after October 24, 2016, except for the conversion of a molding machine from an EPP to an EPS molder via an exemption determination which resulted in no changes in emissions nor debottlenecking, etc.

Of the three applicable regulatory sections of RACT III, namely, §129.114(i)(1)(i), §129.114(i)(1)(ii), and §129.114(i)(2), §129.114(i)(1)(i) was utilized.

The Foam Fabricators RACT II revised permit was approved by the US EPA and said approval was incorporated into the PA SIP and published accordingly on October 16, 2020. Please see the *Federal Register 85 FR65706* for publication of the approval and incorporation into the PA SIP.

Foam Fabricators submitted a RACT III Notification for their Title V Operating Permit 19-00002 for their expandable polystyrene (EPS) foam molding facility located in the South Centre Township, Columbia County on December 29, 2022, in which a RACT II as RACT III evaluation and proposal was also included.

Sources subject to § 129.114(i) - RACT II determination assures compliance with RACT III requirements

Source ID	Source Name	RACT III Provision
P101	Pre-Expander	§129.114(i)(1)(i)
P103	Pre-Puff Storage Bags	§129.114(i)(1)(i)
P104	Molding Machines	§129.114(i)(1)(i)
P105	Finished Goods Storage/Warehouse	§129.114(i)(1)(i)

The RACT II determination/requirements can be found in the attached RACT II review memo and at the following link:

EPA Approved Pennsylvania Source-Specific Requirements | US EPA

RACT II analysis performed by the Company

Foam Fabricators has proposed that RACT II satisfies the requirements of RACT since there have been no changes or modifications to the facility or EPS molding process. To satisfy that proposal, they demonstrated in their RACT II application technical and feasibility analysis that several control technologies were not technically feasible at their facility. They conducted an analysis in which VOC emissions from each phase of the molding process was segregated and tabulated using a well-known EPS molding industry analytical method. Each phase of the process was then evaluated for technical and economic feasibility. For the control methods that were technically feasible, Foam Fabricators demonstrated to the Department's and EPA's satisfaction using the methods of the US EPA's OAQPS Cost Control Manual that the 2017 annualized costs per ton were above the cost thresholds of RACT II. Foam Fabricators did not adjust the costs derived in the 2017 RACT II costing analysis because using those costs shows the dollar per ton of VOC removal values to be above the RACT III screening value of $12,000 per ton of VOC removed. Given the inflationary pressures on the economy, supply chain disruptions and labor issues incurred during the Covid-19 era, there is no reason to believe any of these costs have reduced, consequently, Foam Fabricators did not update the cost analysis.

The table below summarizes the cost of control for RACT II methods evaluated.

Source ID	Source Name	Control Technology	VOC Emissions before Control	VO Emissions after Control	Total Annual Cost of Control Eqpt	VOC ($/Ton) Removal Cost
P101	PE only	Catalytic Oxidation	19.9	0.8	$236,571	$12,386
P101	PE only	Regenerative Thermal Oxidizer	19.9	0.8	$264,954	$13,872
P101	PE only	Thermal Oxidation	19.9	0.8	$278,051	$14,558
P101+P103+P104	PE+PPS+MM	Regenerative Thermal Oxidizer	55.5	7.0	$761,333	$15,698
P101+P103	PE+PPS	Regenerative Thermal Oxidizer	45.1	1.8	$705,913	$16,303
P101+P103	PE+PPS	Catalytic Oxidation	45.1	1.8	$737,115	$17,023
P101+P103+P104	PE+PPS+MM	Catalytic Oxidation	55.5	7.0	$895,237	$18,458
P101+P103+P104	PE+PPS+MM	Thermal Oxidation	55.5	7.0	$1,149,008	$23,691
P101+P103	PE+PPS	Thermal Oxidation	45.1	1.8	$993,105	$22,935

Legend to Table Above

Source ID	Abbrev	Source Name
P101	PE	Pre-Expander
P103	PPS	Pre-Puff Storage Bags
P104	MM	Molding Machines

Company's RACT II equals RACT III Analysis

The control methods evaluated for the potential reduction of VOCs included alternative material substitution, thermal oxidation, regenerative thermal oxidation, catalytic oxidation, flaring, rotary concentrator/oxidation, carbon adsorption, condensation, wet scrubbing, capture and routing of process emissions to boiler in combustion air.

As for reviewing any new or improved control technologies, Foam Fabricators listed the control methods that were used on the 2017 RACT II analysis. Foam Fabricators conducted a review of the RACT/BACT/LAER Clearinghouse to see if new control technologies have come on the market. They also reviewed the EPA's Air Pollution Control Technology Fact Sheets, the National Service Center for Environmental Publications, and DEP's Control Technique Guidelines to assess whether late-breaking technologies had come to the fore and they concluded that the technologies they evaluated remain the current best available.

