

# CHATTANOOGA-HAMILTON COUNTY AIR POLLUTION CONTROL BUREAU

## Statement of Basis Part 70 Permit No. 47-065-2730

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Emission Unit No.	Description
001	Combustion Engineering Boilers #1 and #2
002	Combustion Engineering Boiler #3, Riley Boiler #4, and Babcock & Wilcox Boiler #5
003	Riley Dowtherm <sup>®</sup> Vaporizers #1, #2, #3, #4, #5, and #6
004	Coal/Coal Ash Storage and Handling
005	Dowtherm <sup>®</sup> Transport System
006	Two Hexamethylenediamine Receiving Tanks
007	Continuous Polymerization Line II
008	Batch Polymer Evaporators #1, #2, #3, #4, and #5 and Autoclaves #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, and #18
009	Batch Polymer Flake Handling System
010	Type 32 Spinning Machines 201, 202, 203, 211, 221, 231, 241, and 251
011	Type 71 Spinning Machine 110
012	Texturing Machines 104 and 105

### Purpose

INVISTA S.à r.l., LLC has applied for the renewal of their Part 70 permit, which is due to expire on February 11, 2009. This company name is listed with the Office of the Tennessee Secretary of State. A Part 70 permit application update was received from INVISTA on August 8, 2008. This statement of basis includes discussions of the operation of the permitted equipment, the air pollutant emissions, and the applicable regulations. It has been adapted from the Bureau annual inspection report for INVISTA dated January 28, 2009.

## Process Description

INVISTA manufactures nylon 66 (polyhexamethylene adipamide,  $[\text{HN}(\text{CH}_2)_6\text{NH}(\text{C}=\text{O})(\text{CH}_2)_4\text{C}=\text{O}]_n$ ) polymer in the form of both yarn and flake. INVISTA also has the capability to make polyester yarn, but this is not currently done. The nylon 66 polymer is made from hexamethylenediamine [1,6-hexanediamine,  $\text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2$ ] and adipic acid [hexanedioic acid,  $\text{HOOC}(\text{CH}_2)_4\text{COOH}$ ] raw materials. This polymer is made by both continuous and batch process. All of the nylon polymer that is made is initially extruded, cooled, and cut into flakes. After storage or further processing, the nylon flake may be melted and fed into a spinning machine in which the liquid nylon is extruded through small holes in a spinnerette. The nylon then solidifies into fine threads that are stretched and twisted into yarn. A lubricating oil is applied to the threads in order to improve their processability. Particulate emissions that result from the manufacture of nylon 66 include hexamethylenediamine carbonate, which is readily formed in the ambient air by a reaction between hexamethylenediamine and atmospheric carbon dioxide ( $\text{CO}_2$ ). No appreciable amount of adipic acid is normally emitted because it is used as the limiting reactant.

Steam for both process heating and space heating is provided by five boilers, and six Dowtherm<sup>®</sup> vaporizers are used to provide additional process heat. Dowtherm<sup>®</sup> is a thermal fluid. Combustion Engineering Boilers #1 and #2 (**Emission Unit 001**) and Riley Dowtherm<sup>®</sup> Vaporizers #1-6 (**Emission Unit 003**) primarily burn natural gas, and they use No. 2 fuel oil as a backup fuel. Emissions that result from fuel combustion in these two boilers and six vaporizers are uncontrolled. Boilers #1 and #2 are vented to a single stack. Combustion Engineering Boiler #3, Riley Boiler #4, and Babcock & Wilcox Boiler #5 (**Emission Unit 002**) are traveling-grate spreader stoker boilers that burn bituminous coal exclusively. Filterable particulate emissions that result from burning coal in these three boilers are controlled by either of two baghouses, and other emissions that result from burning coal in these boilers are uncontrolled.

The sulfur content of the coal that is burned in Boilers #3-5 is verified by the analysis of weekly composite coal samples that are collected by each coal supplier. In addition, a random audit sample of coal from each supplier is obtained each week by INVISTA and analyzed for sulfur content.

Coal is delivered by truck to storage piles and then conveyed to an enclosed mill in which oversized pieces are broken up. The coal is then conveyed to bunkers that supply Boilers #3-5. Fugitive particulate emissions result from this storage and handling operation (**Emission Unit 004**) for coal and coal ash. Negligible particulate emissions that result from the coal mill are uncontrolled.

Dowtherm<sup>®</sup> contains approximately 73.5% diphenyl ether (phenyl ether, diphenyl oxide,  $\text{C}_6\text{H}_5\text{OC}_6\text{H}_5$ ) and 26.5% biphenyl (diphenyl,  $\text{C}_6\text{H}_5\text{C}_6\text{H}_5$ ). VOC emissions of diphenyl ether and biphenyl from three Dowtherm<sup>®</sup> vent condensers of a Dowtherm<sup>®</sup> transport system (**Emission Unit 005**) are controlled by up to three demisters (separators). One or two of the three air-cooled vent condensers are normally used at any one time. Fugitive VOC emissions of diphenyl ether and biphenyl result from various valves, flanges, and pumps that are a part of the plant-wide

Dowtherm<sup>®</sup> transport system. All of these valves, flanges, and pumps are inspected and repaired, if necessary, in accordance with INVISTA's *Leak Detection and Repair Program for the Dowtherm<sup>®</sup> Transport System*.

Hexamethylenediamine is held in a total of nine tanks. It is initially received as a 70-80% aqueous solution into two tanks (**Emission Unit 006**) that each have a capacity of 200,000 gallons. These two receiving tanks are connected together so that they are filled and withdrawn from simultaneously and are maintained at a common level. Six 30,000-gallon capacity storage tanks are simultaneously filled from the two receiving tanks by way of a common header so that they are maintained at a common level. In addition, they are filled and withdrawn from almost continuously so that the level in them is nearly constant. The hexamethylenediamine is diluted to an aqueous solution of 32% in another 30,000-gallon capacity tank. This tank is also filled and withdrawn from almost continuously such that the level in it remains nearly constant. Uncontrolled particulate emissions of hexamethylenediamine carbonate result from the two receiving tanks in the form of working losses. Uncontrolled particulate emissions of hexamethylenediamine carbonate due to working losses from the six storage tanks and one dilution tank are considered to be negligible because a nearly constant level is maintained in them. No emissions due to standing storage losses are considered to result from any of the nine tanks because they are each equipped with a conservation vent.

Adipic acid is a powdered material that is pneumatically received into either of two bins by way of a process baghouse. Each bin is served by two such baghouses in parallel which are used to separate the adipic acid from the conveying air stream. The baghouses are therefore not considered to be control equipment. Minimal particulate emissions that are vented from each of the four baghouses are controlled by a security cartridge filter. This receiving operation results only in emissions of particulate and has potential emissions, before being controlled by the cartridge filters, of no more than 0.500 lb/hr. Therefore, it is classified as an insignificant activity in accordance with §4-56(c)(12)(ii).

The hexamethylenediamine and adipic acid raw materials are introduced into either of two reactors where they form an aqueous solution of nylon 66 salt [hexamethylene diammonium adipate,  $\text{H}_3\text{N}(\text{CH}_2)_6\text{NH}_3\text{OOC}(\text{CH}_2)_4\text{COO}$ ]. These two atmospheric continuous reactors supply all of the nylon 66 salt that is used by both INVISTA and Kordsa. No emissions in the form of working losses are considered to result from either of these reactors because the nylon salt in them is normally maintained at a constant level, and no emissions are considered to occur from them as standing storage losses because they are located indoors.

