



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Central Regional Office • 627 Main Street, Worcester MA 01608 • 508-792-7650

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September 29, 2014

Mr. Thomas Coz, President
Polyfoam Corp.
2355 Providence Road
P.O. Box 906
Northbridge, MA 01534-0906

RE: Northbridge
Transmittal No.: X239067 –A1
Application No.: CE-11-031
Class: OP
FMF No.: 134269
Alternative Schedule Project #TF-56
FINAL AIR QUALITY PLAN
APPROVAL Amendment-1

Dear Mr. Coz:

The Massachusetts Department of Environmental Protection (“MassDEP”), Bureau of Waste Prevention, has reviewed your Non-major Comprehensive Plan Application (“Application”) listed above. This Application concerns the operation of an Air Pollution Control Device and additional process equipment at Polyfoam Corp (“Polyfoam”) located at 2355 Providence Road in Northbridge, Massachusetts (“Facility”). The Facility is a shape-molder of expandable polystyrene (“EPS”). The Application bears the seal and signature of James Gagnon, Massachusetts Registered Professional Engineer number 29550.

This Application was submitted in accordance with 310 CMR 7.02 Plan Approval and Emission Limitations as contained in 310 CMR 7.00 “Air Pollution Control,” regulations adopted by MassDEP pursuant to the authority granted by Massachusetts General Laws, Chapter 111, Section 142 A-N, Chapter 21C, Section 4 and 6, and Chapter 21E, Section 6. MassDEP’s review of your Application has been limited to air pollution control regulation compliance and does not relieve you of the obligation to comply with any other regulatory requirements.

Polyfoam conducted background sound level analysis before control equipment was installed and again once the equipment was installed and operating. The sound level and pure tone analysis conducted after modifications indicated that the Facility is in compliance with the MassDEP’s sound policy.

MassDEP has determined that the Application is administratively and technically complete and that the Application is in conformance with the Air Pollution Control regulations and current air pollution control engineering practice, and hereby grants this **Plan Approval** for said Application, as submitted, subject to the conditions listed below.

Please review the entire Plan Approval, as it stipulates the conditions with which the Facility owner/operator (“Permittee”) must comply in order for the Facility to be operated in compliance with this Plan Approval.

1. DESCRIPTION OF FACILITY AND APPLICATION

Polyfoam Corp. (“Polyfoam”) utilizes Expandable Polystyrene (“EPS”) beads containing pentane as a blowing agent to manufacture custom shape molded foam containers for packing, shipping, and thermal insulating applications. The majority of the bead used in manufacturing contains between 3.0% and 6.2% pentane. A copolymer material called Arcel containing between 4-12% pentane is occasionally processed. Beads are pneumatically conveyed to an expander where they are pre-expanded with steam. The resulting pre-puff is transferred and allowed to age in mesh bags for approximately 6 to 48 hours. After aging, pre-puff foam material is conveyed to individual molding machines where it is fused in the molds under heat and pressure. Finished parts are removed from the mold and transferred to the on-site warehouse.

Polyfoam operated under several air quality Plan Approvals, the most recent C-P-93-013 (TR#62554 issued 9/20/93) allowed the Facility to emit 49 tons per consecutive 12 month period of pentane, a volatile organic compound (“VOC”), uncontrolled to the atmosphere from the delivery, expansion, aging, and molding of the EPS beads and the curing or storage of the finished molded foam products.

In August 2006, the Environmental Protection Agency (“EPA”) conducted an inspection of this Facility and determined that Polyfoam had under-calculated the VOC emissions resulting from the EPS bead expansion and molding equipment. EPA alleged that the actual VOC emissions were greater than the major category threshold for a stationary source and therefore Polyfoam was in violation of the Air Quality Plan Approval issued by MassDEP.

On September 15, 2011, a Federal Consent Decree (the “CD”) and Final Judgment was executed by the United States of America on behalf of the EPA against Polyfoam. EPA alleged that Polyfoam committed violations of the New Source Review (“NSR”) requirements, Title V operating permit requirements, and federally enforceable state air quality requirements, arising from the Clean Air Act (“CAA”), 42 U.S.C. § 7401 et. seq. EPA considered Polyfoam to be a major stationary source of VOCs and required the Facility to obtain a federally-enforceable state air permit(s). The applicable state permits are the 310 CMR 7.02 non-major Comprehensive

Plan Approval and a Title V operating permit pursuant to 40 CFR Part 70 as set out in 310 CMR 7.00: Appendix C (“Appendix C”).

The CD established that Polyfoam must submit an application(s) for a new federally-enforceable state air quality plan approval to MassDEP that included a VOC emission rate at least as stringent as that contained in the CD. It also required the use of a capture and control system including a Regenerative Thermal Oxidizer (“RTO”).

For purposes of this Plan Approval:

“Manufacturing emissions” shall mean all VOC emissions that occur during the pre-expansion, aging, and molding of EPS beads and EPS foam products, until the storage of the final product. This is known as Emission Unit #1 (EU #1);

“Post-Manufacturing Emissions” or “Storage Emissions” shall mean VOC emissions that occur for a maximum of 48 hours after an EPS foam product is manufactured. This is known as Emission Unit #2 (EU #2);

“Long Term Storage Emissions” shall mean VOC emissions that occur after Post-Manufacturing Emissions (EU #2) to a maximum of 28 days after an EPS foam product is manufactured. This is known as Emission Unit #3 (EU #3);

“Boiler VOC Emissions” shall mean VOC emissions that occur from the two natural gas process boilers. This is known as Emission Unit #4 (EU #4); and

“Total Facility Pentane Emissions” shall mean the total of VOC emissions from EU #1, EU #2, and EU #3.

Certificate of Analysis (“COA”) = A COA accompanies each shipment of EPS bead to indicate the level of pentane in the beads. The initial blowing agent content of the bead is typically between 3.5 to 6.5 percent (%) by weight.

The CD established for Polyfoam an emission rate of 2.4 pounds of VOC released per 100 pounds of EPS bead processed (“2.4 lb VOC/100 lb EPS”) averaged over 24 hours. The CD stipulated that emissions from Manufacturing and Post-Manufacturing (EU #1 and EU #2) meet the above emission limit rate (e.g. the pentane emissions released during manufacturing and the first 48 hours after manufacture). In addition, this Plan Approval requires that the Total Facility Pentane Emissions meet 2.4 lb VOC/100 lb EPS averaged over 24 hours.

On December 9, 2011, Polyfoam submitted a non- major comprehensive air quality plan approval application for both existing and new foam manufacturing process equipment and new air pollution capture and control equipment. This Plan Approval identifies BACT as it applies to this industry and the Facility and is described in Table 2.