Foam Fabricators' analysis of alternate materials showed that the use of alternates is rarely possible due to factors such as mold design intricacy and its effect on molding, and customer requirements for the container properties. They related that past experience with lower pentane raw material resulted in both unacceptable and costly process and product failure. Consequently, Foam Fabricators deemed alternate material substitution to be technically infeasible.

Foam Fabricators considered flaring as an option but concluded that the low VOC content, ergo low Btu content, captured from the processes would be well under the 300 Btu per standard cubic foot threshold at which flaring is a technically feasible control option. To oxidize the low Btu gas with a flare requires additional fuel gas input from the flare and consequently the emission reductions are offset by increased fuel gas combustion. Therefore, flaring was ruled out as technically infeasible (even though in theory it could be done).

Rotary concentrators utilize a rotating media that adsorbs volatiles and in a subsequent phase of the rotation those adsorbed volatiles, having been concentrated on the media, are desorbed via a thermal process and then sent to a combustion phase for destruction. The key benefit of the concentrator is its ability to pull VOCs from a low concentration effluent stream, concentrate them on the media, after which the VOCs become a higher concentration flow in the desorption phase. The setback for rotary concentrators is processes with the presence of intolerable moisture levels which foul the adsorption media. This is the case with the molding process at Foam Fabricators. Additional detractions for this technology were its low adsorption rate for pentane and the overall explosive nature of pentane which added a safety consideration. As a result, this technology was deemed technically infeasible.

Carbon adsorption was evaluated and the drawbacks for its use was the modest adsorption rate of pentane, the safety considerations of dealing with the captured pentane during its disposal or regeneration (pentane is not destroyed but relocated), and the fouling caused by the high moisture in the molding process. These factors ruled out the use of carbon adsorption as technically feasible.

Condensation methods were determined to not be optimal technologies because these approaches are most efficient and effective in lower flow, higher VOC concentration and higher temperature gas streams. The Foam Fabricators processes are just the opposite of these characteristics and as a result condensation was ruled out.

Wet scrubbing was ruled out because pentane is not particularly soluble in water and wet scrubbing, to be effective, requires the organic to be soluble. On top of that, scrubbing only relocates the highly flammable pentane to another location in a form in which it must be treated

regardless. Consequently, this approach is technically infeasible and also not reasonable given the air contaminant being removed.

Foam Fabricators evaluated the capture of the process streams to route them to the combustion air stream for the existing steam boiler which is used to supply steam for the molding process. They concluded this in part based on the highly problematic experiences with this approach at another Foam Fabricator facility. The technical evaluation at this facility indicated that, with the minimum air flow required to effectively capture the process emissions, this said air flow would exceed the required combustion air flow requirement for the boiler, and consequently this approach is not technically feasible at this facility. An additional technical element not readily resolved in this approach is the high moisture content in the process stream that would become the boiler combustion air stream. Also, for this facility, the boiler would need to be on high-fire during the molding process in order to accommodate the air flow capture rate and this simply does not happen, as boiler demand fluctuates.

Having eliminated the previous control methods due to technical infeasibility, Foam Fabricators evaluated control technologies known to be technically achievable for the processes at the facility. Costing for these approaches included variations of ducting, hoods and other mechanical features to capture and route the process effluent streams to the technically feasible control devices. The technically feasible approaches included thermal oxidation, catalytic oxidation and regenerative thermal oxidation. Foam fabricators looked at capturing and controlling individual phases of the process as well as combinations of the phases. They did not consider capture of the Finished Goods/Warehousing portion of the process due to the sheer volume of this physical space, the total inability to readily capture emissions due to the layout, along with the severe variability of the air stream content due to the loading and unloading and overhead door opening and closing that occurs in this area.

Department's Independent Analysis

The Department also performed an independent analysis which included, the Department's continuous review of permit applications since the applicability date of RACT II, control technology internet searches, RACT/BACT/LAER Clearinghouse search, combined with the knowledge gained from the Department permitting staff participating in technical presentations by several vendors and manufacturers of pollution control technology, along with a review of EPA and MARAMA's documents. Based on our review of these sources and documents, along with training and the expertise of the reviewing staff, the Department concludes that presently there are no new or updated air pollution control technologies available for the sources found at Foam Fabricators. The Department has determined that RACT II requirements for sources P101, P103, P104 and P105 at Foam Fabricators listed in the preceding tables ensures compliance with requirement for RACT III for 25 Pa. Code §§ 129.111 - 129.115.

Public discussion

No discussions occurred with the EPA, the company, or the public beyond the initial application, which materially impacted a decision to include one or more sources under the RACT II is RACT III umbrella.

Conclusion

The Department has analyzed the applicant's proposal for considering RACT II requirements as RACT III and also performed independent analysis. Based on the information provided by the applicant and parallel verification by the Department, the Department determines that the RACT II requirements satisfy the RACT III requirements. The RACT III requirements are identical to the RACT II requirements and are as stringent as RACT II.

File: Foam Fabricators, Permits, TVOP, 19-00002
Cc: Central Office, Air Quality Permits
US EPA Region III