Nylon 66 polymer is made by the continuous process in Continuous Polymerization (CP) Line II (**Emission Unit 007**). This CP line consists of an evaporator, a reactor, and a pair of finishers. Except for periods of start-up and shutdown, only one of the two finishers is used at any one time. The nylon salt solution is concentrated in the evaporator and then polymerized in the tubular reactor vessel. Water that is formed by the reaction is constantly removed in the form of steam, and heat is supplied in order to maintain the material in a molten state. The polymer is then sent to one of the two finishers. Particulate emissions that result from this CP line are in the form of hexamethylenediamine carbonate, nylon salt, and short-chain nylon 66 polymer.

Particulate emissions from the evaporator and reactor are controlled by a single scrubber (contact condenser). Particulate emissions from each finisher are controlled by either of two scrubbers (contact condensers) followed by the scrubber that is used to control particulate emissions from the evaporator and reactor. Water is used as the scrubbing medium in all three of the scrubbers. Nylon polymer from this CP Line is cut into flakes in a pelletizer that is followed by a classifier. Particulate emissions from the classifier are controlled by a cyclone.

In the batch process for making nylon 66 polymer, an evaporator is used to concentrate the nylon salt solution, and the solution is then pumped to a pressurized autoclave in which the nylon salt polymerizes and the resulting water is driven off. This process is performed in Batch Polymer (BP) Evaporators #1-5 and Autoclaves #1-18 (**Emission Unit 008**). Particulate emissions in the form of hexamethylenediamine carbonate and nylon salt result from both the evaporators and the autoclaves. Particulate emissions of short-chain nylon 66 polymer also result from the autoclaves. A single scrubber (contact condenser) is used to control the particulate emissions from these five evaporators and eighteen autoclaves. This scrubber is also used to control particulate emissions from the emission sources of CP Line II.

Nylon 66 polymer from BP Autoclaves #1-18 is cut into flakes by any of five casting machines that are vented to a single stack. Any of Autoclaves #1-10 can also be used to make a “block polymer” of nylon 66 and nylon 6 (polycaprolactam,  $[\text{HN}(\text{CH}_2)_5\text{C}=\text{O}]_n$ ), although this is not currently being done. If the block polymer is produced in an autoclave, uncontrolled VOC emissions of caprolactam  $[\text{HN}(\text{CH}_2)_5\text{C}=\text{O}]$  would result from the casting machine that serves that autoclave. No more than two casting machines would be used at any one time to cut the block polymer into flakes.

A BP flake handling system (**Emission Unit 009**) is used to pneumatically convey nylon flake from BP Autoclaves #1-18 to various spinning machines, blenders, storage bins, packaging operations, and loading facilities. Flake in the blenders of this system is blended by pneumatic recirculation. Particulate emissions from all of the emission sources of this interconnected plant-wide system are currently controlled by a total of forty-four baghouses. Thirteen of the baghouses are vented to a total of six stacks

Nylon 66 yarn is currently made in some of Type 32 Spinning Machines 201, 203, 211, 231, 241, and 251, and polyester yarn can be made in Type 32 Spinning Machines 202 and 221 (**Emission Unit 010**), although this is not presently being done. Spinning Machine 211 could be modified in the future so that polyester yarn can be made in it rather than nylon yarn, but there are no plans to do this at present. Spinning Machines 201, 202, and 203, which are built together as a single unit, have four, eight, and four spinning positions, respectively, for a total of sixteen positions. Each of Spinning Machines 211, 221, 231, 241, and 251 has thirty-two spinning positions. Spinning Machine 231 is actually partitioned into Spinning Machines 231 and 232, but these two modules, which each comprise sixteen spinning positions, are collectively referred to as Spinning Machine 231.

Polyester flake that was used in Spinning Machines 202 and 221 was brought in from another facility and required conditioning in a polyester flake handling and conditioning system.

Polyester flake for use in Spinning Machine 211, if modified, would also be conditioned in this system. This flake was received from trucks into any of four storage silos, and particulate emissions that resulted from each silo during loading were controlled by a baghouse. The flake was pneumatically conveyed by either of two conveyors from the silos to sets of flake conditioning equipment, and a baghouse was used to control particulate emissions that occurred from each of these conveyors. Each spinning machine that was used to make polyester yarn was served by a separate set of flake conditioning equipment in which the flake was purged with nitrogen in order to change the equilibrium moisture content of the polymer. A pair of dryers for specialty additive polyester flake also served each spinning machine that was used to make polyester yarn. Particulate emissions that resulted from the two additive flake dryers and flake conditioning equipment of Spinning Machine 202 were controlled by a single baghouse. Particulate emissions that resulted from each of the two additive flake dryers that served Spinning Machine 221 were controlled by a baghouse, and a baghouse would also be used to control particulate emissions from each of two additive flake dryers that would serve Spinning Machine 211, if modified. Particulate emissions did not occur from the flake conditioning equipment of Spinning Machine 221, and particulate emissions would also not result from flake conditioning equipment that would serve Spinning Machine 211, if modified. VOC emissions of acrolein (2-propenal,  $\text{CH}_2=\text{CHCHO}$ ) from one purge vent of the sets of flake conditioning equipment and VOC emissions of acetaldehyde (ethanal,  $\text{CH}_3\text{CHO}$ ) from a second purge vent of these sets of equipment were uncontrolled.

The conditioned flake and additive flake were conveyed by either of two nitrogen conveyors to Spinning Machine 221, and two nitrogen conveyors would also convey conditioned and additive flake to Spinning Machine 211, if modified. Particulate emissions from each of the two nitrogen conveyors of Spinning Machine 221 were controlled by a HEPA (high-efficiency particulate air) filter, and each of these two HEPA filters would also control particulate emissions from a nitrogen conveyor of modified Spinning Machine 211. Conditioned and additive flake were fed to Spinning Machine 202 by gravity rather than by nitrogen conveyors.

Each of the eight spinning machines is equipped with both a monomer exhaust and a hot chest exhaust, and Spinning Machines 221, 231, and 241 are each also equipped with a draw jet exhaust. A draw jet exhaust has been removed from each of Spinning Machines 201, 202, 211, and 251, but could be reinstalled onto any of them. Spinning Machine 203 has apparently never been equipped with a draw jet exhaust, but it could be fitted with one. Uncontrolled particulate emissions of hexamethylenediamine carbonate result from the monomer exhaust of each spinning machine that is in nylon yarn production. The monomer exhaust of each spinning machine in polyester yarn production resulted in uncontrolled particulate emissions and uncontrolled VOC emissions of acrolein and acetaldehyde. The monomer exhausts of Spinning Machines 201, 202, 203, 211, 221, and 231 are vented together and share two stacks. The monomer exhausts of Spinning Machines 241 and 251 are vented together and share two other stacks.

Particulate emissions of lubricating oil from the hot chest exhausts of Spinning Machines 201 and 203 combined are controlled by an electrostatic precipitator, and this electrostatic precipitator was also used to control particulate emissions of lubricating oil from the hot chest

exhaust of Spinning Machine 202. Particulate emissions of lubricating oil from the hot chest exhaust of Spinning Machine 211 are controlled by either a separate demister or the demister that is designated for Spinning Machines 201, 202, and 203. Particulate emissions of lubricating oil that resulted from the hot chest exhaust of Spinning Machine 221 were controlled by a separate electrostatic precipitator. Particulate emissions of lubricating oil from the hot chest exhaust of Spinning Machine 231 are controlled by either a separate demister or the demister that is designated for Spinning Machine 221. A separate electrostatic precipitator is used to control particulate emissions of lubricating oil from the hot chest exhaust of each of Spinning Machines 241 and 251.