An EPS Bead Study Report was submitted by Polyfoam consultants, O'Reilly, Talbot & Okun Associates, on July 17, 2012. The study described the protocol and results of testing the pentane content of three different nominal bead types (approximate initial pentane content of 6.1%, 4.5%, and 3.5%). The sampling and analysis protocol was based on a Southern California Air Quality Monitor District ("SCAQMD") test Method 306 and determined the amount of pentane left in the bead at different times of manufacturing and storage. An additional bead analysis was conducted during the initial compliance test in November 2013, testing a mid-range bead pursuant to the initial protocol.

Polyfoam tested the pentane content of the initial bead (raw material), the product after molding, the product after 48 hours of storage and the product after 28 days of storage. These results are used in this Plan Approval in calculating the VOC emissions. The pentane content of the EPS bead and product was confirmed through the initial compliance testing, conducted in November 2013 after the RTO became operational and the formula(s) were updated accordingly in this Plan Approval.

This Plan Approval contains the CD requirements concerning VOC emission limits, VOC capture and control, and performance testing. This Plan Approval allows an increase in the consecutive 12 month VOC emission limit to 72 Tons per Year ("tpy"). It also limits the daily average pentane emission rate for the whole Facility (Total Facility Pentane Emissions), specifies a monthly VOC limit, and requires the continuous operation of the RTO whenever there is 500 pounds of EPS material or more in the aging room to control VOC emissions.

The design of the capture and control system for pentane emissions includes, what is identified in the supplied schematic by Elliot Thermodynamics Co., as 'dry' and 'wet' stream pentane emissions. These are described below:

Dry Stream pentane emissions

The Kurtz fluid bed dryer hood and Kurtz drop-chute hood, Hirsch Wiper hopper vents and the two (2) raw bead vacuum pumps vent collectively. They have a total air flow of 939 Standard Cubic Feet per Minute ("scfm") and are directed to the Aging Bag Room via a 1,250 scfm blower.

The pre-puff fill blowers on the mold machines are ducted to the outside corner of the Aging Room at ceiling height and have an estimated flow of 925 scfm.

The Kurtz and Hirsch pre-puff conveying blowers deliver 2,593 scfm of pre puff air into the top of the aging bags.

The total dry stream to the Aging Bag Room: $939+925+2593= 4,457$ scfm.

Negative pressure will be maintained in the Aging Room with a 5,000 scfm blower. Negative pressure is continuously measured with a wall mounted Dwyer magnehelic differential pressure gauge located in the Aging Bag Room.

Wet Stream pentane emissions

A steam, pentane/air mixture is evacuated from the expansion chambers of the Kurtz and Hirsch Pre-expanders by a vacuum pump operated at 500 scfm.

A steam, pentane/air mixture is evacuated from the mold chambers of each mold machine vacuum pump operated at 50 scfm each prior to entering the pre-treatment system. (10 machines peaking at 50 scfm /machine = 500 scfm total). The wet stream will pass through a metal mesh filter and condenser and cooled. The wet stream flow of 1000 + scfm will be reduced to 703 scfm. After the condenser, the stream will be diluted with 1,250 scfm “dry” slip stream and be heated up to 120 °F in the steam pre-heater to avoid moisture drop-out in the carbon bed.

Total flow to the RTO:	
“Dry” stream	4,457 scfm
“wet” stream	
(after condensed water loss)	<u>703 scfm</u>
	5,160 scfm

The Facility may replace any existing molding machine as well as add up to four new additional molding machines. The facility is limited to a total of 20 molding machines. Each new or replacement molder must be evacuated and ducted to the pre-treatment system and be controlled by the RTO.

This Plan Approval encompasses the entire Facility including the boilers that provide expansion steam, and **will replace and supersede all Air Quality Plan Approvals issued to this Facility** to date: Tr# 62554 issued September 20, 1993 (process), Tr# W009917 issued April 10, 2000, (250 hp natural gas boilers) and Tr# X239067, the Conditional Plan Approval issued December 12, 2012 (process), and Tr# X239067 issued August 14, 2014.

With the satisfactory completion of the required performance and compliance testing in Tables 3 through 6 (e.g. VOC capture and destruction system, bead testing, and sound monitoring), and the receipt of the test results and any necessary mitigation plans and schedule, MassDEP is now issuing the final Plan Approval.

Pursuant to 310 CMR 7.02(8)(a)(2), MassDEP has determined that an emission rate of 2.4 lb VOC/100 lb EPS for the Total Facility Pentane Emissions is Best Available Control Technology (“BACT”). This determination is based upon the review of the submitted plan application (CE-11-031) and supplemental materials.

2. EMISSION UNIT (EU) IDENTIFICATION

Each Emission Unit (EU) identified in Table 1 is subject to and regulated by this Plan Approval :

Table 1			
EU#	Description	Design Capacity	Pollution Control Device (PCD)
1	Manufacturing: <ul style="list-style-type: none"> • (2) Pre-Expansion (expander) : (1) Kurtz and (1) Hirsch, • Pre- Puff Aging (30 mesh aging bags), and • Molding (20 vacuum assisted machines) 	Capacity of the expander is dependent on the density of the expanded ‘pre-puff’: High density material: ex. 2 pound per ft ³ processed at about 1,500 pounds per hour. Low density material: ex. 0.75 pounds per ft ³ processed at about 750 pounds per hour. Maximum combined capacity of the two expanders based on actual densities utilized is 2000 pounds per hour.	TANN Langbein Engelbracht America model # TR692C Regenerative Thermal Oxidizer (RTO) <ul style="list-style-type: none"> • rated at 6,000 scfm • ≥ 99% VOC destruction efficiency • Equipped with puff capture package • Random packed ceramic saddle media • Noise abatement enclosure • Equipped with a “carbon flywheel” (wet stream) • 1,500,000 Btu/hr (Maxon full modulating burner or equivalent) • Capture of pentane emissions from bead manufacturing i.e. pre-expansion, aging and molding was determined to have an average efficiency of 87.5 %, subject to verification during performance testing using EPA approved methodologies.
2	Post –Manufacturing: finished product storage for a maximum of 48 hours after manufacturing	NA	NA
3	Long term storage occurring after the initial 48 hours of final product storage (from day 3 to day 28). Assuming between 11- 26% of the original pentane content remains in product when shipped.	NA	NA

Table 1			
EU#	Description	Design Capacity	Pollution Control Device (PCD)
4	Two (2) natural gas process boilers that provide bead expansion steam	10,200,000 Btu/hr and 7,500,000 Btu/hr	NA

Table 1 Key:

% = percentage

≥ = greater than or equal to

Btu/hr = British thermal units per hour

EU# = Emission Unit Number

ex. = example

ft³ = cubic feet

NA= Not applicable

PCD= Pollution Control device

RTO= Regenerative Thermal Oxidizer

scfm= standard cubic feet per minute

VOC = Volatile Organic Compounds

3. APPLICABLE REQUIREMENTS

A. OPERATIONAL, PRODUCTION and EMISSION LIMITS

The Permittee is subject to, and shall not exceed the Operational, Production, and Emission Limits as contained in Table 2 below:

