pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

MEMO

To: Mark J Wejkszner, P.E M.W. 8/4/2023
Program Manager
Air Quality Program

From: Shailesh Patel, P.E SP 8/3/2023
Air Quality Engineer
Air Quality Program

Through: Raymond Kempa, P.E R. K. 8/4/23
Environmental Group Manager
Air Quality Program

DATE **August 3. 2023**

RE Carpenter Co.
TV Operating Permit No. 39-00040
Upper Macungie Township, Lehigh County

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 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 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
Carpenter Co. operates the Fogelsville manufacturing facility in Lehigh County, PA under Title V operating permit No. 39-00040. The facility manufactures foam products, including expanded polystyrene (EPS) and polyurethane products. The Fogelsville facility is a major source of volatile organic compounds (VOC) per Title 25 of the Pennsylvania Code, Chapter 121.1. The Carpenter's Fogelsville site's potential to emit NOx is less than 100 tons per year (tpy); therefore, the site is classified as a minor NOx facility under the RACT III rule, and hence is exempted from this rule for NOx emission sources. Potential VOC emissions exceed 50 tpy, subjecting the VOC sources at the facility to the RACT III VOC requirements. There are no new emission sources or changes to existing sources after October 24, 2016.

The EPA approved RACT II case-by-case RACT requirements for the facility on October 20, 2020 in 85 FR 66489. Their Fogelsville facility is not a major source of nitrogen oxides (NO_X) and therefore, according to 25 Pa Code 129.96(a), is not subject to any of the NO_X related requirements of the rule.

The applicant submitted their RACT II equals RACT III proposal on December 20, 2022. Revisions were submitted on July 27, 2023.

List of sources(s) subject to § 129.114(i) - RACT II determination assures compliance with RACT III requirements

Source ID	Source Description	VOC RACT Status	Potential VOC Emissions (tpy)	Actual VOC Emissions (tpy)
101	EPS manufacturing process	Alternative VOC RACT Proposal per 25 Pa Code 129.114(i)	88.8	44.29
102	Polyurethane foam manufacturing process	Alternative VOC RACT Proposal per 25 Pa Code 129.114(i)	20	3.86
033	Boiler – EPS Building	Exempt	< 1	< 1

N/A	Polyester fiber line	Exempt	< 1	< 1
N/A	BFL line	Exempt	< 1	< 1
N/A	Laser cutter	Exempt	< 1	< 1
N/A	CaCO3 unloading	Exempt	< 1	< 1
N/A	Polyurethane foam line storage tanks	Exempt	< 1	< 1

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 III analysis performed by the Department under § 129.114(j)(1):

EPS Manufacturing Process (Source ID 101)
The EPS manufacturing process (Source ID 101) uses steam to convert raw materials to styrene. The process steps generally include bead expansion, bead drying, bead storage, block molding, block aging and final product fabrication. The raw material consists of beads impregnated with pentane to act as a blowing agent. The beads are received in "supersacks". Beads are fed to the expander where steam is used to expand the beads to approximately 1/8" diameter, in a one- or two-stage operation. The expanded beads flow to a fluidized bed dryer, where surface moisture is removed using air blown through the "bed" of beads. The beads flow through an airlock and are blown to storage bags. After aging in storage bags, to stabilize the prepuff, the beads are transferred to a mold where steam further expands and fuses them together into block form. After aging to stabilize, the block is cut and fabricated for insulation products or architectural shapes.

Pentane is lost during the expansion process. Pentane emissions from the EPS manufacturing process are currently controlled by a 16.329 MMBtu/hr boiler (Source ID 33, Stack ID S03). The Epsilon system collects the pentane vapors from the process and injects them into the boiler's combustion air. As a result, the pentane replaces some of the natural gas used as boiler fuel. The boiler has a destruction efficiency of greater than 99% for VOC. Fugitive pentane is also emitted from the storage and fabrication area. This area is ventilated via five wall mounted fans.