Particulate emissions of lubricating oil from the former draw jet exhaust of Spinning Machine 201 were normally controlled by a specific demister. Up to three other demisters could also be used to control these emissions from Spinning Machine 201. Any of these three demisters were used to control particulate emissions of lubricating oil from the former draw jet exhausts of Spinning Machines 202 and 211 combined and could also be used to control particulate emissions of lubricating oil from the draw jet exhaust that could be installed onto Spinning Machine 203. Particulate emissions of lubricating oil from the draw jet exhaust of Spinning Machine 221 were also controlled by any of these three demisters. The four demisters that are designated for Spinning Machines 201, 202, 203, 211, and 221 share a single stack.

Either or both of two demisters are used to control particulate emissions of lubricating oil from the draw jet exhaust of Spinning Machine 231. Particulate emissions of lubricating oil from the former draw jet exhaust of Spinning Machine 251 were controlled by a separate demister. Particulate emissions of lubricating oil from the draw jet exhaust of Spinning Machine 241 are controlled by a separate demister, by a specific one of the two demisters that can be used for Spinning Machine 231, or by the demister that is designated for Spinning Machine 251. The demister that can only be used for Spinning Machine 241 and the demister designated for Spinning Machine 251 share a single stack.

Type 71 Spinning Machine 110 (**Emission Unit 011**) is equipped with a monomer exhaust, a hot chest exhaust, and a bulking exhaust. Particulate emissions of short-chain nylon 66 polymer from the monomer exhaust are controlled by a baghouse. Particulate emissions of lubricating oil from the hot chest exhaust are controlled by a venturi scrubber. A demister (wave-plate separator) and venturi scrubber in series are used to control particulate emissions of lubricating oil from the bulking exhaust, and this scrubber vents to either of two stacks. Both of the scrubbers use water as the scrubbing medium.

Texturing Machines 104 and 105 (**Emission Unit 012**) are used to form twists or kinks in nylon yarn. Each of these two texturing machines is equipped with two identical bulking exhausts, and particulate emissions of lubricating oil from each bulking exhaust are controlled by a fibrous filter. The two filters of each texturing machine are vented to a single stack.

Steel rolls are used to keep nylon yarn in tension as it is being wound onto bobbins, and the yarn stays in place on the rolls more readily if the surfaces of the rolls have been etched. This is accomplished by blasting the steel rolls with alumina (aluminum oxide, Al<sub>2</sub>O<sub>3</sub>) abrasive

in a self-contained system. This blasting operation results only in emissions of particulate and has potential emissions, before being controlled by a baghouse, of no more than 0.500 lb/hr. Therefore, it is classified as an insignificant activity in accordance with §4-56(c)(12)(ii).

Four water cooling towers are in use at the plant. These towers result only in emissions of particulate, and uncontrolled potential emissions from the four towers combined have been estimated to be 4.71 tons/yr, based on continuous operation. Therefore, they are classified as an insignificant activity in accordance with §4-56(c)(11)(xiv). A fifth water cooling tower has been dismantled and removed.

## Evaluation

It has been previously determined that particulate emissions from INVISTA significantly impact on the air quality within the former particulate non-attainment area. Therefore, particulate emission sources at this plant that were constructed or modified between September 16, 1980, and August 28, 1995, are subject to BACT [§4-8(e)(2)]. Particulate emission sources at this plant that were constructed or modified after August 29, 1995, are subject to Rule 27. In addition, applicable sources of particulate emissions at this plant that were in existence on January 1, 1978, are subject to Rule 26 (RACT). VOC emission sources at this plant that were constructed or modified after December 26, 1979, are subject to BACT (Rule 25.3).

Emission Unit 001	Combustion Engineering Boilers #1 and #2
Emission Unit 002	Combustion Engineering Boiler #3, Riley Boiler #4, and Babcock & Wilcox Boiler #5
Emission Unit 003	Riley Dowtherm <sup>®</sup> Vaporizers #1, #2, #3, #4, #5, and #6

Baghouses #1 and #2 each have an estimated particulate control efficiency of 99%. The rated capacities are 58.5 MMBtu/hr for each of Combustion Engineering Boilers #1 and #2, 65 MMBtu/hr for Combustion Engineering Boiler #3, 150 MMBtu/hr for Riley Boiler #4, 150 MMBtu/hr for Babcock & Wilcox Boiler #5, 22 MMBtu/hr for each of Riley Dowtherm<sup>®</sup> Vaporizers #1-5, and 18 MMBtu/hr for Riley Dowtherm<sup>®</sup> Vaporizer #6. Boilers #1 and #2 are typically operated only during the winter months. Natural gas is normally burned in Boilers #1 and #2 and Vaporizers #1-6 except for when its use is curtailed, in which case No. 2 fuel oil is burned that has average and maximum allowable sulfur contents of 0.18% and 0.3% by weight, respectively. During calendar year 2005,  $122.608 \times 10^6$  cubic feet of natural gas were burned in Boilers #1 and #2 combined and  $505.460 \times 10^6$  cubic feet of natural gas and 266,304 gallons of No. 2 fuel oil were burned in the six vaporizers combined. No. 2 fuel oil was not burned in either Boiler #1 or #2 during 2005. 43,264 tons of bituminous coal, with an average sulfur content of 0.99529% by weight and an average chlorine content of 0.06% by weight, were burned in Boilers #3-5 combined during 2005. 45,281 tons of bituminous coal, with an average sulfur content of 0.99821% by weight, were burned in Boilers #3-5 combined during 2006. 39,637 tons of bituminous coal, with an average sulfur content of 0.74655% by weight, were burned in Boilers #3-5 combined during 2007. The coal that is burned can result in maximum

allowable hourly SO<sub>2</sub> emissions of 4 lbs/MMBtu and can have a maximum allowable annual-average sulfur content of 1.25% by weight.

The estimated emissions of particulate (PM<sub>2.5</sub> and total), SO<sub>x</sub>, NO<sub>x</sub>, CO, VOCs, and methane (CH<sub>4</sub>) that result from fuel combustion in the five boilers and six vaporizers are given in Table I, which follows. The estimated emissions of ethane (CH<sub>3</sub>CH<sub>3</sub>) that result from burning natural gas in Boilers #1 and #2 and in Vaporizers #1-6 and the estimated emissions of hydrogen chloride (HCl) and hydrogen fluoride (HF) that result from burning coal in Boilers #3-5 are also given in this table. The controlled emissions of filterable particulate that result from coal combustion were determined by an emissions test of Boiler #5 that was performed on February 15, 1983, to be 0.02717 lb/MMBtu. This is comparable to the AP-42 (1998) filterable particulate emission factor of 0.0254 lb/MMBtu, after being controlled, based on a heat content for bituminous coal of 26 MMBtu/ton and on a control efficiency of 99%. The actual emissions of hydrogen chloride that result from coal combustion were determined to be 0.64 pound (as chlorine) per pound chlorine in the coal by an emissions test that was conducted in June 2002 of a boiler burning bituminous coal at an INVISTA (formerly DuPont) facility in Camden, South Carolina. All of the other emissions were calculated by using AP-42 (1998) emission factors.