Table 2			
EU#	Operational / Production Limit	Air Contaminant	Emission Limit
1	1. The aging room shall operate under negative air pressure to ensure approximately 98% capture of VOC emissions. 2. The Dry Stream Pentane Emissions shall be exhausted to the aging room enclosure.	VOC	See EUs 1-3

Table 2			
EU#	Operational / Production Limit	Air Contaminant	Emission Limit
1	<p>3. Regenerative Thermal Oxidizer (RTO) shall have:</p> <ul style="list-style-type: none"> a. 99% or better VOC destruction efficiency b. Minimum operating temperature of 1499.7⁰ F, or as determined through compliance testing based on an hourly average basis. c. Minimum residence time of 0.5 seconds d. Equipped with puff capture e. Noise abatement enclosure f. Equipped with a “carbon flywheel” (wet stream) g. Must operate whenever \geq 500 pounds EPS material is in the aging room h. Electronic interlock system 		
	4. Capture of pentane emissions from bead manufacturing i.e. pre-expansion, aging and molding is assumed to have a capture efficiency of 87.5%.		
	5. Maximum air flow \leq 6000 scfm to the RTO		
	6. At no time shall any pre-expansion or molding machines be disconnected from any ductwork or other VOC capture equipment that vents VOC emissions from the machines to the RTO at any time while such machines are being used.		
	7. At no time shall any ductwork or other VOC capture equipment from the aging room that vents VOC emissions from the machines to the RTO be disconnected while there is \geq 500 lbs EPS material in the aging room.		

Table 2			
EU#	Operational / Production Limit	Air Contaminant	Emission Limit
1-3	NA	VOC	≤ 2.4 pounds VOCs per 100 pounds EPS beads processed, calculated on a daily average ¹ in accordance with the methodology specified in Attachment A; 8 TPM ² and , 72 TPY ³
4	NA	NO _x ⁴	7.75 TPY
		SO ₂ ⁴	0.05 TPY
		PM ⁴	0.59 TPY
		CO ⁴	6.51 TPY
		VOC ⁴	0.43 TPY
			0% opacity
Facility Wide		VOC	72.43 TPY

Table 2 Notes:

1. "Daily" shall mean a continuous 24-hour period commencing at 7 a.m.
2. Monthly VOC emissions shall be based on 30 day rolling period
3. Annual VOC emissions shall be based on 12 month rolling period
4. Annual combustion emissions are based on AP-42, Fifth Edition, Compilation of Air Pollution Emission Factors, lb pollutant/MMscf per year maximum potential fuel usage (2 boilers = 17,700,000 Btu/hr input/ 1000 scf per MM Btu/hr= 17,700 scf / hr input)
 Potential fuel usage based on both boilers running: 8760 hours/yr x 17,700 scf/hr = 155 x 10⁶ scf/yr

Table 2 Key:

<p>% = percent \geq = greater than or equal to CO = Carbon Monoxide EPS= expandable polystyrene EU# = Emission Unit Number hr= hour MM Btu/hr = Million British thermal units per hour NA= Not applicable NO_x = Nitrogen Oxides</p>	<p>PM = Total Particulate Matter RTO= Regenerative Thermal Oxidizer scf/hr = standard cubic feet per hour scf/yr= Standard Cubic Feet Per Year SO₂ = Sulfur Dioxide TPM = tons per calendar month TPY = tons per consecutive 12-month period VOC = Volatile Organic Compounds</p>
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B. COMPLIANCE DEMONSTRATION

The Permittee is subject to, and shall comply with, the monitoring, testing, record keeping, and reporting requirements as contained in Tables 3, 4, and 5 below:

Table 3	
EU#	Monitoring and Testing Requirements
1	<p>1. The Permittee conducted performance testing, using a mass-balance approach and EPA methods 25A, 3A and 4, on the VOC control system on November 19, 2013. This test determined the capture efficiency (CE) of the collection system (including the aging room), destruction efficiency of the RTO and determined the pounds of VOC emissions per 100 pounds of EPS beads processed over a 28-day period. Capture efficiency was determined to be 87.55 % and destruction efficiency was determined to be 99.06% while operating at an average temperature of 1499.7⁰ F.</p> <p>2. The Permittee shall within five (5) years of the date of the initial compliance stack test, but no later than November 19, 2018, and every five (5) years thereafter, conduct performance and emission testing to determine the operating temperature of the RTO necessary to maintain a VOC destruction efficiency of 99% or better and to verify compliance with the provisions of this Plan Approval and applicable federal requirements.</p> <p>3. The Permittee shall within ten (10) years of the date of the initial compliance stack test, but no later than November 19, 2023, and every ten (10) years thereafter, conduct performance testing to determine the capture efficiency of the control system, including the aging room and to verify compliance with the provisions of this Plan Approval and applicable federal requirements. If the capture system is operating with an efficiency of less than 87.5 %, then an evaluation of the system shall be conducted to determine what may have caused the decrease in efficiency. A written capture efficiency evaluation shall be submitted with test results to MassDEP within 60 days of the test.</p>
1-3	<p>4. The Permittee shall within ten (10) years of the date of the initial compliance stack test, but no later than November 19, 2023, and every ten (10) years thereafter, conduct additional bead analysis on every bead type (i.e. low, medium and high range) at 15 minutes after molding, at the end of 48 hours of storage and at the end of 4 weeks of storage. The bead analysis shall be conducted concurrently with the capture efficiency test.</p>
4	<p>5. The Permittee shall inspect and maintain the boilers in accordance with the manufacturer's recommendations and test for efficient operation at least once in each calendar year. The result of said inspection, maintenance, and testing and the date upon which it was performed shall be recorded and posted conspicuously on or near the boilers per 310 CMR 7.04.</p>
Facility-wide	<p>6. The Permittee shall monitor all operations to ensure that sufficient information is available to comply with 310 CMR 7.12 Source Registration.</p> <p>7. The Permittee shall monitor all operations to ensure that sufficient information is available to comply with 310 CMR 7.00: Appendix C.</p> <p>8. The Permittee shall conduct emission testing in accordance with USEPA Reference Test Methods and regulation 310 CMR 7.13.</p>

Table 3 Notes:

1. Consent Decree for United States v. Polyfoam Corp.
2. Appendix I of the CD- Requirements for Air Source Emission Testing

Table 3 Key:

