GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

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NARRATIVE

TO: Jeng-Hon Su

FROM: Susan Jenkins

DATE: December 15, 2023 (Updated January 11, 2023)

Facility Name:	**Foam Products Corporation**
AIRS No.:	055-00021
Location:	Trion, GA (Chattooga County)
Application #:	29031
Date of Application:	September 19, 2023 (Updated October 26, 2023 & November 17, 2023)

Background Information

Foam Products Corporation (hereinafter "facility") is requesting a permit to construct and operate an irradiated cross-linked polyethylene (IXPE) foam underlayment manufacturing process within an existing structure located at 15276 US Highway 27, Trion, Georgia in Chattooga County. Irradiation cross-linked polyethylene (IXPE) foam is a kind of macromolecule closed cell foaming material used, in this case, as underlayments in floors. IXPE should not be confused with polystyrene foam underlayment manufacturing process.

Raw ingredients, such as thermoplastic resins, chemical foaming (or blowing) agents, and additives arrive at the facility and are transferred to raw material silos. The automated process transfers various amounts of these raw ingredients (based on a proprietary formula) to hoppers which feed kneaders which feed their respective extruders. A large continuously revolving screw encased in a long heating chamber then carries the heated resin down the length of the screw toward a die (orifice) at the end of the chamber. The revolving screw forces the fluidized resin material through the die which has the shape of the cross section of the final product. Next, the engineered plastic material is crosslinked using an irradiation process (controlled electron beams). The crosslinked material is then expanded in one or more foaming ovens with the help of a non-VOC chemical foaming (or blowing) agent. At the end of the oven, the material is rolled up or cut into sheets depending on the material and the frothing furnace.

Purpose of Application

The facility submitted an air permit application (assigned number 29031) received on September 22, 2023, to construct and operate a facility which manufactures IXPE foam underlayment. The Division's initial review of the application revealed that there was missing and unclear information.

In order to obtain the needed information, the Division generated a questions document ("Q&A") seeking clarity on the following components of its regulatory analysis and submitted them to the consultant: (1) SIP Form 1.00: What is the correct legal name of the facility as the applicant has used more than one name; (2) SIP Form 2.00: Missing process description along with a process flow diagram (PFD); (3) Missing an equipment list which correlates with the missing PFD, SIP Form 3.00, and SIP Form 5.00. Resolution was achieved on some of these points and not on others.

Application Component	Date of Division Question(s)	Date of Facility's Response
SIP Form 1.00	10/16/2023	10/26/2023 *Updated legal name of the facility in the Division's Q&A document rather than by submitting an updated SIP Form 1.00.
SIP Form 2.00 Information necessary to build a PFD, process description, and equipment list	10/16/2023 10/26/2023	10/26/2023 & 11/16/2023 Incomplete. *See Note A.1*
SIP Form 3.00 Information does not correlate with SIP Form 2.00	10/16/2023 10/26/2023	10/26/2023 & 11/16/2023 Somewhat useful *See Note A.1*
SIP Form 5.00 Filled out incorrectly	10/16/2023 10/26/2023	10/26/2023 & 11/16/2023 Still incorrect
SIP Form 7.00 Missing	10/16/2023 10/26/2023	Never submitted Never submitted
Appendix B Emissions Calculations	10/16/2023 10/26/2023	Missing 11/17/2023-Partly helpful *See Note B*

Note A.1-The Division Built Its Own Process Description and Its Own Equipment List: The Division utilized the applicant's November updated SIP Forms as well as public information via the internet on the process steps in producing IXPE foam underlayment. **The Division used this information to build a general process description and facility equipment list which the consultant approved on December 14, 2023.**

Note B-Potential to Emit Calculations: The Division utilized the applicant's November updated SIP Forms as well as its updated emissions calculations dated November 17, 2023. **The Division used this information to generate PTE for applicable pollutants per process point. The consultant approved this information on December 14, 2023.**

Equipment List

This equipment list was generated by S. Jenkins and approved by the consultant on December 14, 2023 for the said application.