The actual emissions are based on fuel usages for calendar year 2005. The potential emissions are based on operation of all of the boilers and vaporizers at their rated capacities, and the potential emissions from Boilers #1 and #2 and Vaporizers #1-6 are based on continuous operation. The hourly potential emissions are based on burning the fuel that results in the highest emissions. The annual potential emissions from Boilers #3-5 are based on burning 112,000 tons of coal that has the maximum annual-average sulfur content. The hourly potential emissions of particulate, SO<sub>x</sub>, and NO<sub>x</sub> from Boilers #1 and #2 and Vaporizers #1-6 are based on burning No. 2 fuel oil that has the maximum allowable sulfur content. The annual potential emissions of these three pollutants from Boilers #1 and #2 combined are based on burning 1,830,000 gallons of No. 2 fuel oil that has the maximum sulfur content and on burning the maximum amount of natural gas that can be burned after this much No. 2 fuel oil has been burned. The annual potential emissions of these three pollutants from Vaporizers #1-6 combined are based on burning 2,000,000 gallons of No. 2 fuel oil that has the maximum sulfur content and on burning the maximum amount of natural gas that can be burned after this much No. 2 fuel oil has been burned. The potential emissions of CO, VOCs, methane, and ethane from Boilers #1 and #2 and Vaporizers #1-6 are based on natural gas combustion.

Table I. Emissions from Boilers #1-5 and Dowtherm<sup>®</sup> Vaporizers #1-6

Pollutant and Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
<b>Particulate Matter ≤ 2.5 μm (PM<sub>2.5</sub>)</b>				
Boilers #1 and #2	0.466	1.295	4.282	11.70
Boilers #3-5	26.470	17.178	68.525	36.50
Vaporizers #1-6	2.127	1.417	4.684	5.80
<b>Total PM<sub>2.5</sub></b>	<b>29.063</b>	<b>19.891</b>	<b>77.492</b>	<b>54.00</b>
<b>Total Particulate Matter</b>				
Boilers #1 and #2	0.466	2.758	5.883	11.70
Boilers #3-5	37.779	24.517	97.800	36.50
Vaporizers #1-6	2.360	3.017	6.434	5.80
<b>Total Particulate</b>	<b>40.605</b>	<b>30.292</b>	<b>110.117</b>	<b>54.00</b>
<b>Sulfur Oxides (SO<sub>x</sub>)</b>				
Boilers #1 and #2	0.035	36.103	39.743	36.10
Boilers #3-5	824.819	1,460.000	2,681.700	1,460.0
Vaporizers #1-6	3.596	39.497	43.435	39.50
<b>Total SO<sub>x</sub></b>	<b>828.449</b>	<b>1,535.600</b>	<b>2,764.879</b>	<b>1,535.6</b>
<b>Nitrogen Oxides (NO<sub>x</sub>)</b>				
Boilers #1 and #2	6.376	16.714	57.490	n/a
Boilers #3-5	237.952	154.423	616.000	n/a
Vaporizers #1-6	28.947	18.286	62.889	n/a
<b>Total NO<sub>x</sub></b>	<b>273.275</b>	<b>189.423</b>	<b>736.378</b>	<b>n/a</b>
<b>Carbon Monoxide (CO)</b>				
Boilers #1 and #2	5.150	9.635	42.203	n/a
Boilers #3-5	108.160	70.192	280.000	n/a
Vaporizers #1-6	21.895	10.541	46.170	n/a
<b>Total CO</b>	<b>135.205</b>	<b>90.369</b>	<b>368.373</b>	<b>n/a</b>

Table I. Emissions from Boilers #1-5 and Dowtherm<sup>®</sup> Vaporizers #1-6 (continued)

Pollutant and Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
<b>Volatile Organic Compounds (VOCs)</b>				
Boilers #1 and #2	0.331	0.619	2.713	n/a
Boilers #3-5	1.082	0.702	2.800	n/a
Vaporizers #1-6	1.391	0.678	2.968	n/a
<b>Total VOCs</b>	<b>2.804</b>	<b>1.999</b>	<b>8.481</b>	<b>n/a</b>
<b>Methane</b>				
Boilers #1 and #2	0.141	0.264	1.156	n/a
Boilers #3-5	1.298	0.842	3.360	n/a
Vaporizers #1-6	0.588	0.289	1.264	n/a
<b>Total Methane</b>	<b>2.027</b>	<b>1.395</b>	<b>5.780</b>	<b>n/a</b>
<b>Ethane</b>				
Boilers #1 and #2	0.190	0.356	1.557	n/a
Vaporizers #1-6	0.783	0.389	1.704	n/a
<b>Total Ethane</b>	<b>0.974</b>	<b>0.745</b>	<b>3.261</b>	<b>n/a</b>
<b>Hydrogen Chloride</b>				
<b>Boilers #3-5</b>	<b>17.086</b>	<b>16.846</b>	<b>67.200</b>	<b>n/a</b>
<b>Hydrogen Fluoride</b>				
<b>Boilers #3-5</b>	<b>3.245</b>	<b>2.106</b>	<b>8.400</b>	<b>n/a</b>

All of the particulate emissions that result from burning natural gas are both PM<sub>2.5</sub> and PM<sub>10</sub>. 47.0% and 69.7% of the particulate emissions that result from No. 2 fuel oil combustion are PM<sub>2.5</sub> and PM<sub>10</sub>, respectively. 70.1% and 83.8% of the particulate emissions that result from coal combustion are PM<sub>2.5</sub> and PM<sub>10</sub>, respectively. The VOC emissions that result from natural gas combustion consist of up to 33.3% hexane [CH<sub>3</sub>(CH<sub>2</sub>)<sub>4</sub>CH<sub>3</sub>] and 1.39% formaldehyde (methanal, H<sub>2</sub>CO). VOC emissions that result from burning No. 2 fuel oil include up to 28.4% formaldehyde. In addition, VOC emissions that result from coal combustion are approximately 5.0% cyanide compounds, 2.60% benzene (C<sub>6</sub>H<sub>6</sub>), 1.40% benzyl chloride (C<sub>6</sub>H<sub>5</sub>CH<sub>2</sub>Cl), 1.16% isophorone [(C=O)HC=C(CH<sub>3</sub>)CH<sub>2</sub>C(CH<sub>3</sub>)<sub>2</sub>CH<sub>2</sub>], 1.14% acetaldehyde (ethanal, CH<sub>3</sub>CHO), and 1.06% methyl chloride (chloromethane, CH<sub>3</sub>Cl). All of these percentages were determined by using AP-42 (1998) emission factors. Hydrogen chloride, hydrogen fluoride, hexane, formaldehyde, cyanide compounds, benzene, benzyl chloride, isophorone, acetaldehyde, and methyl chloride are all HAPs.

Boilers #1 and #2 were installed in 1948, Boiler #3 was installed in 1953, Boiler #4 was installed in 1966, Boiler #5 was installed in 1969, Dowtherm<sup>®</sup> Vaporizers #1-5 were installed in 1966, and Dowtherm<sup>®</sup> Vaporizer #6 was installed in 1975. Vaporizers #1-5 were each modified by an increase in capacity in July 1995. Therefore, each of Vaporizers #1-5 is subject to the provisions of “Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units” [40 CFR Part 60, Subpart Dc (§60.40c-48c)], as adopted at Rule 15. §60.42c(d) stipulates that no fuel shall be burned in any of these vaporizers that has a sulfur content of greater than 0.5% by weight. Reporting and recordkeeping requirements are given in §60.48c.

Appropriate No. 2 fuel oil usage limitations have been previously determined to be 1,830,000 gal/yr for Boilers #1 and #2 combined and 2,000,000 gal/yr for Vaporizers #1-6 combined. An appropriate coal usage limitation for Boilers #3-5 combined has been previously determined to be 112,000 tons/yr. INVISTA requested these limitations in order to reduce their annual Part 70 permit fee, which is based on their allowable emissions. The potential emissions that are given in Table I are based upon these limitations.