<p>% = percent</p> <p>CD = Consent Decree</p> <p>CMR = Code of Massachusetts Regulation</p> <p>EU = emission unit</p>	<p>MassDEP = Massachusetts Department of Environmental Protection</p> <p>RTO = regenerative thermal oxidizer</p> <p>VOC = Volatile Organic Compounds</p>
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Table 4	
EU#	Record Keeping Requirements
1-3	<ol style="list-style-type: none"> 1. The Permittee shall maintain, on site, the daily records, documents and supporting evidence that the Facility complies with the 2.4 pounds VOC per daily average per 100 pounds of EPS beads. Documents shall include but are not limited to daily bead throughput, pentane content of bead, capture efficiencies, destruction efficiencies of control equipment, and mass balance calculations. 2. A Certificate of Analysis (“COA”) from the bead manufacturer shall accompany each bead lot shipment received by the Permittee. 3. The COA for each bead shipment shall be maintained on site for at least 5 years. 4. The Permittee shall maintain a copy of any emission stack tests and bead study results on site for at least 5 years. 5. The Permittee shall adjust all emission calculations if stack test and bead study results indicate that the previous assumptions about capture efficiency, destruction efficiency, and/or pentane content in the bead/product were inaccurate. 6. The Permittee shall maintain a record of the quantity of beads and the bead pentane content to demonstrate compliance with emission limits and restriction described in Table 2. 7. The Permittee shall maintain an accurate standard operating and maintenance procedure (“SOMP”) for each EU, the RTO, the capture and control systems and auxiliary monitoring equipment such as the temperature , variable frequency drive indicator and pressure differential monitors on site that is accessible to Facility personnel. It shall be revised as needed and the most up-to-date SOMP shall remain at or near the equipment at all times. 8. A repair and maintenance manual shall be maintained on site that documents any downtime or repairs conducted on the RTO and/ or capture system, the items inspected, and the maintenance conducted. This manual shall be dated and signed by the personnel conducting the work.

Table 4	
EU#	Record Keeping Requirements
Facility Wide	9. The Permittee shall maintain adequate records on-site to demonstrate compliance with all operational, production, and short and long term emission limits contained in Table 2 above. Records shall also include the actual emissions of air contaminant(s) emitted for each calendar month and for each consecutive twelve month period (current month plus prior eleven months). These records shall be compiled no later than the 15 th day following each month. An electronic version of the MassDEP approved record keeping form, in Microsoft Excel format, can be downloaded at http://www.mass.gov/dep/air/approvals/aqforms.htm#report .
	10. The Permittee shall maintain records of monitoring and testing as required by Table 3.
	11. The Permittee shall maintain a copy of this Plan Approval, and underlying Application approved herein on-site.
	12. The Permittee shall maintain a record of routine maintenance activities performed on the approved EU(s), PCD(s) and monitoring equipment. The records shall include, at a minimum, the type or a description of the maintenance performed and the date and time the work was completed.
	13. The Permittee shall maintain a record of all malfunctions affecting air contaminant emission rates on the approved EU(s) and PCD and monitoring equipment. At a minimum, the records shall include: date and time the malfunction occurred; description of the malfunction; corrective actions taken; the date and time corrective actions were initiated and completed; and the date and time emission rates and monitoring equipment returned to compliant operation, quantity of excess emissions associated with the malfunction and when MassDEP was notified.
	14. The Permittee shall maintain records to ensure sufficient information is available to comply with 310 CMR 7.12 Source Registration.
	15. The Permittee shall maintain records required by this Plan Approval on-site for a minimum of five (5) years.
	16. The Permittee shall make records required by this Plan Approval available to MassDEP and USEPA personnel upon request.

Table 4 Key:

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|--|---|
| COA= Certificate of Analysis | RTO = regenerative thermal oxidizer |
| CMR= Code of Massachusetts Regulations | SOMP= Standard Operating Maintenance Procedure |
| EU#=emission unit number | USEPA= United States Environmental Protections Agency |
| MassDEP= Mass Department of Environmental Protection | VOC= Volatile Organic Compounds |
| PCD= pollution control device | |

Table 5	
EU#	Reporting Requirements
1	<p>1. The Permittee shall submit a written pre-test draft protocol to MassDEP for approval at least 90 days prior to the Facility conducting compliance testing of the VOC capture and control system. It shall contain all testing, monitoring, sampling, and analytical procedures for the test as required by Appendix I² of the CD.</p> <p>The pre-test draft protocol shall be sent to Central Regional Office of MassDEP, 627 Main Street, Worcester, MA 01608. Attention: BWP Permit Chief or by email to Roseanna.stanley@state.ma.us and EPA, Air Technical Unit attn: Air Compliance Clerk. Air Technical Unit, US Environmental Protection Agency - Region 1, 5 Post Office Square, Suite 100, Mail code OES04-2, Boston, MA 02109.</p>
	<p>2. If EPA or MassDEP comment on the draft pre-test protocol or any revised protocol, the Permittee shall incorporate those comments and re-submit a revised protocol to EPA and MassDEP within 15 days of receiving the comments.</p>
	<p>3. Notification of the compliance testing shall be made at least 60 days prior to the scheduled testing of the RTO and is subject to the approval and presence of both the MassDEP and EPA.</p>
	<p>4. The Permittee shall submit an emission stack test final results report to MassDEP and EPA, within 60 days after emission testing, as defined in Table 3. The test reports shall contain all information as required to determine compliance with emission limits and restrictions identified in Table 2 and in accordance with Appendix I² of the CD¹.</p>
1-3	<p>5. The Permittee shall submit to MassDEP and EPA for approval a written pre-test draft protocol for the bead testing analysis listed in Table 3.</p>
	<p>6. The Permittee shall submit the bead analysis final results report to MassDEP and EPA, within 60 days after bead testing, as defined in Table 3.</p>
Facility Wide	<p>7. The Permittee shall submit to MassDEP an Operating Permit application as defined in 310 CMR 7.00; Appendix C, within 1 year of this Plan Approval (TR# X239067).</p>
	<p>8. The Permittee shall submit quarterly VOC emission reports to MassDEP that demonstrate compliance with emission limits listed in Table 2 to Central Regional Office of MassDEP, 627 Main Street, Worcester, MA 01608. Attention: BWP Permit Chief or by email: CERO.air@massmail.state.ma.us and EPA, Air Technical Unit, attn: Air Compliance Clerk. Air Technical Unit, US Environmental Protection Agency - Region 1, 5 Post Office Square, Suite 100, Mail code OES04-2, Boston, MA 02109.</p>
	<p>9. The Permittee shall submit to MassDEP all information required by this Plan Approval over the signature of a "Responsible Official" as defined in 310 CMR 7.00 and shall include the Certification statement as provided in 310 CMR 7.01(2)(c).</p>

Table 5	
EU#	Reporting Requirements
Facility- wide	10. The Permittee shall notify the Central Regional Office of MassDEP, BWP Permit Chief by telephone (508) 792-7650, or email: CERO.air@massmail.state.ma.us or fax (508)792-7621 as soon as possible, but no later than one (1) business day after discovery of an exceedance(s) of Table 2 requirements. A written report shall be submitted to same as above at MassDEP within three (3) business days thereafter and shall include: identification of exceedance(s), duration of exceedance(s), reason for the exceedance(s), corrective actions taken, and action plan to prevent future exceedance(s).
	11. The Permittee shall report annually to MassDEP, in accordance with 310 CMR 7.12, all information as required by the Source Registration/Emission Statement Form. The Permittee shall note therein any minor changes (under 310 CMR 7.02(2) (e), 7.03, 7.26, etc.), which did not require an Air Quality Plan Approval.
	12. The Permittee shall provide a copy to MassDEP of any record required to be maintained by this Plan Approval within 30 days from MassDEP's request.