Emission Units		Associated Control Devices	
Source Code	**Description**	**Source Code**	**Description**
SS1	Silo Storage #1 (Stores LDPE resin)	N/A	N/A
SS2	Silo Storage #2 (Stores EVA resin)	N/A	N/A
Batch Processing			
1*	Bag dumping station	DC-01 DC-02 DC-03 DC-04	Dust Collectors which exhaust to the indoor plant environment
2*	Bag dumping station		
3*	Bag dumping station		
4*	Bag dumping station		
Kneader Extrusions			
5* & 9*	Extruder #1 (5) & Kneader #1 (9)	DC-05	Dust Collector which exhausts to the indoor plant environment.
6* & 10*	Extruder #2 (6) & Kneader #2 (10)	DC-06	Dust Collector which exhausts to the indoor plant environment.
7* & 11*	Extruder #3 (7) & Kneader #3 (11)	DC-07	Dust Collector which exhausts to the indoor plant environment.
8* & 12*	Extruder #4 (8) & Kneader #4 (12)	DC-08	Dust Collector which exhausts to the indoor plant environment.
Irridation (Electron Accelerators Are Used to Physically Crosslink Polymer Chains in the Extruded Sheet)			
13*	Electron Accelerator #1	N/A	N/A
14*	Electron Accelerator #2	N/A	N/A
Activate Ingredients Into Cross-Link Product (Cure Products)			
15	Foam Furnace #1-Equipped with a 15.99 MMBtu/hr Low NOx Burner	WS-01	Wet Scrubber
16	Foam Furnace #2-Equipped with a 15.99 MMBtu/hr Low NOx Burner		
17	Foam Furnace #3-Equipped with a 15.99 MMBtu/hr Low NOx Burner		
18	Foam Furnace #4-Equipped with a 15.99 MMBtu/hr Low NOx Burner		

*proposed within current application

Emissions Summary

The proposed operation will generate emissions of volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxides (NOx), particulate matter ($PM/PM_{10}/PM_{2.5}$), greenhouse gases (GHGs), and hazardous air pollutants (HAPs).

VOC Emissions

Kneaders Extruders: The kneader extruders will operate uncontrolled for emissions of VOCs and their operation may generate VOC emissions based on some thermal degradation of the polyethylene resin used. The facility proposes to mix low density polyethylene (LDPE) resin with ethylene-vinyl acetate (EVA) resin based on a proprietary recipe.

Emissions factors have been developed by the Society of the Plastics Industry (e.g., Plastics Industry Association) for VOC, HAP, and PM emissions during extrusion of copolymers with ethylene, and this research was documented in *Development of Emission Factors for Polypropylene Process* (Journal of the Air & Waste Management Association, Volume 49, January 1999. The applicant utilized the VOC, PM, and individual HAP emissions factors presented in Table 5 of this AWMA document for Test Run No. 8 for the extrusion of "random copolymers" for generic resin grades assuming a potential resin usage (LDPE and EVA) of 1,800,000 tons per year.

The facility assumed an uncontrolled VOC emissions rate of 59.4 micrograms VOC from engineered plastics extruder per gram of resin used (μg/g) based on results presented in the referenced AWMA paper.

VOC Emissions (tons/yr) from the extrusion process =
(59.4 μg VOC/grams of resin beads)*(1000 grams/2.205 lb)*(2000 lb/ton)*(10^{-6} grams/ μg)*(2.205 lb/1000 grams)*(1,800,000 tons of resin beads/yr)*(1 ton/2000 lb) = 106.92 tpy

Foam Furnaces-Natural Gas Combustion: VOC emissions are anticipated from the combustion of natural gas in these furnaces and the computation of the potential VOC emissions is noted as follows:

VOC Emissions (tons/yr) from the combustion of natural gas =
(15.9 MMBtu/hr-oven)*(4 ovens)*(5.5 lb VOC/MMscf)*(scf/1020 Btu)*(8760 hrs./yr)*(1 ton/2000 lb) = 1.5 tpy

Foam Furnaces-Use of Chemical Foaming Agent (aka Blowing Agent): VOC emissions from the use of chemical foaming (blowing) agent azodicarbonamide are expected to be negligible because the thermal degradation of this chemical foam agent is expected to result in nitrogen, CO, CO_2, isocyanic acid and ammonia emissions. Note that the wet scrubber (ID No. WS-01) will be used to control isocyanic acid and ammonia.