Potential particulate emissions are estimated to be 1.379 lbs/hr from each of Boilers #1 and #2, 4.366 lbs/hr from Boiler #3, 10.076 lbs/hr from each of Boilers #4 and #5, and 0.424 lb/hr from Vaporizer #6. The particulate emissions from each of Boilers #1-5 and Vaporizer #6 are limited by Rule 26.6 to 0.1 lb/MMBtu. This limitation is equivalent to 5.85 lbs/hr for each of Boilers #1 and #2, 6.50 lbs/hr for Boiler #3, 15.00 lbs/hr for each of Boilers #4 and #5, and 1.80 lbs/hr for Vaporizer #6 while they are operating at their rated capacities. This limitation is more stringent than the Rule 8.1 (Schedule 1) particulate emission limits of 22.19 lbs/hr for each of Boilers #1 and #2, 23.99 lbs/hr for Boiler #3, and 44.57 lbs/hr for each of Boilers #4 and #5 and the Rule 8.2 (Schedule 2) particulate emission limit of 7.78 lbs/hr for Vaporizer #6.

Potential particulate emissions from each of Vaporizers #1-5 are estimated to be 0.519 lbs/hr. A BACT [§4-8(e)(2)] particulate emission limitation for each of Vaporizers #1-5 has been previously determined to be 0.80 lb/hr. No controls are necessary in order to achieve this limitation for each vaporizer. This limitation is more stringent than the both Rule 8.2 (Schedule 2) particulate emission limit of 8.51 lbs/hr for each of the five vaporizers and the Rule 26.6 particulate emission limit of 0.1 lb/MMBtu, which is equivalent to 2.20 lbs/hr for each of the vaporizers while they are operating at their rated capacities.

An appropriate sulfur content limitation for the No. 2 fuel oil that is burned in Boilers #1 and #2 and Vaporizers #1-6 has been previously determined to be 0.3% by weight. An appropriate limitation for the annual-average sulfur content of the coal that is burned in Boilers #3-5 has been previously determined to be 1.25% by weight. INVISTA requested these limitations in order to reduce their annual Part 70 permit fee. The SO<sub>2</sub> emissions from Boilers #3-5 are limited by Rule 13.2 to 4 lbs/MMBtu. This limitation is equivalent to 260.0 lbs/hr for Boiler #3 and 600.0 lbs/hr for each of Boilers #4 and #5 while they are operating at their rated capacities. Combustion of No. 2 fuel oil with the maximum allowable sulfur content in Boilers #1 and #2 and in Vaporizers #1-6 at their rated capacities results in potential SO<sub>x</sub> emissions of 18.05 lbs/hr from each of Boilers #1 and #2, 6.79 lbs/hr from each of Vaporizers #1-5, and 5.55

lbs/hr from Vaporizer #6. These SO<sub>x</sub> emission rates are the effective SO<sub>x</sub> emission limitations for Boilers #1 and #2 and the six vaporizers. These limitations are more stringent than the Rule 13.2 SO<sub>2</sub> emission limit of 4 lbs/MMBtu, which is equivalent to 234.0 lbs/hr for each of Boilers #1 and #2, 88.0 lbs/hr for each of Vaporizers #1-5, and 72.0 lbs/hr for Vaporizer #6 while they are operating at their rated capacities.

An appropriate BACT (Rule 25.3) limitation for the VOC emissions from each of Vaporizers #1-5 has been previously determined to be 0.20 lb/hr. No controls are necessary in order to achieve this limitation for each vaporizer. No limitation is applicable for the VOC emissions from any of the five boilers or Vaporizer #6. No limitations are applicable for the emissions of NO<sub>x</sub>, CO, and methane from any of the five boilers or six vaporizers. No limitation is applicable for the ethane emissions from either Boiler #1 or #2 or any of the six vaporizers. In addition, no limitations are applicable for the emissions of hydrogen chloride and hydrogen fluoride from any of Boilers #3-5.

#### Emission Unit 004 Coal/Coal Ash Storage and Handling

The potential emissions of particulate from the coal/coal ash storage and handling operation are estimated to be 0.813 ton/yr. This operation commenced in 1953. The particulate emissions from this storage and handling operation are limited by Rule 10.2 (Schedule 1) to 48.4 lbs/hr, based on a process weight of 150,000 lbs/hr. The Rule 10.7 particulate emission limit of 0.25 gr/scf is not applicable because the emissions are fugitive in nature.

#### Emission Unit 005 Dowtherm<sup>®</sup> Transport System

The Toxic Release Inventory (TRI) report for 1999 lists the highest fugitive VOC emissions of biphenyl in recent years for the Dowtherm<sup>®</sup> transport system. According to the 1999 and 2003 TRI reports, plant-wide fugitive VOC emissions of biphenyl were 8.997 tons/yr and 2.350 tons/yr, respectively. Using the ratio of diphenyl ether to biphenyl in Dowtherm<sup>®</sup>, the plant-wide fugitive VOC emissions of diphenyl ether are estimated to be 24.954 tons/yr for calendar year 1999 and 6.518 tons/yr for 2003.

Each of the three demisters has an estimated VOC control efficiency of 98.5%. Potential emissions from the three vent condensers combined are estimated to be less than 1.0 lb/hr and 4.38 tons/yr for VOC emissions of biphenyl and less than 2.774 lbs/hr and 12.148 tons/yr for VOC emission of diphenyl ether. The Dowtherm<sup>®</sup> transport system was last modified in 1996. Control of the VOC emissions from each of the three Dowtherm<sup>®</sup> vent condensers of this system by a demister has been determined to be BACT (Rule 25.3). Appropriate BACT limitations for the three vent condensers combined have been previously determined to be 1.0 lb/hr for VOC emissions of biphenyl and 4.0 lbs/hr for emissions of total VOCs. Adherence to the *Leak Detection and Repair Program for the Dowtherm<sup>®</sup> Transport System* has been determined to be BACT for the sources of fugitive VOC emissions that are a part of the Dowtherm<sup>®</sup> transport system.

Biphenyl is a HAP. SCREEN3 modeling (assuming flat terrain and no building downwash) of the allowable biphenyl emissions of 1.0 lb/hr from the three vent condensers combined results in a maximum ambient concentration of 117.2  $\mu\text{g}/\text{m}^3$  (8 hr avg.). This concentration is 9.1% of the TLV (8 hr avg.) of 0.2 ppm (1,283  $\mu\text{g}/\text{m}^3$ ).

Emission Unit 006 Two Hexamethylenediamine Receiving Tanks

The two hexamethylenediamine receiving tanks are loaded at a rate of approximately 150 gal/min, and the six storage tanks are simultaneously filled and withdrawn from at a rate of about 40 gal/min. The net displacement from the two receiving tanks during loading is therefore normally about 110 gal/min. 75,460.3 tons (approximately 21,231,304 gallons) of hexamethylenediamine were loaded into the two receiving tanks during calendar year 2004.

The estimated particulate emissions of hexamethylenediamine carbonate from the two receiving tanks are given below in Table II. These emissions were estimated by using an AP-42 equation for working losses. The hourly potential emissions are based on a displacement of 150 gal/min. The annual potential emissions are based on loading 31,791,400 gallons of hexamethylenediamine, which has been calculated to be the maximum amount that could be used by the plant, and on using a net displacement of 89.514 gal/min [150 gal/min - (31,791,400 gal/yr  $\div$  525,600 min/yr)]. The actual emissions for 2004 are based on using a net displacement of 109.606 gal/min [150 gal/min - (21,231,304 gal/yr  $\div$  525,600 min/yr)]. All of the particulate emissions from these two tanks are considered to be both  $\text{PM}_{2.5}$  and  $\text{PM}_{10}$ .