Table 5 Note:

1. Consent Decree for United States v. Polyfoam Corp
2. Appendix I of the Consent Decree- Requirements for Air Source Emission Testing

Table 5 Key:

CD=Consent Decree	EPA=Environmental Protection Agency
CMR=Code of Massachusetts Regulations	RTO=Regenerative Thermal Oxidizer
EU# = emission unit number	VOC=Volatile Organic Compound
MassDEP= Massachusetts Department of environmental Protection	

4. SPECIAL TERMS AND CONDITIONS

The Permittee is subject to, and shall comply with, the following special terms and conditions:

- A. The Permittee shall comply with the Special Terms and Conditions as contained in Table 6 below:

Table 6

EU#	Special Terms and Conditions
1	<ol style="list-style-type: none"> <li data-bbox="373 566 1382 629">1. The Permittee shall post the Standard Operating and Maintenance Procedures (“SOMP”) as approved by the MassDEP, at a location readily accessible to the RTO operator. <li data-bbox="373 636 1366 837">2. The Permittee shall vent <u>all</u> manufacturing emissions from the pre-expansion, aging, and molding of EPS beads and EPS foam products to the RTO in a manner that ensures compliance with the VOC limit or operational restrictions set forth in Table 2. At no time shall pre expansion, aging or molding equipment be disconnected from any ductwork or other VOC capture equipment that vents VOC emissions to the RTO any time that such equipment are being used. <li data-bbox="373 844 1358 882">3. The Permittee shall <u>not</u> allow an untreated process stream to bypass the RTO at any time. <li data-bbox="373 889 1382 996">4. The Permittee shall ensure that the air streams used to transfer pre-puff bead to the molding machines and the air used to purge bead transfer lines at the molding machines is captured by the VOC capture and control system. <li data-bbox="373 1003 1382 1151">5. The total VOC capture efficiency of EU#1 shall be equal to or greater than 87.5% or as determined by the most recent approved compliance test on an average hourly basis while EPS beads are being processed. The emission calculations shall account for any changes to the capture efficiency. <li data-bbox="373 1158 1382 1265">6. Negative pressure shall be maintained at all times at the pre-puff aging room, hoods and /or other equipment necessary to capture and vent Polyfoam’s manufacturing emission to the RTO for VOC destruction. <li data-bbox="373 1272 1050 1310">7. All aging of pre-puff material shall occur in the aging room. <li data-bbox="373 1317 1394 1379">8. Whenever there is 500 pounds or more of pre-puff material in the aging room, the RTO shall be operating as specified in this Plan Approval. <li data-bbox="373 1386 1414 1628">9. The negative pressure within the aging room shall be continuously monitored with a magnehelic pressure differential gauge. Personnel shall verify that the gauge reads negative once per shift and sign the negative pressure verification log book. The Permittee shall respond to an increasing pressure to determine the cause of the increase. The result of the assessment and any action taken shall be recorded in a maintenance and malfunction log book. The make, model and operating literature for this monitor shall be contained within the SOMP for the capture and control systems stored on site. <li data-bbox="373 1635 1398 1800">10. The Permittee shall operate a Lower Explosive Limit (LEL) monitor(s) that <u>continually</u> monitors pentane concentrations within the aging room. The LEL shall alert employees with an audible and visual alarm when pentane emissions are outside of safe conditions. The make, model and operating literature for this monitor shall be contained within the SOMP for the capture and control systems stored on site.

Table 6

EU#	Special Terms and Conditions
1	11. The Permittee shall operate a device to continually measure RTO fan frequency in Hertz (Hz). The fan frequency shall be recorded in a logbook once every 24 hours. The Permittee shall respond to an increasing motor frequency of 40 Hz or greater to determine the cause of the increase. The result of the assessment and any action taken shall be recorded in a maintenance and malfunction log book.
	12. The Permittee shall operate a device to measure the pressure differential at the RTO. The pressure shall be recorded in a logbook once every 24 hours. The Permittee shall respond to an increase in pressure of 17" w.c. or greater to determine the cause of the resistance to flow. The result of the assessment and any action taken shall be recorded in a maintenance and malfunction log book.
	13. The RTO combustion chamber shall operate at a minimum of 1499.7 °F (on an hourly average basis) or at the temperature necessary to assure a minimum of 99% VOC destruction efficiency, as determined by the most recent EPA approved compliance test. A thermocouple shall be located at the exit point of the oxidizer chamber. The operation and maintenance of the thermocouple shall be in accordance with manufacturer recommendations.
	14. The RTO combustion chamber temperature shall be continuously monitored and recorded.
	15. Only when the RTO is at and maintaining the minimum combustion temperature to assure 99% VOC destruction efficiency shall the Permittee begin production. The electronic interlock system shall include audible and visual alarms to alert operators that the system is not ready. Start-up shall be conducted in accordance with the SOP, which shall not allow production until the RTO is at 1499.7° F. The SOP shall require that production operations be safely shut-down if the hourly average RTO operating temperature falls below the minimum temperature of 1499.7 °F.
	16. The temperature of the RTO shall be continuously monitored and recorded. The data recorder shall properly indicate time and date. The make, model and operating literature for the temperature monitor and recorder shall be contained within the SOMP for the capture and control systems stored on site. The Permittee shall maintain digital records of the RTO combustion chamber temperature produced by the system data-logger. Data recorded by the data-logger shall be downloaded, at minimum on a quarterly basis, into a spread sheet form.
	17. The RTO shall be equipped with an operating low and high temperature alarm to alert employees when temperatures are outside of the operating zone necessary to achieve a minimum of 99% VOC destruction efficiency, as determined by the most recent compliance test. The make, model, and operating literature for the RTO temperature alarm shall be contained within the SOMP for the capture and control systems stored on site.
	18. The Permittee shall only allow a maximum air flow of ≤ 6000 scfm to the RTO.
	19. Replacement and new molding machines shall be equipped with an equivalent or better VOC vacuum and emission capture and control system as the replaced molding equipment.