Particulate Matter (PM, PM_{10}, $PM_{2.5}$)

All particulate matter emissions will be treated as PM. This regulatory analysis considers that PM emissions may originate from the following: (1) raw material transfer to the kneaders will take place indoors and will this equipment exhaust to the indoor plant atmosphere; (2) silo storage of raw materials; and (3) extruders. PM emissions from the combustion of natural gas are assumed to be negligible since natural gas contains little to no ash. PM emissions from the storage silos are assumed to be negligible by virtue of their design and operation. Lastly, this regulatory analysis will consider the proposed dust collectors as voluntary control devices which exhaust to the indoor plant atmosphere.

The facility assumed a PM emissions rate of 27.9 μg PM/grams of resin beads from engineered plastics extruder per gram of resin used as presented in the same AWMA paper (*Development of Emission Factors for Polypropylene Process*, noted above).

Uncontrolled PM Emissions (tons/yr) from the extrusion process =
(27.9 μg PM/grams of resin beads)*(1000 grams/2.205 lb)*(2000 lb/ton)*(10^{-6} grams/ μg)*(2.205 lb/1000 grams)*(1,800,000 tons of resin beads/yr)*(1 ton/2000 lb) = 50.2 tpy

NOx Emissions

NOx emissions will most likely result from the combustion of natural gas at the facility and the potential NOx emissions are estimated as follows based on AP-42:

(15.9 MMBtu/hr-oven)*(4 ovens)*(100 lb NOx/MMscf)*(scf/1020 Btu)*(8760 hrs./yr)*(1 ton/2000 lb) = 27.3 tpy

CO Emissions

Carbon monoxide (CO) emissions may be generated from the foaming ovens (i.e., the thermal decomposition of azodicarbonamide) even though the azodicarbonamide decomposition products will most likely remain the foam. CO emissions will most likely result from the combustion of natural gas at the facility and the potential CO emissions are estimated as follows based on AP-42:

CO Emissions (tons/yr) from the combustion of natural gas =
(15.9 MMBtu/hr-oven)*(4 ovens)*(84 lb CO/MMscf)*(scf/1020 Btu)*(8760 hrs./yr)*(1 ton/2000 lb) = 22.9 tpy

Hazardous Air Pollutants (HAPs)

HAP emissions will most likely result from the combustion of natural gas at the facility and the operation of kneader extruders. This analysis considered hexane and formaldehyde emissions from the combustion of natural gas and their PTE is computed as follows based on AP-42:

Hexane Emissions from Combustion of Natural Gas (tons/yr) =
(15.9 MMBtu/hr-oven)*(4 ovens)*(1.8 lb /MMscf)*(scf/1020 Btu)*(8760 hrs./yr)*(1 ton/2000 lb) = 0.51 tpy

Formaldehyde Emissions from Combustion of Natural Gas (tons/yr) =
(15.9 MMBtu/hr-oven)*(4 ovens)*(0.075 lb/MMscf)*(scf/1020 Btu)*(8760 hrs./yr)*(1 ton/2000 lb) = 0.0213 tpy

The kneader extruders will operate uncontrolled for emissions of HAPs. The same AWMA paper (*Development of Emission Factors for Polypropylene Process*, noted above) presents individual HAP emissions factors as those are presented in the following table and their PTE is computed based on a potential bead usage of 1,800,000 tons resin beads per year.