*Table II. Particulate Matter ( $\text{PM}_{2.5}$  &  $\text{PM}_{10}$ ) Emissions of Hexamethylenediamine Carbonate from Two Hexamethylenediamine Receiving Tanks*

Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
	<i>lbs/hr</i>	<i>tons/yr</i>	
0.954	1.107	1.166	40.5

The two hexamethylenediamine receiving tanks were installed in 1950. The particulate emissions from these two tanks combined are limited by Rule 10.2 (Schedule 1) to 40.5 lbs/hr, based on a process weight of 63,976 lbs/hr (150 gal/min). The Rule 10.7 particulate emission limit is not applicable to storage tanks for liquids.

Emission Unit 007 Continuous Polymerization Line II

Continuous Polymerization (CP) Line II is normally operated continuously (8,760 hrs/yr). Annual production from this CP line during calendar year 2004 was 62.305% of what would

result from continuous operation at the maximum production rate. Each of the three scrubbers has an estimated particulate control efficiency of 99.9%. The particulate control efficiency of the cyclone is estimated to be at least 80%. The estimated particulate emissions from the various emission sources of CP Line II are given below in Table III. The potential emissions are based on continuous operation at the maximum production rate. All of the particulate emissions from the evaporator, reactor, and two finishers of this CP line are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

*Table III. Particulate Matter Emissions from Continuous Polymerization Line II*

Emission Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
Evaporator*	0.0035	0.0013	0.0057	0.07
Reactor*	0.011	0.0039	0.017	
Two Finishers*	0.0087	0.0032	0.014	0.03
Pelletizer Classifier	0.019	0.0068	0.030	0.10
<b>Total Particulate</b>	<b>0.042</b>	<b>0.015</b>	<b>0.067</b>	<b>0.20</b>

\*Particulate matter emissions from these sources are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

CP Line II was modified in 1993 by the addition of a second evaporator, which was later removed. Control of the particulate emissions from the evaporator and reactor by a scrubber and from each of the finishers by a scrubber has been determined to be BACT [§4-8(e)(2)]. An appropriate BACT limitation for the particulate emissions from the evaporator and reactor combined has been previously determined to be 0.07 lb/hr. An appropriate BACT limitation for the particulate emissions from the two finishers combined has been previously determined to be 0.03 lb/hr. This limitation is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (0.076 lb/hr) for the two finishers. The sum of the two BACT particulate emission limitations is 0.10 lb/hr, which is more stringent than the Rule 26.17(1)d particulate emission limit of 1.5 lbs/hr for CP Line II. In addition, the particulate emissions from the evaporator and reactor of CP Line II and from Batch Polymer Evaporators #1-5 and Autoclaves #1-18 combined, as vented to the scrubber, are limited by Rule 10.7 to 0.25 gr/scf. This limitation cannot be converted into units of lbs/hr because the exhaust flow rate of the scrubber is not available at this time.

The pelletizer classifier was installed in 2002. Potential particulate emissions, before being controlled, from this pelletizer classifier are estimated to be 0.15 ton/yr, based on continuous operation at the maximum production rate. Therefore, the particulate emissions from the pelletizer classifier are subject to Rule 27.3. Control of these emissions by a cyclone has been determined to be reasonable and proper, in accordance with Rule 27.3. An appropriate reasonable and proper limitation for the particulate emissions from this pelletizer classifier has

been previously determined to be 0.10 lb/hr. This limitation is more stringent than both the Rule 10.3 (Schedule 2) particulate emission limit of 4.71 lbs/hr, based on a process weight of 3,100 lbs/hr for the pelletizer classifier, and the Rule 10.7 particulate emission limit of 0.25 gr/scf (10.71 lbs/hr). The sum of the two BACT particulate emission limitations for CP Line II and the reasonable and proper limitation for the pelletizer classifier is 0.20 lb/hr, which is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 7.74 lbs/hr, based on a process weight of 6,900 lbs/hr for CP Line II.

Emission Unit 008 Batch Polymer Evaporators #1, #2, #3, #4, and #5 and Autoclaves #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, and #18

Annual production from Batch Polymer (BP) Evaporators #1-5 and Autoclaves #1-18 during calendar year 2004 was 72.876% of what would result from continuous operation at the maximum production rate. The scrubber has an estimated particulate control efficiency of 99.9%. The estimated particulate emissions from the five evaporators combined and eighteen autoclaves combined are given below in Table IV. The potential emissions are based on continuous operation at the maximum production rate. All of the particulate emissions from these evaporators and autoclaves are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

*Table IV. Particulate Matter (PM<sub>2.5</sub> & PM<sub>10</sub>) Emissions from the BP Evaporators and Autoclaves*

Emission Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
BP Evaporators #1-5	0.0066	0.0021	0.0091	6.0
BP Autoclaves #1-18	0.183	0.057	0.251	17.1
<b>Total Particulate</b>	<b>0.190</b>	<b>0.059</b>	<b>0.260</b>	<b>23.1</b>

The particulate emissions from each of BP Evaporators #1-5 are limited by Rule 26.17(1)b to 1.2 lbs/hr. The particulate emissions from each of BP Autoclaves #1-17 are limited by Rule 26.17(1)c to 1.0 lb/hr. In addition, the particulate emissions from each of Autoclaves #1-17, as vented through their respective scrubber bypass stacks, are limited by Rule 10.7 to 0.25 gr/scf (0.43 lb/hr).

BP Autoclave #18 was installed in 1998. Potential particulate emissions, before being controlled, from this autoclave are estimated to be 13.9 tons/yr, based on continuous operation at the maximum production rate. Therefore, the particulate emissions from Autoclave #18 are subject to Rule 27.3. Control of these emissions by a scrubber has been determined to be reasonable and proper, in accordance with Rule 27.3. An appropriate reasonable and proper limitation for the particulate emissions from this autoclave has been previously determined to be

0.10 lb/hr. This limitation is more stringent than the Rule 26.17(1)c particulate emission limit of 1.0 lb/hr for the autoclave. The sum of the Rule 26.17 limitations for Evaporators #1-5 and Autoclaves #1-17 and the reasonable proper limitation for Autoclave #18 is 23.1 lbs/hr, which is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 26.7 lbs/hr, based on a process weight of 50,887 lbs/hr for the five evaporators and eighteen autoclaves combined. In addition, the particulate emissions from Evaporators #1-5, Autoclaves #1-18, and the evaporator and reactor of CP Line II combined, as vented to the scrubber, are limited by Rule 10.7 to 0.25 gr/scf. This limitation cannot be converted into units of lbs/hr because the exhaust flow rate of the scrubber is not available at this time.

Although it is not currently done, production of the block polymer in any one of Autoclaves #1-10 would result in VOC emissions of caprolactam of 0.013 pound per 15-minute casting period from the casting machine that serves that autoclave. The block polymer can be made in each of Autoclaves #1-10 at a maximum rate of one batch every 130 minutes, and no more than two of the five casting machines would be used at any one time to cut the resulting block polymer into flakes. The potential emissions from the five casting machines combined, based on continuous production of the block polymer at the maximum rate, are estimated to be 0.263 ton/yr.

Autoclaves #1-10 began to be used on occasion to make the block polymer in 1998. An appropriate BACT (Rule 25.3) limitation for the VOC emissions of caprolactam from the five casting machines combined that serve these autoclaves has been previously determined to be 0.10 lb/hr. No controls are necessary in order to achieve this limitation.

Emission Unit 009 Batch Polymer Flake Handling System

Annual throughput for the batch polymer (BP) flake handling system during calendar 2004 was 71.613% of what would result from continuous operation at the maximum throughput rate. Each of the baghouses has an estimated particulate control efficiency of at least 99%. The estimated particulate emissions from the combined emission sources of the BP flake handling system are given below in Table V. These emissions were calculated by using an uncontrolled particulate emission factor of 0.000316 lb/lb. The potential emissions are based on continuous operation at the maximum throughput rate.