Polyurethane Manufacturing Process (Source ID 102)
In the polyurethane foam manufacturing process (Source ID 102), the primary ingredients include polyol, toluene diisocyanate (TDI) or methylene diphenyl diisocyanate (MDI), and water. The raw materials, along with secondary additives such as carbon dioxide (CO2) blowing agent, catalysts, surfactants, and colorants are metered into a mixing chamber and then dispersed onto a moving conveyor. The foaming action starts almost immediately and is complete within five minutes.

VOCs are emitted from the polyols, TDI, MDI, and amine catalysts used the process. Most of the VOC emissions from the polyurethane manufacturing process are vented from the pouring tunnel through six large exhaust vents ducted into one exhaust stack above the roof (Stack S04). Additional VOC emissions are vented to a second exhaust stack (Stack S05) after the pouring tunnel. After the foam progresses through the tunnel, it is cut into convenient slab lengths for storage. The slabs are moved from the pouring line to the slab room.

Fugitive VOCs are generated during the curing process in the slab room. The room is ventilated via eight wall-mounted exhaust fans. After the slabs have cured for a minimum time, the foam is ready to be cut according to customer requirements.

In addition, the foam is subject to flammability testing in a quality control laboratory known as the "burnroom." Tests are short in duration, approximately one hour, and occur every few days. Minor smoke emissions occur from this testing. The final products produced from the foam slabs may be furniture cushions, carpet underlay, medical pads for hospitals, bedding, automotive pads, or any product that requires flexible foam.

Other Source Information

A boiler rated at 16.329 MMBtu/hr which is fired on natural gas and pentane serves as a control device for pentane emissions from the EPS manufacturing process. The polyurethane foam line includes several storage tanks which store VOCs. There are several other emission points throughout the facility which exhaust to the atmosphere, including exhaust stacks for the polyester fiber line, exhaust stacks for the bonded foam line (BFL), laser cutters, and calcium carbonate (CaCO3) unloading operations. Emissions from the foam grinding system (FGS) are discharged inside the building.

Sources Exempt from RACT

Sources with a potential to emit of one (1) tpy or less of VOC are exempt from the RACT III VOC related requirements, in accordance with 25 Pa Code 129.111(c). The EPS Boiler (Source ID 033), the polyester fiber line, the BFL line, the laser cutters, and the CaCO3 unloading operations have potential emissions of VOC less than one (1) tpy. As such, these sources are exempt from VOC RACT requirements and do not require further assessment.

Units which are subject to various sections of 25 Pa Code 129 are exempt from the RACT III VOC related requirements, in accordance with 25 Pa Code 129.111(a). The VOC-containing storage tanks used in the polyurethane foam manufacturing process are subject to 25 Pa Code 129.56 and 129.57. As such, these sources are exempt from VOC RACT requirements and do not require further assessment.

Carpenter has determined that there are no additional technically feasible or cost-effective control technologies available at the time of submittal. This was the same conclusion that was determined for Carpenter's RACT II submittal under 25 Pa Code §129.99(e). A summary of the RACT II analyses along with descriptions for technically infeasible controls are as shown in table below. A cost effectiveness analysis was not performed for the RACT II analysis per §129.99(e) as the best available control technology was selected as RACT for source ID 101.

Feasibility Analysis for Control Technologies for Carpenter RACT II Submittals

Control Technology	Technical Feasibility	Economic Feasibility	Cost for Technically Feasible controls ($/ton)
Source ID 101: EPS manufacturing process (VOC)			
Emissions Routed to Boiler	Feasible	Installed	N/A
Thermal Oxidizer	Feasible	N/A	N/A
Catalytic Oxidizer	Feasible	N/A	N/A

Carbon Adsorption	Feasible	N/A	N/A
Refrigerated Condensers	Infeasible	N/A	N/A
Flares	Infeasible	N/A	N/A
Source ID 102: Polyurethane foam manufacturing process (VOC)			
Thermal Oxidizer	Feasible	N/A	40,000
Catalytic Oxidizer	Infeasible	N/A	N/A
Carbon Adsorption	Infeasible	N/A	N/A
Good Operating and Management Practices	Feasible	Installed	N/A
Refrigerated Condensers	Infeasible	N/A	N/A
Flares	Infeasible	N/A	N/A

The following summarizes the findings for RACT control RACT II. There is no change to the assessment for any of these technologies for RACT III as compared to RACT II.