Table 6	
EU#	Special Terms and Conditions
	20. The Permittee shall notify MassDEP in writing of the pending installation of replacement, modified or new equipment at least 30 days prior to its installation. The notification shall identify the new equipment's make and model, and a diagram and schematic of how it will be connected to existing VOC capture and control systems.
1 and 2	21. If the performance testing required by Table 3 or other performance tests whose methods and results are acceptable to MassDEP and EPA, demonstrates that the VOC capture and control system cannot meet EU 1 and 2 emission limits required by Table 2 , and if the VOC capture and control system was properly designed, installed, operated, and maintained before and during the test, then, for purposes of this Plan Approval , the Permittee shall inform MassDEP and EPA and propose a schedule for additional control equipment and performance testing, as required to meet and demonstrate compliance with the EU 1 and 2 emission limit required by Table 2.
1 - 3	<p>22. Within 30 days of issuance of this Plan Approval, the Permittee shall maintain a spreadsheet that calculates, and documents that VOC emissions comply with Table 2 of this Plan Approval. The spreadsheet shall accurately calculate the following :</p> <ul style="list-style-type: none"> • <u>Daily average rates</u>³ of pentane emissions from manufacturing and post manufacturing processes and from manufacturing through long term storage. • <u>Calendar monthly rate</u> of pentane emissions from the manufacturing through long term storage. • <u>12 month rolling rate</u> of pentane emissions from the manufacturing through long term storage. <p>The spread sheet shall follow the guidance given in Attachment A, VOC/Pentane Emission Daily Calculations, of this Plan Approval</p>
	23. VOC /pentane emissions shall be calculated on a daily basis by identifying the pentane content of the raw bead and the bead throughput (i.e. production rate) for each lot processed and then using a mass balance equation (see Attachment A).
	24. The Permittee shall notify MassDEP and EPA in writing if compliance testing has resulted in adjustments to assumptions regarding capture and destruction efficiencies or residuals of pentane found in the EPS bead or product which impact the calculations to determine emissions. The Permittee shall submit a written report with all adjusted calculations and assumptions within 30 days of the actual testing. Additionally, the Permittee shall submit a revised calculation spread sheet that incorporates any new information including revised daily, monthly and annual emission rates, capture and control efficiencies and fugitive emissions.
Facility Wide	25. All efforts shall be made to minimize VOC emissions from all areas of the Facility including all storage and pentane content of the incoming bead.

Table 6 Notes:

1. Consent Decree for United States v. PolyFoam Corp. Civil Action No. 411-cv-40134
2. Appendix I Consent Decree - Requirements For Air Emission Testing

3. Daily average rate = defined in the Consent Decree as a Continuous 24-hour period commencing at 7 a.m.

Table 6 Key:

% = percent
 °F = degrees Fahrenheit
 “ w.c. = inches water column

 ≤ = less than or equal to
 CD = Consent Decree
 EPA = Environmental Protection Agency
 EPS = expandable polystyrene

EU# = emission unit number
 Hz = hertz
 MassDEP = Massachusetts Department of
 Environmental Protection
 RTO = Regenerative Thermal Oxidizer
 SOMP= Standard Operating Maintenance Procedure
 SOP = standard operating procedure
 VOC = Volatile Organic Compound

B. The Permittee shall install and use an exhaust stack, as required in Table 7, on each of the Emission Units that is consistent with good air pollution control engineering practice and that discharges so as to not cause or contribute to a condition of air pollution. Each exhaust stack shall be configured to discharge the gases vertically and shall not be equipped with any part or device that restricts the vertical exhaust flow of the emitted gases, including but not limited to rain protection devices known as “shanty caps” and “egg beaters.” The Permittee shall install and utilize exhaust stacks with the following parameters, as contained in Table 7 below, for the Emission Units that are regulated by this Plan Approval :

Table 7				
EU#	Stack Height Above Ground (feet)	Stack Inside Exit Dimensions (feet)	Stack Gas Exit Velocity Range (feet per second)	Stack Gas Exit Temperature Range (°F)
1	41	2.33	7-36	200-350

Tables 7 Key:

°F = Degree Fahrenheit

EU# = Emission Unit Number

5. GENERAL CONDITIONS

The Permittee is subject to, and shall comply with, the following general conditions:

A. Pursuant to 310 CMR 7.01, 7.02, 7.09 and 7.10, should any nuisance condition(s), including but not limited to smoke, dust, odor or noise, occur as the result of the operation of the Facility, then the Permittee shall immediately take appropriate steps including shutdown, if necessary, to abate said nuisance condition(s).

- B. If asbestos remediation/removal will occur as a result of the approved construction, reconstruction, or alteration of this Facility, the Permittee shall ensure that all removal/remediation of asbestos shall be done in accordance with 310 CMR 7.15 in its entirety and 310 CMR 4.00.
- C. If construction or demolition of an industrial, commercial or institutional building will occur as a result of the approved construction, reconstruction, or alteration of this Facility, the Permittee shall ensure that said construction or demolition shall be done in accordance with 310 CMR 7.09(2) and 310 CMR 4.00.
- D. Pursuant to 310 CMR 7.01(2)(b) and 7.02(7)(b), the Permittee shall allow MassDEP and / or USEPA personnel access to the Facility, buildings, and all pertinent records for the purpose of making inspections and surveys, collecting samples, obtaining data, and reviewing records.
- E. This Plan Approval does not negate the responsibility of the Permittee to comply with any other applicable Federal, State, or local regulations now or in the future.
- F. Should there be any differences between the Application and this Plan Approval, the Plan Approval shall govern.
- G. Pursuant to 310 CMR 7.02(3)(k), MassDEP may revoke this Plan Approval if the construction work is not commenced within two years from the date of issuance of this Plan Approval , or if the construction work is suspended for one year or more.
- H. This Plan Approval may be suspended, modified, or revoked by MassDEP if MassDEP determines that any condition or part of this Plan Approval is being violated.
- I. This Plan Approval may be modified or amended when in the opinion of MassDEP such is necessary or appropriate to clarify the Plan Approval conditions or after consideration of a written request by the Permittee to amend the Plan Approval conditions.
- J. The Permittee shall conduct emission testing, if requested by MassDEP, in accordance with USEPA Reference Test Methods and regulation 310 CMR 7.13. A pretest protocol report shall be submitted to MassDEP and EPA at least 30 days prior to emission testing and the final test results report shall be submitted within 45 days after emission testing.
- K. Pursuant to 310 CMR 7.01(3) and 7.02(3) (f), the Permittee shall comply with all conditions contained in this Plan Approval. Should there be any differences between provisions contained in the General Conditions and provisions contained elsewhere in the Plan Approval, the latter shall govern.