*Table V. Particulate Matter Emissions from the Batch Polymer Flake Handling System*

Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
	<i>lbs/hr</i>	<i>tons/yr</i>	
0.257	0.082	0.359	4.60

The BP flake handling system was last modified in 2002. Potential particulate emissions, before being controlled, from this system are estimated to be 35.9 tons/yr, based on continuous operation at the maximum throughput rate. Therefore, the particulate emissions from this flake handling system are subject to BACT (Rule 27.1). Control of the particulate emissions from the various emissions sources of this system by a baghouse has been determined to be BACT. An appropriate BACT limitation for the particulate emissions from each of the thirty-seven stacks of this flake handling system has been previously determined to be 0.10 lb/hr. This limitation is more stringent than both the Rule 10.3 (Schedule 2) particulate emission limit for each stack and the Rule 10.7 particulate emission limit of 0.25 gr/scf for each stack. The sum of the thirty-seven BACT limitations is 4.60 lbs/hr, which is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 17.6 lbs/hr, based on a process weight of 25,931 lbs/hr for the combined emission sources of the flake handling system.

Emission Unit 010 Type 32 Spinning Machines 201, 202, 203, 211, 221, 231, 241, and 251

Annual nylon production during calendar year 2004 was 0.446% for Type 32 Spinning Machines 201 and 203, 22.064% for Type 32 Spinning Machine 211, 48.970% for Type 32 Spinning Machine 231, 26.698% for Type 32 Spinning Machine 241, and 10.044% for Type 32 Spinning Machine 251 of what would result from continuous operation at the maximum production rates. Annual polyester production during 2004 was 48.005% for Spinning Machine 202 and 51.990% for Spinning Machine 221 of what would result from continuous operation at the maximum production rates. Estimated particulate control efficiencies are 95% for each of the six electrostatic precipitators, 90% for each of the eight demisters, at least 99% for each of the nine current baghouses and two proposed baghouses, and at least 99.9% for each of the two HEPA filters. The storage silos were loaded with polyester flake at a rate of 21.0 tons/hr, and it is possible to load no more than two silos simultaneously. The dryers for specialty additive flake were only used as needed.

The estimated particulate emissions from the eight spinning machines and polyester flake handling and conditioning system are given in Table VI, which follows. The estimated VOC emissions of acrolein and acetaldehyde from Spinning Machines 202, 211, and 221 and the flake handling and conditioning system are given in Table VII, which follows. The actual emissions are based on Spinning Machines 201, 202, and 211 still being fitted with a draw jet exhaust in 2004 and on all of the 2004 nylon production for Spinning Machines 201 and 203 being accomplished in Spinning Machine 201. The potential emissions are based on continuous operation at the maximum production rates; on polyester production in Spinning Machines 202, 211, and 221; and on a draw jet exhaust being used with each of the eight spinning machines. The potential particulate emissions from the silos are based on loading two silos simultaneously and on supplying sufficient polyester flake to allow for continuous operation of Spinning Machines 202, 211, and 221. All of the particulate emissions from the spinning machines are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

Table VI. Particulate Matter Emissions from Type 32 Spinning Machines 201, 202, 203, 211, 221, 231, 241, and 251 and the Polyester Flake Handling and Conditioning System

Emission Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
Four Flake Storage Silos	0.00090	0.013	0.0032	1.0
Flake Handling and Conditioning	0.0024	0.0018	0.0080	0.40
SM 201, 202, & 203 Monomer Exhausts*	0.140	0.234	1.025	2.50
SM 201, 202, & 203 Hot Chest Exhausts*	0.0060	0.010	0.044	
SM 201, 202, & 203 Draw Jet Exhausts*	0.359	0.600	2.628	
SM 211 Monomer Exhaust*	0.226	0.260	1.139	1.0
SM 211 Hot Chest Exhaust*	0.0097	0.011	0.049	
SM 211 Draw Jet Exhaust*	0.580	0.667	2.920	
SM 221 Monomer Exhaust*	0.592	0.260	1.139	1.0
SM 221 Hot Chest Exhaust*	0.025	0.011	0.049	
SM 221 Draw Jet Exhaust*	1.518	0.667	2.920	
SM 231 Monomer Exhaust*	0.502	0.234	1.025	1.0
SM 231 Hot Chest Exhaust*	0.021	0.010	0.044	
SM 231 Draw Jet Exhaust*	1.287	0.600	2.628	
SM 241 Monomer Exhaust*	0.274	0.234	1.025	1.0
SM 241 Hot Chest Exhaust*	0.012	0.010	0.044	
SM 241 Draw Jet Exhaust*	0.702	0.600	2.628	
SM 251 Monomer Exhaust*	0.103	0.234	1.025	1.0
SM 251 Hot Chest Exhaust*	0.0044	0.010	0.044	
SM 251 Draw Jet Exhaust*	-0-	0.600	2.628	
<b>Total Particulate</b>	<b>6.364</b>	<b>5.267</b>	<b>23.013</b>	<b>8.9</b>

\*Particulate matter emissions from these sources are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

Table VII. VOC Emissions from Type 32 Spinning Machines 202, 211, and 221 and the Polyester Flake Handling and Conditioning System

Pollutant and Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
<b>Acrolein</b>				
Flake-Conditioning Purge Vent	0.028	0.023	0.099	0.10
SM 202 Monomer Exhaust	0.0011	0.00050	0.0022	0.01
SM 211 Monomer Exhaust	-0-	0.0020	0.0088	0.01
SM 221 Monomer Exhaust	0.0046	0.0020	0.0088	0.01
<b>Total Acrolein</b>	<b>0.034</b>	<b>0.027</b>	<b>0.119</b>	<b>0.13</b>
<b>Acetaldehyde</b>				
Flake-Conditioning Purge Vent	0.028	0.023	0.099	0.10
SM 202 Monomer Exhaust	0.0011	0.00050	0.0022	0.01
SM 211 Monomer Exhaust	-0-	0.0020	0.0088	0.01
SM 221 Monomer Exhaust	0.0046	0.0020	0.0088	0.01
<b>Total Acetaldehyde</b>	<b>0.034</b>	<b>0.027</b>	<b>0.119</b>	<b>0.13</b>
<b>Total VOCs</b>	<b>0.068</b>	<b>0.054</b>	<b>0.237</b>	<b>0.26</b>

The polyester flake handling and conditioning system was installed in 2001 and modified in 2002. Potential particulate emissions, before being controlled, from this system are estimated to be 1.48 tons/yr, based on continuous operation at the maximum production rates. Therefore, the particulate emissions from this flake handling and conditioning system are subject to Rule 27.3. Control of the particulate emissions from each of the four storage silos and each of the seven current and two proposed flake handling and conditioning exhaust vents of this system by a baghouse or HEPA filter has been determined to be reasonable and proper, in accordance with Rule 27.3.

An appropriate reasonable and proper limitation for the particulate emissions from the four silos of the polyester flake handling and conditioning system combined has been previously determined to be 1.0 lb/hr. This limitation is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (2.14 lbs/hr) for each silo. An appropriate reasonable and proper limitation for the particulate emissions from the nine flake handling and conditioning exhaust vents of this system combined is 0.40 lb/hr. This limitation is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (0.43 lb/hr) for each of the two pneumatic conveyors leading to the flake conditioning equipment. The particulate emissions from each of the two current dryers for additive flake that serve Spinning Machine 221 and from each of the two

proposed additive flake dryers for Spinning Machine 211 are limited by Rule 10.7 to 0.25 gr/scf (0.0043 lb/hr). In addition, the particulate emissions from each of the two current nitrogen conveyors or from each pair of one current and one proposed nitrogen conveyor leading from flake conditioning equipment, as vented to a HEPA filter, are limited by Rule 10.7 to 0.25 gr/scf (0.17 lb/hr). The Rule 10.7 limit of 0.25 gr/scf for the particulate emissions from the flake conditioning equipment and two additive flake dryers that serve Spinning Machine 202, as vented to a baghouse, cannot be converted into units of lbs/hr because the exhaust flow rate of the baghouse is not available at this time.