Source ID 101- EPS manufacturing process
The EPS manufacturing process (Source ID 101) uses steam to convert raw materials to styrene. The process steps generally include bead expansion, bead drying, bead storage, block molding, block aging and final product fabrication. Pentane is lost during the expansion process. Pentane emissions from the EPS manufacturing process are currently controlled by a 16.329 MMBtu/hr boiler (Source ID 33, Stack ID S03). The Epsilon system collects the pentane vapors from the process and injects them into the boiler's combustion air. As a result, the pentane replaces some of the natural gas used as boiler fuel. The boiler has a destruction efficiency of greater than 99% for VOC. Fugitive pentane is also emitted from the storage and fabrication area. This area is ventilated via five wall-mounted fans. The EPS system has the potential to emit more than 2.7 tons of VOC per year but does not have a presumptive limit in RACT III.

Carpenter determined that the continued routing of emissions to boilers are RACT for source ID 102. The following controls were determined to be technically infeasible:

Refrigerated Condensers: Based on research this technology has not been commercially demonstrated on EPS manufacturing processes like those at the Fogelsville facility. Also, this technology is not identified in the RBLC search results for similar processes.

Flares: Based on research this technology has not been commercially demonstrated on EPS manufacturing processes like those at the Fogelsville facility. Also, this technology is not identified in the RBLC search results for similar processes.

As shown in Table above, Carpenter has concluded there are no upgrades or new equipment available as they will comply with 25 Pa Code §129.114(i)(1). In addition, each technically feasible control was determined to have a cost above $12,000 per ton VOC. As such, Carpenter will comply with 25 Pa Code §129.114(i)(1)(i).

Carpenter is including the following information as required by 25 Pa Code §129.114(i)(1)(i):

Ranked Control Technologies for EPS Manufacturing Process

Ranked Control Technologies	Control Efficiency
1. Current Control – Emissions Routed to Boiler	99%
2. Thermal Oxidation	99%
3. Catalytic Oxidation	95%
4. Carbon absorption	90%

As shown in Table above, the technology currently used to control VOC emissions from the EPS manufacturing process, routing emissions to the boiler, is the most effective technically feasible control technology for the process. The EPA Polystyrene Report confirms that where applicable, use of existing boilers would be the most effective control option. Although thermal oxidation has a similar control efficiency, the cost effectiveness of implementing this new control technology would obviously be much higher than the cost effectiveness of continuing to operate the existing control technology currently in place. Also, the current control technology offsets a portion of the fuel required to produce the steam needed for the EPS manufacturing process. Implementation of a new control technology would result in an undesirable increase in fuel usage at the facility. The less effective control options are eliminated as potential RACT technologies and are not reviewed further.

All the above control technologies were evaluated by PADEP in support of Carpenter's alternative RACT II analysis for Source ID 101.

If a cost analysis were performed again for the feasible VOCs controls, the calculated cost would be higher than those previously determined. This is due to inflation and the increased cost of materials and labor. For this reason, Carpenter has determined that the cost effectiveness of implementing this new control technology would obviously be much higher than the cost effectiveness of continuing to operate the existing control technology currently in place.