Pollutant CAS No.	EF (µg/grams of resin beads)	EF (lb/ton of resin beads)	PTE (tpy)
Acetaldehyde 75070	0.08	1.6E-04	0.144
Acrylic Acid 79107	0.08	1.6E-04	0.144
Formaldehyde 50000	0.09	1.8E-04	0.162
Propionaldehyde 123386	0.02	4.0E-05	0.036
		Total	**0.50**

Greenhouse Gases (GHGs)

GHG emissions may be generated from the foaming ovens (i.e., the thermal decomposition of azodicarbonamide) even though the azodicarbonamide decomposition products will most likely remain the foam. GHG emissions will most likely result from the combustion of natural gas at the facility and the potential GHG emissions are estimated as follows using AP-42:

(15.9 MMBtu/hr-oven)*(4 ovens)*(120,000 lb CO_2/MMscf)*(scf/1020 Btu)*(8760 hrs./yr)*(1 ton/2000 lb)

= 32,772 tpy

Facility-Wide Emissions
(in tons per year)

Pollutant	Uncontrolled Potential Emissions	
	W/O Permit Limit	W/Permit Limit
$PM/PM_{10}/PM_{2.5}$	50.2	50.2
NOx	27	27
SO_2	0.0	0.0
CO	23	23
VOC	108	<100
Max. Individual HAP	0.51	0.51
Total HAP	1.02	1.02
Total GHG (if applicable)	32,772	32,772

Note: $PM/PM_{10}/PM_{2.5}$ potential emissions would be expected much lower than 50.2 tpy because (1) the emission units are to be controlled by dust collectors, and (2) the dust collectors will exhaust to the indoor plant environment.

Regulatory Applicability

Georgia Rule 391-3-1-.02(2)(b)-"Visible Emissions": Georgia Rule (b) applies, in this case, because the manufacturing process is subject to another emission standard in Georgia Rule 391-3-1-.02(2). Georgia Rule (b) limits the opacity to less than 40 percent.

Georgia Rule 391-3-1-.02(2)(e)-"Particulate Emission from Manufacturing Process": This state rule limits PM emissions from the manufacturing process based on a dry process weight input rate formula. The maximum hourly process input rate per extruder was estimated to be 551 lb/hr. This yields an allowable PM emissions limit of 1.73 lbs/hr. The estimated potential PM emissions from each extruder on an uncontrolled basis with the proposed 1,650,000 tpy resin throughput limit (as shown below) as 10.5 lbs/hr. With the proposed dust collectors, the after-control PM emissions from the manufacturing process should easily comply with Georgia Rule (e). In addition, the dust collectors will exhaust to the indoor plant environment so the PM emissions into the atmosphere will be much lower.

Note: The foaming ovens are considered to be direct-fired and therefore PM emissions are subject to Georgia Rule (e) rather than Georgia Rule (d).

Georgia Rule 391-3-1-.02(2)(g) – "Sulfur Dioxide": Georgia Rule (g) limits the fuel sulfur content, in this case, to 2.5 weight percent for all proposed fuel-burning sources at the facility. The facility will combust natural gas which should easily comply with Georgia Rule (g).

Georgia Rule 391-3-1-.02(2)(qqq)-"VOC Emissions from Extruded Polystyrene Products Manufacturing Utilizing a Blowing Agent": This state rule does not apply for the following reasons: (1) The facility will not be located in an applicable county covered by this state rule; and (2) The facility is not classified as an *extruded polystyrene products manufacturing facility*.

Avoidance of 40 CFR Part 70: The facility-wide VOC emissions, without a permit limit, are greater than 100 tpy. VOC emissions are based on the mass of resins used. The potential resin usage is 1,800,000 tons per year. The allowed resin usage for purposes of avoidance of 40 CFR Part 70 is derived as follows based on 98 tpy of VOC emissions from the facility (excluding VOC emissions from fuel-burning sources):

Potential resin usage (tons/yr) = (98 tons VOC/yr)*(grams resin beads/59.4 μg VOC)*($\mu g/10^{-6}$ grams)
= 1,650,000 tpy.