6. MASSACHUSETTS ENVIRONMENTAL POLICY ACT

MassDEP has determined that the filing of an Environmental Notification Form (ENF) with the Secretary of Energy & Environmental Affairs, for air quality control purposes, was not required prior to this action by MassDEP. Notwithstanding this determination, the Massachusetts Environmental Policy Act (MEPA) and 301 CMR 11.00, Section 11.04, provide certain “Fail-Safe Provisions,” which allow the Secretary to require the filing of an ENF and/or an Environmental Impact Report (EIR) at a later time.

7. APPEAL PROCESS

This Plan Approval is an action of MassDEP. If you are aggrieved by this action, you may request an adjudicatory hearing. A request for a hearing must be made in writing and postmarked within twenty-one (21) days of the date of issuance of this Plan Approval.

Under 310 CMR 1.01(6)(b), the request must state clearly and concisely the facts, which are the grounds for the request, and the relief sought. Additionally, the request must state why the Plan Approval is not consistent with applicable laws and regulations.

The hearing request along with a valid check payable to the Commonwealth of Massachusetts in the amount of one hundred dollars (\$100.00) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
P.O. Box 4062
Boston, MA 02211

This request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver as described below. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority.

MassDEP may waive the adjudicatory hearing-filing fee for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file, together with the hearing request as provided above, an affidavit setting forth the facts believed to support the claim of undue financial hardship.

Enclosed is a stamped approved copy of the application submittal.

Should you have any questions concerning this Plan Approval, please contact Maria L'Annunziata by telephone at 508-767-2748, or in writing at the letterhead address.

This final document copy is being provided to you electronically by the Department of Environmental Protection. A signed copy of this document is on file at the DEP office listed on the letterhead.

Roseanna E. Stanley
Acting Permit Chief
Bureau of Waste Prevention

Enclosure

ecc: Bud Early, Polyfoam
Steve Calder, EPA Region I
Christine Sansevero, EPA Region I
Northbridge Board of Health
Northbridge Fire Department
Yi Tian, MassDEP/Boston
James Gagnon, O'Reilly, Talbot and Okun Associates, LLC

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Kim McCoy; MassDEP/CERO

Attachment A

VOC/Pentane Emission Daily Calculations

VOC /pentane emissions shall be calculated on a daily basis by determining the pentane content of the raw bead for each lot processed, identifying the bead throughput (i.e. production rate) for each lot processed and then using a mass balance, which is described below. The bead's pentane content shall be documented by obtaining a Certificate of Analysis ("COA") for each lot processed from the manufacturer. If a Certificate of Analysis is not available, then the maximum pentane content listed on the Material Safety Data Sheet shall be utilized.

Pentane emissions shall be determined each day based upon the following:

Amount of Pentane Released During Manufacturing and Storage

The raw bead being processed shall be categorized into one of three bead types based on its COA.

- COA \leq 4.0% pentane = Low Range % Pentane EPS (~ 3.5%)
- COA > 4.0% to \leq 5.2% = Mid % Pentane EPS (~4.0%)
- COA > 5.2% = High % Pentane EPS (~6.1%)

Calculating the percent of pentane released during the manufacturing process, the first 48 hours of storage, and the next 26 days of storage (28 days after molding) shall be based on bead testing. The calculations in this Plan Approval for the amount of pentane released are based on the bead testing performed by Polyfoam in the Spring of 2012 and November 2013. These calculations will be modified, as needed, by future performance compliance testing

The Spring 2012 and November 2013 analytical results of pentane retained in the product at various points in the manufacturing and storage cycle are shown in Table A below.

Table A Bead Test Results				
Sample Bead Data	Symbol	Low % Pentane lbs/100 lbs EPS	Mid % Pentane lbs/100 lbs EPS	High % Pentane lbs/100 lbs EPS
Certificate Of Analysis	COA	3.500	3.993	6.100
15 min after molding (EU 1)	15m	1.840	2.181	2.530
48 hrs after molding (EU 2)	48h	1.550	1.890	1.930
28 days after molding (EU 3)	28d	0.590	1.032	0.710

Manufacturing (EU# 1)

The amount of pentane released during manufacturing (i.e. pre-expansion, aging, and molding) and available for capture/destruction shall be calculated as follows:

$$(COA - 15m) = \text{lbs of pentane released /100 pounds of EPS beads processed.}$$

$$((COA - 15m)/COA) * 100 = \text{percent loss in manufacturing}$$

Using the 3.5 % pentane bead as an example of this calculation:

$$(3.5-1.84) = 1.66 \text{ lbs pentane released/100 lbs EPS processed}$$

$$((3.5-1.84)/3.5)*100 = 47.4 \% \text{ of original amount of pentane released during manufacturing}$$

First 48 hours of storage (EU #2)

The amount of pentane released during the first 48 hours of storage shall be calculated as follows:

$$(15m - 48h) = \text{lbs of pentane released /100 pounds of EPS beads processed.}$$

$$((15m - 48h)/COA) * 100 = \text{percent loss in the first 48 hours of storage.}$$

Using the 3.5 % pentane bead as an example of this calculation:

$$(1.84-1.55) = 0.96 \text{ lbs pentane released/100 lbs EPS processed}$$

$$((1.84-1.55)/3.5)*100 = 8.286 \% \text{ of original amount of pentane released during the first 48 hours of storage}$$

Long Term Storage (EU #3)

The amount of pentane released during the next 26 days of storage (26 days after the first 48 hours) shall be calculated as follows:

$$(48h - 28d) = \text{lbs of pentane released /100 pounds of EPS beads processed.}$$

$$((48h - 28d)/COA) * 100 = \text{percent loss in the first 4 weeks of storage.}$$

Using the 3.5 % pentane bead as an example of this calculation:

$$(1.55 - 0.59) = 0.29 \text{ lbs pentane released/100 lbs EPS processed}$$

$$((1.55 - 0.59)/3.5)*100 = 27.429 \% \text{ of original amount of pentane released during the first 4 weeks of storage}$$

Retained in Product

The amount of pentane remaining in the product when shipped, and therefore *not* emitted at the Facility, shall be calculated as follows:

$$(28d) = \text{lbs of pentane shipped} / 100 \text{ pounds of EPS beads processed.}$$

$$(28d/\text{COA}) * 100 = \text{percent of pentane shipped in product.}$$

Using the 3.5% pentane bead as an example of this calculation:

$$0.59 \text{ lbs pentane shipped} / 100 \text{ lbs EPS processed}$$

$$(0.59/3.5)*100 = 16.857 \% \text{ of original amount of pentane shipped in product.}$$

The calculated percentages shall be applied for each group of beads processed. Based on the Spring 2012 and November 2013 test results, the percentages for each group are presented in Table B. These percentages will change if future compliance bead testing results are different.