Source ID 102 - Polyurethane foam manufacturing process

In the polyurethane foam manufacturing process (Source ID 102), the primary ingredients include polyol, toluene diisocyanate (TDI) or methylenediphenyl diisocyanate (MDI), and water. The raw materials, along with secondary additives such as carbon dioxide (CO_2) blowing agent, catalysts, surfactants, colorants and flame retardants, are metered into a mixing chamber and then dispersed onto a moving conveyor. The foaming action starts almost immediately and is complete within five minutes. VOCs are emitted from the polyols, TDI, MDI, and amine catalysts used in the process. Most of the VOC emissions from the polyurethane manufacturing process are vented from the pouring tunnel through six large exhaust vents ducted into one exhaust stack above the roof (Stack S04). Additional VOC emissions are vented to a second exhaust stack (Stack S05) after the pouring tunnel. After the foam progresses through the tunnel, it is cut into convenient slab lengths for storage. The slabs are moved from the pouring line to the slab room.

Carpenter has not identified any add-on control technologies as RACT for the polyurethane foam manufacturing process at the Fogelsville facility. The following controls were determined to be technically infeasible:

Refrigerated Condensers: Based on research this technology has not been commercially demonstrated on a polyurethane foam manufacturing processes like those at the Fogelsville facility. Also, this technology is not identified in the RBLC search results for similar processes.

Flares: Based on research this technology has not been commercially demonstrated on a polyurethane foam manufacturing processes similar to those at the Fogelsville facility. Also, this technology is not identified in the RBLC search results for similar processes.

Carpenter has concluded there are no upgrades or new equipment available as they will comply with 25 Pa Code §129.114(i)(1). In addition, each technically feasible control was determined to have a cost above $12,000 per ton VOC. As such, Carpenter will comply with 25 Pa Code §129.114(i)(1)(i). Carpenter is including the following information as required by 25 Pa Code §129.114(i)(1)(i):

Ranked Control Technologies for the Polyurethane Manufacturing Process

Ranked Control Technologies	Control Efficiency
1. Thermal Oxidation	99%
2. Current Control – Good Operating and management	--

Carpenter has not identified any add-on control technologies as RACT for the polyurethane foam manufacturing process at the Fogelsville facility. In addition, Carpenter is already employing appropriate work practices to minimize VOC emissions, such as using non-VOC blowing agents and ensuring that all clean up solvent operations comply with Best Available Technology to minimize emissions. All new and used cleaning solvents are stored in closed containers. Carpenter is operating in compliance with these standards. Carpenter proposes that work practice standards noted above as well as the existing VOC emission limit of 20 tpy from the foam line be applied as RACT for the polyurethane foam manufacturing process at the Fogelsville facility.

All the above control technologies were evaluated by PADEP in support of Carpenter's alternative RACT II analysis for Source ID 102.

A control efficiency of 98% was assumed for the thermal oxidizer. Other assumptions and cost estimates used in the analysis are based on methods found in the OAQPS CCM, Sixth Edition. The results of this cost analysis demonstrate an annualized cost effectiveness of over $292,000 per ton of VOC controlled from the stack emissions only and an annualized cost effectiveness of over $40,000 per ton of VOC controlled from combined stack and fugitive emissions. Both cost estimates are based on an assumed 10-year life span of the equipment. This cost effectiveness is not reasonable, therefore thermal oxidation is not RACT for the polyurethane foam manufacturing process processes.

If a cost analysis were performed again for the controls listed above in table, the calculated cost would be higher than those previously determined. This is due to inflation and the increased cost of materials and labor. For this reason, Carpenter has determined that cost effectiveness of implementing this new control technology would obviously be much higher than the cost effectiveness of continuing to operate the existing control technology currently in place.

A review of the U.S. Environmental Protection Agency's RACT/BACT/LAER Clearinghouse (RBLC) database determined no new cleaning devices, air pollution control technologies, or techniques could be applied to these sources. I performed a series of online searches for new controls and found no newer control device for VOC emissions control from these types of processes. All available control technologies for this type of process emissions were evaluated.

Based on the control technology review, the Department concludes that no new control technologies or sufficient changes to the technical capabilities of the existing technologies were identified.

Public discussion
No discussions occurred with the EPA, the company, or the public after the company submitted the RACT II is RACT III proposal application.