Potential resin usage will be limited to 1,650,000 tons per year.

40 CFR 63 Subpart OOOOOO (6O) – "Flexible Polyurethane Foam Production and Fabrication Area Sources: The proposed facility is not subject to the Area Source NESHAP because it will not meet the definition of *flexible polyurethane foam production and fabrication area* as defined in the NESHAP.

Permit Conditions

Condition 2.1 limits the consecutive twelve-months mass of polyethylene resins to be used in the kneader extruders to 1,650,000 tons for purposes of avoidance of 40 CFR 70.

Condition 2.2 limits the visible emissions to less than forty percent from the building atmospheric exhaust points.

Condition 2.3 limits the PM emissions from the process to less than that allowed by Georgia Rule (e).

Condition 2.4 limits the fuel sulfur content of fuel combusted in fuel-burning sources at the facility.

Condition 7.1 requires the facility to notify the Division of startup of said facility.

Conditions 7.2 and 7.3 require the facility to maintain monthly and consecutive twelve-month mass of resins used in the kneader extruders for purposes of avoidance of 40 CFR 70.

Toxic Impact Assessment

The proposed facility has the potential to emit a number of pollutants classified as *toxic air pollutants* (TAPs) regulated under the Georgia Air Toxics Guideline.

Step 1
The first step in this assessment is to identify which pollutants are potentially emitted, determine if the pollutant is classified as a TAP, and whether the Minimum Emissions Rate (MER) applies.

Note-1: The MER applies when at least 80% of the PTE is from an unobstructed vertical stack. The Division conducted this review and has summarized its findings in Table TIA.1

Note-2: The pollutants noted in Table TIA.1 exhaust to the indoor atmosphere of the plant which is assumed to exhaust to the outdoor atmosphere via building vents. The location of the building vents and their sizes is unknown.

Table TIA.1

Pollutant CAS No.	Regulated as a TAP?	Exhaust Point to the Outdoor Atmosphere?	Does the MER Apply?
Acetaldehyde 75070	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No
Acetone 67641	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No
Acetic Acid 64197	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No
Acrylic Acid 79107	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No
Benzaldehyde 100527	No	--	--
Butyraldehyde 123728	No	--	--
Ethane 74840	No	--	--
Ethylene 74851	No	--	--

Table TIA.1			
Pollutant CAS No.	**Regulated as a TAP?**	**Exhaust Point to the Outdoor Atmosphere?**	**Does the MER Apply?**
Formaldehyde 50000	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents. Combustion of natural gas whose exhaust to the outdoor atmosphere through unobstructed vertical stacks.	~88% is exhausted through building vent rather than through an unobstructed building vent. Therefore, the MER does not apply.
Formic Acid 64186	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No
Hexane 110543	Yes	Foam Furnaces which exhausts through an unobstructed vertical stack.	Yes
MEK 78933	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No
Propionaldehyde 123386	Yes	Kneader Extruder which vents indoors and the building enclosure exhausts to the outdoor atmosphere through building vents.	No

Step 2

Next, determine if the impact of the applicable TAP emissions must be determined via air dispersion modeling for which the MER applies. The Division conducted this review and has summarized its findings in Table TIA.2

Table TIA.2			
Pollutant CAS No.	**PTE (lb/yr)**	**MER (lb/yr)**	**Requires Modeling?**
Hexane CAS No.110543	1,020	170,000	No, because the PTE < MER Therefore, there is an assumed compliance with the GA Air Toxics Guideline for hexane.

Step 3

Next, the Division determined the PTE (lb/hr) for the applicable TAPs for which the MER, in this case, does not apply.