Table B Amount of Pentane Released			
Sample Bead Data	Low % Pentane lbs/100 lbs EPS	Mid % Pentane lbs/100 lbs EPS	High % Pentane lbs/100 lbs EPS
COA	3.500	3.993	6.100
15 min after molding (EU 1)	1.840	2.181	2.530
48 hrs after molding (EU 2)	1.550	1.890	1.930
28 days after molding (EU 3)	0.590	1.032	0.710
Amount Released During :			
manufacturing (in lbs) [COA-15m]	1.660	1.812	3.570
as a % released	47.429	45.379	58.525
after 48 hrs storage (in lbs) [15m-48h]	0.290	0.291	0.600
as a % released	8.286	7.288	9.836
Subtotal lbs released per Consent Decree [COA-48h]			
	1.950	2.103	4.170
as a % released	55.714	52.667	68.361
Subtotal lbs released during long term storage [48h-28d] :			
	0.960	0.858	1.220

Table B Amount of Pentane Released			
Sample Bead Data	Low % Pentane lbs/100 lbs EPS	Mid % Pentane lbs/100 lbs EPS	High % Pentane lbs/100 lbs EPS
<i>as a % released</i>	27.429	21.488	20.000
<i>Total released in 28 days (in lbs) [COA-28d]</i>	2.910	2.96	5.390
<i>as a % released</i>	83.143	74.15	88.361
<i>Amount in shipped product (in lbs) [28d]</i>	0.590	1.03	0.710
<i>as a % retained</i>	16.857	25.85	11.639

Capture and Destruction Efficiencies

The capture and destruction efficiencies shall be determined during compliance testing. They shall be calculated as follows or as otherwise determined by EPA during compliance testing:

Capture Efficiency (“CE”) =

$$\frac{\text{Inlet Pentane Rate (lbs/hr) x Duration of Stack Test (hr)}}{\text{Mass of EPS Bead Processed During Stack Test (lbs) x (COA – 15m)/100}} \times 100$$

Destruction Efficiency (“DE”) =

$$\frac{\text{Inlet Pentane Rate (lbs/hr) to RTO – Outlet Pentane Rate (lbs/hr) from RTO}}{\text{Inlet Pentane Rate (lbs/hr)}} \times 100$$

– For the purposes of the calculations described in this Plan Approval, the capture and destruction efficiencies shall be assumed to be 87.5% and 99.1% respectively.

Calculating Emissions

The equations to calculate the pentane emissions shall use the value of pentane left in the product after molding (15m), after the first 48 hrs (48h), and after 28 days from molding (28d) as shown in the above tables. These equations are as follows (examples are using a 3.5 % bead):

Pentane Destroyed in RTO (“ $P_{\text{Destroyed}}$ ”) = (CE)(DE)(COA – 15m).

Example: $(0.875)(0.991)(3.5 - 1.840) = 1.439$ lbs Pentane destroyed/100 lbs EPS processed.

Pentane Captured but Not Destroyed & Emitted from RTO (“ $P_{\text{Not Destroyed}}$ ”) = (CE)(1-DE)(COA -15m).

Example: $(0.875)(1.0-0.991)(3.5 - 1.840) = 0.013$ lbs Pentane not destroyed/100 lbs EPS processed.

Pentane Not Captured in Manufacturing (“ $P_{\text{Not Captured}}$ ”) = (1-CE)(COA -15m).

Example: $(1.0-0.875)(3.5 - 1.840) = 0.208$ lbs Pentane not captured during manufacturing/100 lbs EPS processed.

Pentane Emitted & Uncontrolled in 48 hr Storage (“ P_{Storage} ”) = (15m - 48h).

Example: $(1.84-1.55) = 0.290$ lbs Pentane emitted during first 48 hours of storage/100 lbs EPS processed.

Pentane Emitted in Manufacturing & First 48 Hours (“ P_{Emitted} ”) = ($P_{\text{Not Destroyed}} + P_{\text{Not Captured}} + P_{\text{Storage}}$).

Example: $(0.013 + 0.208 + 0.29) = 0.511$ lbs Pentane Emitted/100 lbs of EPS processed.

Note: P_{Emitted} is the value needed for calculating and meeting the conditions of the Consent Decree.

Total Pentane Emitted from Manufacturing to Product Shipped (“ $P_{\text{Total Emit}}$ ”) = $P_{\text{Emitted}} + (48h - 28d)$

Example: $(0.511) + (1.55-0.59) = 1.471$ lbs Total Pentane Emitted /100 lbs of EPS processed.

Mass Balance:

$COA = (P_{\text{Not Destroyed}} + P_{\text{Not Captured}} + P_{\text{Storage}} + P_{\text{Destroyed}} + 48h)$

Since the COA of the raw beads will vary from lot to lot processed, the amount of pentane at each stage in manufacturing and storage must be calculated based on the percent of pentane released at each of these stages and the pentane group in which the bead is categorized (i.e. low, medium, or high).

As an example, a 3.6% bead would be categorized as a low percent bead. Therefore it would use the percentages derived from testing the 3.5% bead. Specifically, the 3.6% bead would be assumed to lose 47.429 % of the pentane after molding, an additional 8.286 % loss after 48 hours of storage, and an additional 27.429 % loss after 28 days of storage, leaving a residual of 16.857% of the original pentane amount left in and shipped with the product.

Calculating the lbs of pentane in the product per 100 lbs of EPS bead processed for a 3.6% bead (COA) would yield the following results:

$3.6 \times 0.474 = 1.707$ lbs pentane/100 lbs of EPS after molding (15m)

$3.6 \times 0.0828 = 0.298$ lbs pentane/100 lbs of EPS after 48 hours of storage (48h)

$3.6 \times 0.274 = 0.987$ lbs pentane/100 lbs of EPS after 28 days of storage (28d)

$3.6 \times 0.169 = 0.607$ lbs pentane/100 lbs of EPS left in the product

Therefore using the equations above, the P_{Emitted} would be = 0.526 lbs pentane/100 lbs of 3.6 % EPS processed and $P_{\text{Total Emit}} = 1.51$ lbs pentane/100 lbs of 3.6 % EPS processed.

Calculating the Daily Average

Pursuant to the Consent Decree, the daily average (i.e. a 24 hour period, starting at 7 AM) for P_{Emitted} shall be no greater than 2.4 pounds of VOCs (pentane) per 100 pounds of EPS beads processed.

Using the P_{Emitted} of 0.526 lbs pentane/100 lbs of 3.6 % EPS processed, 15,000 lbs of raw beads processed would yield 78.83 lbs of pentane emitted [$P_{\text{Emitted}} \times \text{lbs of bead processed} / 100$]. The amount of pentane emitted must be calculated for each percent bead used in a 24 hour period.

The total amount of lbs of pentane emitted divided by the total amount of raw beads processed/day, multiplied by 100 will give the average amount of lbs pentane/100 lbs of EPS processed.

A similar calculation for $P_{\text{Total Emitted}}$ shall be done as well on a daily basis.