Conclusion
The Department has analyzed Carpenter Co's Fogelsville manufacturing facility's proposal for considering RACT II requirements as RACT III and performed independent analysis. Based on the information provided by the applicant of the facility and independently verified 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.

cc: NERO, TV Operating Permit No. 39-00040
EPA Region 3

COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
RACT II Review Memo

SUBJECT: Title V Operating Permit Review Memo (Significant Modification – RACT II)
Carpenter Co.
Upper Macungie Township, Lehigh County
Application No. 39-00040
APS:947591 Auth Id: 1193647

To: Mark J Wejkszner, PE MJW
Program Manager
Air Quality Program

From: Shailesh Patel, PE SP
Air Quality Engineer
Air Quality Program

Through: Raymond Kempa, PE RK
Environmental Group Manager
Air Quality Program

On July 11, 2017, the Department received an application for a Significant Modification to address PADEP's RACT II regulations to the existing TVOP, number 39-00040, for the Carpenter Co.

This application is to address the RACT II regulations found in 25 Pa. Code §§ 129.96-100.

Administrative/Notifications

Application Received:	July 11, 2017
GIF:	N/A with this application.
Compliance History:	Submitted with the application.
Site Location:	57-A Olin Way, Fogelsville, PA 18051
Coordination involvement:	None Required
Application Fee:	$750.00, received with application.
Municipal Notification:	Submitted with the application.

RACT II affects many sources at the Carpenter's facility. However, most of these are either exempted from these regulations as their potential emissions on a source-by-source bases are below the applicable thresholds of they meet the presumptive RACT II requirements that are noted in 25 Pa. Code § 129.96

The company has prepared case-by-case analyses and proposed compliance strategies for the control of VOC emissions from certain emissions sources at the facility. As detailed in 25 Pa. Code §129.99(c), for each VOC air contamination source with the potential to emit (PTE) equal to or greater than 2.7 tpy, which is not subject to 25 Pa. Code §129.97 (i.e., presumptive RACT 2 Rule requirements and/or emissions limitations), the facility must propose a VOC RACT requirement and/or emissions limitation, or both in accordance with 25 Pa. Code §129.99(c)-(d). As summarized below, Carpenter is required to propose alternative RACT requirements or emissions limitations, or both under 25 Pa. Code §§ 129.99(c) for the two listed emissions sources. This significant modification deals with the individual sources and addresses the RACT II requirements found in 25 Pa. Code §§ 129.96 – 100. The affected sources for this regulation are as follows:

VOC Sources Subject to RACT II at the Fogelsville Plant

Source ID	Source Description	VOC RACT Status	Potential VOC Emissions (tpy)	Actual VOC Emissions (tpy)
101	EPS manufacturing process	Case-by-Case	88.8	35.4
102	Polyurethane foam manufacturing process	Case-by-Case	20	6.5
033	Boiler - EPS Building	Exempt	<1	<1
N/A	Polyester fiber line	Exempt	<1	<1
N/A	BFL line	Exempt	<1	<1
N/A	Laser cutter	Exempt	<1	<1
N/A	CaCO3 unloading	Exempt	<1	<1
N/A	Polyurethane foam line storage tanks	Exempt	<1	<1

Units with a potential to emit of one (1) tpy or less of VOC are exempt from the RACT II VOC related requirements, in accordance with 25 Pa Code 129.96(c). The EPS Boiler (Source ID 033), the polyester fiber line, the BFL line, the laser cutters, and the CaCO3 unloading operations have potential emissions of VOC less than one (1) tpy. As such, these sources are exempt from VOC RACT requirements.