Table TIA.3			
Pollutant CAS No.	**EF (lb/ton of resin beads)**	**PTE[1] (lb/hr)**	**PTE (g/s)**
Acetaldehyde 75070	1.6E-04	0.088	0.0111
Acetone 67641	3.6E-04	0.198	0.0249
Acetic Acid 64197	1.04E-03	0.573	0.072
Acrylic Acid 79107	1.6E-04	0.088	0.0111

[1] 551 tons of resin beads/hr, per SIP Application Form 2.06

Table TIA.3			
Pollutant CAS No.	**EF (lb/ton of resin beads)**	**PTE[1] (lb/hr)**	**PTE (g/s)**
Formaldehyde 50000	1.8E-04	0.099	0.0125
Formic Acid 64186	6.2E-04	0.341	0.043
MEK 78933	8.0E-05	0.044	5.51
Propionaldehyde 123386	4.0E-05	0.022	0.0028

Step 4

Next, the Division established the default SCREEN3 input data for this analysis and these values are summarized in Table TIA.4. Note: The facility could not present an approvable air toxics guideline analysis.

Table TIA.4	
Input Parameter	**Value Using Volume Source Characterization for a Building Vent**
Height of Release	Assume a building height of 40 ft based on Appendix B of application. Release height = 20 ft (6.10 meters)
Initial Lateral Dimension	Building length = 550 ft (167.6 meters) Syinit = 167.6 meters/4.3 Syinit= 39.0
Initial Vertical Dimension	Assume a building height of 40 ft. (12.2 meters) Szinit = 12.2/2.15 Szinit = 5.67
Exhaust Temp	Ambient, 293 deg. K
Meteorology	Full atmospheric stability
Modeled Emission Rate	1 g/second

The Division's SCREEN3 results are summarized in Table TIA.5.

Table TIA.5		
Averaging Period	**MGLC based on 1 g/s emissions rate (µg/m^3)**	**Note(s)**
1-hour	752.4	Based on SCREEN3 model run
15-minute	993.17	=(752.4 * 1.32)
24-hour	301	=(752.4*0.40)
Annual	60.2	=(752.4*0.08)

Step 5

The Division scaled the values in Table TIA.5 to a calculated MGLC value based on the PTE of the TAP on an hourly basis based on the following formula:

$$\text{MGLC } (\mu g/m^3) = (\text{MGLC based on 1 g/s})*(\text{PTE of TAP, g/s})$$

The Division's results are summarized in Table TIA.6 and the results lead to the conclusion that compliance with the Georgia Air Toxics Guideline is expected.

Table TIA.6

TAP	Avg Period	AAC ($\mu g/m^3$)	MGLC ($\mu g/m^3$)	Passes?
Acetaldehyde 75070	15-minute	4,500	11.03	Yes
	Annual	4.55	0.67	Yes
Acetic Acid 64197	15-minute	3,700	71.70	Yes
Acetone 67641	15-minute	178,200	24.81	Yes
	24-hour	5,710	7.52	Yes
Acrylic Acid 79107	Annual	1.00	0.67	Yes
Formic Acid 64186	15-minute	940.7	42.74	Yes
	24-hour	21.4	12.95	Yes
Formaldehyde 50000	15-minute	245	12.41	Yes
	Annual	1.10	0.75	Yes
MEK 78933	15-minute	88,500	5.52	Yes
	Annual	5,000	0.33	Yes
Propionaldehyde 123386	Annual	8.00	0.17	Yes

Summary & Recommendations

The facility submitted a SIP Air Permit Application assigned number 29031 for the construction and operation of an IXPE underlayment manufacturing facility. A Public Advisory was issued which expired on October 27, 2023, with no comments received. The facility-wide VOC emissions are limited to less than 100 tpy by limiting the annual mass of resin (LDPE and EVA) to less than 1,650,000 tons of resin. I recommend the issuance of Permit No. 3086-055-0021-S-01-0.

Addendum to Narrative

The 30-day public review started on month day, year and ended on month day, year. Comments were/were not received by the Division.

//If comments were received, state the commenter, the date the comments were received in the above paragraph. All explanations of any changes should be addressed below.//