Units which are subject to various sections of 25 Pa Code 129 are exempt from the RACT II VOC related requirements, in accordance with 25 Pa Code 129.96(a). The VOC-containing storage tanks used in the polyurethane foam manufacturing process are subject to 25 Pa Code 129.56 and 129.57. As such, these sources are exempt from VOC RACT requirements and do not require further assessment

For sources which do not qualify for one of the source categories that have presumptive RACT limits, Option 2 for RACT compliance applies. Under this option, facilities must propose an alternative RACT emission limitation (i.e., a "case-by-case RACT limit") and submit a permit modification request, or Plan Approval application to PADEP to establish this RACT II limit. The Source 101, (EPS manufacturing Process) and Source 102, (Polyurethane foam Mfg Process) at the Fogelsville facility are subject to a case-by-case VOC RACT analyses.

CASE BY CASE RACT

Case-by-case RACT involves conducting a "top-down" analysis as outlined in the US EPA Draft "New Source Review Workshop Manual". This was published in October 1990, but the procedures established are still followed today. This involves the use of the RACT/BACT/LAER Clearing house (RBLC), as well as the use of additional information available on the US EPA's website and information garnered from control device vendors.

A basic summary of this top-down analysis after determining the sources and pollutant (NOx and/or VOC) subject to the regulation is as follows:

1. Identify all available control technologies;
2. Eliminate the technically infeasible control technologies;
3. Rank the remaining control options by effectiveness;
4. Evaluate the remaining control options for economic, environmental and energy impacts in accordance with Section 4.2, Chapter 1, of the Office of Air Quality Planning and Standards (OAQPS) Air Pollution Control Cost Manual and document the results;
5. Finally, identify RACT based on the above steps.

Presumptive RACT II values.

PADEP has established the following presumptive RACT benchmarks with a 25% buffer in dollars per ton of pollutant removed:

NOx – $3500.00
VOC - $7000.00

RACT Analysis for Source ID. 101 (EPS Manufacturing Process)

The EPS manufacturing process (Source ID 101) uses steam to convert raw materials to styrene. The process steps generally include bead expansion, bead drying, bead storage, block molding, block aging and final product fabrication. The raw material consists of beads impregnated with pentane to act as a blowing agent. The beads are received in polyethylene lined cardboard containers (gaylords) and/or "supersacks", Beads are fed to the expander where steam is used to expand the beads to approximately 1/8" diameter, in a one- or two-stage operation. The expanded beads flow to a fluidized bed dryer, where surface moisture is removed using air blown through the "bed" of beads. The beads flow through an airlock and are blown to storage bags. After aging in storage bags, to stabilize the prepuff, the beads are transferred to a mold where steam further expands and fuses them together into block form. After aging to stabilize, the block is cut and fabricated for insulation products or architectural shapes.

Pentane is lost during the expansion process. Pentane emissions from the EPS manufacturing process are currently controlled by a 16.329 MMBtu/hr boiler (Source ID 33, Stack ID S03). The Epsilon system collects the pentane vapors from the process and injects them into the boiler's combustion air. As a result, the pentane replaces some of the natural gas used as boiler fuel. The boiler has a destruction efficiency of greater than 99% for VOC,

Fugitive pentane is also emitted from the storage and fabrication area. This area is ventilated via five wall-mounted fans.

Available VOC Control Options

Thermal Oxidizer
Catalytic Oxidizer
Carbon Adsorption
Current Control - Emissions Routed to Boiler

Neither of the technologies listed above have been commercially demonstrated on EPS manufacturing processes similar to those at the Facility. Also, these technologies are not identified in the RBLC. The use of alternative blowing agents is not reviewed as a potential VOC control technology for the EPS manufacturing process under RACT. There are no commercially available blowing agents which are appropriate for use in the EPS manufacturing process other than pentane. According to the EPA's "Control of VOC Emissions from Polystyrene Foam Manufacturing" report (EPA Polystyrene Report), published in 1990, pentane is the only blowing agent that is has a high enough molecular weight to not vaporize at ambient air pressure during aging and storage of impregnated beads but a low enough molecular weight to vaporize during bead expansion.".

Elimination of technically infeasible control technologies.

Thermal Oxidation

Thermal oxidation is a potentially feasible control device for the EPS manufacturing process.

Catalytic Oxidation

Catalytic oxidation is a potentially feasible control device for the EPS manufacturing process.

Carbon Adsorption

Carbon adsorption is a potentially feasible control device for the EPS manufacturing process.

Emissions Routed to Boiler

The continued use of a boiler to control pentane emissions from the EPS manufacturing system is a technically feasible control strategy for the EPS manufacturing process at Carpenter's Fogelsville facility.

Ranking of VOC Control Options

1. Current Control - Emissions Routed to Boiler - 99 % Control Efficiency
2. Thermal Oxidation - 99 % Control Efficiency
3. Catalytic Oxidation - 95 % Control Efficiency
4. Carbon absorption - 90 % Control Efficiency

Control technology evaluation.

As shown above, the technology currently used to control VOC emissions from the EPS manufacturing process, routing emissions to the boiler, is the most effective technically feasible control technology for the process. Although thermal oxidation has a similar control efficiency, the cost effectiveness of implementing this new control technology would obviously be much higher than the cost effectiveness of continuing to operate the existing control technology currently in place. Also, the current control technology offsets a portion of the fuel required to produce the steam needed for the EPS manufacturing process. Implementation of a new control technology would result in an undesirable increase in fuel usage at the facility.

Identify RACT.

Based upon the analysis provided above, Carpenter has identified the existing control technology, routing emissions to the boiler, as RACT for the EPS manufacturing process processes at the facility. Under the facility's current Title V operating permit, the boiler is required to be operating within the parameters established in the Compliance Assurance Monitoring (CAM) plan whenever the EPS manufacturing process is operational and must achieve at least 99% destruction efficiency for VOCs. Carpenter is operating in compliance with the standards. Carpenter proposes that these permit requirements as well as the current VOC emission limit of 88.8 tpy be applied as RACT for the EPS manufacturing process at the Fogelsville facility.

RACT Analysis for Source Id 102: Polyurethane Foam Manufacturing Process:

In the polyurethane foam manufacturing process (Source ID 102), the primary ingredients include polyol, toluene diisocyanate (TDI) or methylenediphenyl diisocyanate (MDI), and water. The raw materials, along with secondary additives such as carbon dioxide (CO_2) blowing agent, catalysts, surfactants, colorants and flame retardants, are metered into a mixing chamber and then dispersed onto a moving conveyor. The foaming action starts almost immediately and is complete within five minutes.

VOCs are emitted from the polyols, TDI, MDI, and amine catalysts used the process. Most of the VOC emissions from the polyurethane manufacturing process are vented from the pouring tunnel through six large exhaust vents ducted into one exhaust stack above the roof (Stack S04). Additional VOC emissions are vented to a second exhaust stack (Stack S05) after the pouring tunnel. After the foam progresses through the tunnel, it is cut into convenient slab lengths for storage. The slabs are moved from the pouring line to the slab room.

Fugitive VOCs are generated during the curing process in the slab room. The room is ventilated via eight wall-mounted exhaust fans. After the slabs have cured for a minimum time, the foam is ready to be cut according to customer requirements.

In addition, the foam is subject to flammability testing in a quality control laboratory known as the "burn room." Tests are short in duration, approximately one hour, and occur every few days. Minor smoke emissions occur from this testing. The final products produced from the foam slabs may be furniture cushions, carpet underlay, medical pads for hospitals, bedding, automotive pads, or any product that requires flexible foam

Available VOC control Options:

Thermal Oxidizer
Catalytic Oxidizer
Carbon Adsorption
Current Control - Good Operating and Management Practices

Elimination of technically infeasible control technologies

Thermal Oxidation

Thermal oxidation is a potentially feasible control device for the Polyurethane Foam Manufacturing Process.

Catalytic Oxidation

Catalytic oxidation is a technically infeasible control device for the Polyurethane Foam Manufacturing Process.

Carbon Adsorption

Carbon adsorption is a technically infeasible control device for the Polyurethane Foam Manufacturing Process.

Good Operating and Management Practices

Carpenter is already employing appropriate work practices to minimize VOC emissions, such as using non-VOC blowing agents and ensuring that all clean up solvent operations comply with Best Available Technology to minimize emissions. All new and used cleaning solvents are stored in closed containers. Carpenter is operating in compliance with these standards.

Ranking of VOC Control Options

1. Thermal Oxidation - 99 % Control Efficiency
2. Good Operating practices

Control technology evaluation

The most efficient, control technology which is technically feasible for the polyurethane foam manufacturing process is thermal oxidation. Therefore, a cost analysis was performed on thermal oxidation control technology for the polyurethane foam manufacturing process.

A control efficiency of 98% was assumed for the thermal oxidizer. Other assumptions and cost estimates used in the analysis are based on methods found in the OAQPS CCM, Sixth Edition. The results of this cost analysis demonstrate an annualized cost effectiveness of over $292,000 per ton of VOC controlled from the stack emissions only and an annualized cost effectiveness of over $40,000 per ton of VOC controlled from combined stack and fugitive emissions. Both cost estimates are based on an assumed 10-year life span of the equipment. This cost effectiveness is not reasonable, therefore thermal oxidation is not RACT for the polyurethane foam manufacturing process processes.

Identify RACT

Based upon the analysis provided above, Carpenter has not identified any add-on control technologies as RACT for the polyurethane foam manufacturing process at the facility. In addition, Carpenter is already employing appropriate work practices to minimize VOC emissions, such as using non-VOC blowing agents and ensuring that all clean up solvent operations comply with Best Available Technology to minimize emissions. All new and used cleaning solvents are stored in closed containers. Carpenter is operating in compliance with these standards. Carpenter proposes that work practice standards noted above as well as the existing VOC emission limit of 20 tpy from the foam line be applied as RACT for the polyurethane foam manufacturing process at the facility.

RACT Summary

EPS Manufacturing Process, Case-by-case

1. The annual VOC emissions from the process shall not exceed 88.8 tons per year based on a 12-month rolling sum.
2. The facility shall achieve at least 99% destruction efficiency for the VOC emissions in the control device (C33); and
3. The company shall ensure that the capture system and control device (C33) area operated at all times the source (101) is in operation. The boiler must be operating within the parameters established in the CAM plan whenever the EPS process is operating.

Monitoring:

1. The facility shall ensure that the boiler is equipped with the applicable monitoring equipment and the monitoring equipment shall be installed, calibrated, and maintained in accordance with good manufacturing practices at all times the boiler is in use.
2. The operating range of the boiler is 15-270 psi of steam pressure as per boiler manual. The permittee shall monitor the steam pressure once a day during normal operating hours whenever source 101 is in operation (excluding weekends and holidays). If the boiler fails, pentane will still be collected by Process 101 until the concentration reaches 50% of the LEL, at which point the pentane is related and emitted. When the boiler is operating properly and pentane concentration in Process 101 reaches 85% of the LEL, then pentane is released and emitted. This would constitute a failure of the control device.

Recordkeeping:

1. The permittee shall record the steam pressure once a day during normal operating hours whenever source 101 is in operation (excludes weekends and holidays).

Polyurethane Foam Manufacturing Process, Case-by-case

1. The annual VOC emission rate from this source shall never exceed 20 tons per year based on a 12-month rolling sum as calculated by the company and approved by the Department; and
2. All clean up solvent operations must comply with Best Available Technology to minimize VOC emissions. All cleaning operations must store new and used cleaning solvents in closed containers; and
3. The company shall use only a non-traditional blowing agent (i.e., carbon dioxide) in the process. VOC blowing agents are prohibited from being used.

Recordkeeping:

1. Compliance with the VOC emission limit shall be demonstrated by recording the chemical usage for the foam line on a daily and monthly basis.

Recommendation

I recommend issuance of significant operating permit modification to address the Case-by-Case RACT II requirements found in 25 Pa. Code § 129.99(a).