Type 32 Spinning Machine 221 was modified for the production of polyester yarn in 2001, Type 32 Spinning Machine 202 was further modified for increased production of polyester yarn in 2002, and Type 32 Spinning Machine 211 may be modified for polyester yarn production in the future. Potential particulate emissions, before being controlled, from these three spinning machines combined are estimated to be 70.5 tons/yr, based on continuous operation at the maximum polyester production rates. Therefore, the particulate emissions from these spinning machines are subject to BACT (Rule 27.1). Control of the particulate emissions from the hot chest exhaust of each of these three spinning machines by an electrostatic precipitator has been determined to be BACT. Control of the particulate emissions from the current draw jet exhaust of Spinning Machine 221 and from the former draw jet exhaust of each of Spinning Machines 202 and 211 by a demister has been determined to be BACT. It has been determined that no controls are necessary in order to satisfy BACT for the particulate emissions from the monomer exhaust of each of these spinning machines.

Potential particulate emissions from Spinning Machine 202 are estimated to be 0.234 lb/hr. An appropriate BACT particulate emission limitation for this spinning machine has been previously determined to be 0.50 lb/hr. This limitation is more stringent than the Rule 26.17(1)a particulate emission limit of 1.0 lb/hr for Spinning Machine 202. An appropriate BACT particulate emission limitation for each of Spinning Machines 211 and 221 has been previously determined to be 1.0 lb/hr. These limitations are equivalent to the Rule 26.17(1)a particulate emission limit of 1.0 lb/hr for each of Spinning Machines 211 and 221, and they are more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (2.59 lbs/hr) for the hot chest exhaust of each of the two spinning machines. The sum of the BACT particulate emission limitations for the polyester flake handling and conditioning system and Spinning Machines 202, 211, and 221 is 3.9 lbs/hr, which is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 5.94 lbs/hr, based on a process weight of 4,500 lbs/hr for the three spinning machines combined.

The particulate emissions from each of Type 32 Spinning Machines 201, 203, 231, 241, and 251 are limited by Rule 26.17(1)a to 1.0 lb/hr. These limitations are more stringent than the Rule 10.7 particulate emission limits of 0.25 gr/scf (48.67 lbs/hr) for the monomer exhausts of Spinning Machines 241 and 251 combined; 0.25 gr/scf (2.59 lbs/hr) for the hot chest exhaust of each of Spinning Machines 231, 241, and 251; 0.25 gr/scf (7.88 lbs/hr) for the current draw jet exhaust of Spinning Machine 231; 0.25 gr/scf (7.88 lbs/hr) for the current draw jet exhausts of Spinning Machines 231 and 241 combined; and 0.25 gr/scf (15.77 lbs/hr) for the current draw jet

exhaust of Spinning Machine 241 and former draw jet exhaust of Spinning Machine 251 combined.

The BACT particulate emission limitations for Spinning Machines 202, 211, and 221 and the Rule 26.17 particulate emission limitations for Spinning Machines 201, 203, and 231 are more stringent than the Rule 10.7 particulate emission limits of 0.25 gr/scf (48.67 lbs/hr) for the monomer exhausts of Spinning Machines 201, 202, 203, 211, 221, and 231 combined; 0.25 gr/scf (2.59 lbs/hr) for the hot chest exhausts of Spinning Machines 201, 202, and 203 combined; and 0.25 gr/scf (8.45 lbs/hr) for the current draw jet exhaust of Spinning Machine 221, former draw jet exhausts of Spinning Machines 201, 202, and 211, and possible draw jet exhaust of Spinning Machine 203 combined. The sum of the BACT particulate emission limitations for the polyester flake handling and conditioning system; the BACT particulate emission limitations for Spinning Machines 202, 211, and 221; and the Rule 26.17 particulate emission limitations for Spinning Machines 201, 203, 231, 241, and 251 is 8.9 lbs/hr, which is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 10.4 lbs/hr, based on a process weight of 11,200 lbs/hr for the eight spinning machines combined.

Acrolein and acetaldehyde are HAPs. Appropriate BACT (Rule 25.3) limitations for the VOC emissions of acrolein have been previously determined to be 0.10 lb/hr from the two current sets and one proposed set of flake conditioning equipment combined and 0.01 lb/hr from the monomer exhaust of each of Spinning Machines 202, 211, and 221. Appropriate BACT limitations for the VOC emissions of acetaldehyde have been previously determined to be 0.10 lb/hr from the three sets of flake conditioning equipment combined and 0.01 lb/hr from the monomer exhaust of each of Spinning Machines 202, 211, and 221. No controls are necessary in order to achieve any of these limitations.

#### Emission Unit 011    Type 71 Spinning Machine 110

Type 71 Spinning Machine 110 can be used in two different configurations. In the first configuration, which is currently used exclusively, all three of the exhausts are employed, but particulate emissions from the hot chest exhaust occur at a reduced rate. Only the monomer and hot chest exhausts are used in the second configuration. Annual production from this spinning machine during calendar year 2006 was 74.715% of what would result from continuous operation at the maximum production rate of 1,100 lbs/hr. The baghouse has an estimated particulate control efficiency of 99%. The venturi scrubber for the hot chest exhaust is at least 80% efficient in controlling particulate emissions. Particulate control efficiencies are estimated to be 50% for the demister and 85% for the venturi scrubber of the bulking exhaust, resulting in a combined particulate control efficiency of 92.5%.

The estimated particulate emissions from this spinning machine are given in Table VIII, which follows. The potential emissions are based on continuous operation at the maximum production rate. The potential emissions from the bulking exhaust are based on using the spinning machine in the first configuration. The potential emissions from the hot chest exhaust and the potential emissions of total particulate from the spinning machine are based on using the

spinning machine in the second configuration. All of the particulate emissions from this spinning machine are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

*Table VIII. Particulate Matter (PM<sub>2.5</sub> & PM<sub>10</sub>) Emissions from Type 71 Spinning Machine 110*

Emission Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
Monomer Exhaust	0.0093	0.0028	0.012	1.0
Hot Chest Exhaust	0.393	0.210	0.921	
Bulking Exhaust	0.288	0.088	0.385	
<b>Total Particulate</b>	<b>0.690</b>	<b>0.213</b>	<b>0.933</b>	<b>1.0</b>

Type 71 Spinning Machine 110 was installed in 1998. Potential particulate emissions, before being controlled, from this spinning machine are estimated to be 9.0 tons/yr, based on continuous operation in the first configuration at the maximum production rate. Therefore, the particulate emissions from this spinning machine are subject to Rule 27.3. Control of the particulate emissions from this spinning machine by a baghouse for the monomer exhaust, by a venturi scrubber for the hot chest exhaust, and by a demister and venturi scrubber in series for the bulking exhaust has been determined to be reasonable and proper, in accordance with Rule 27.3.

An appropriate reasonable and proper limitation for the particulate emissions from this spinning machine has been previously determined to be 1.0 lb/hr, which is identical to the Rule 26.17(1)a particulate emission limit. This limitation is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 2.48 lbs/hr, based on a process weight of 1,100 lbs/hr for the spinning machine. This reasonable and proper limitation is also more stringent than the Rule 10.7 particulate emission limits of 0.25 gr/scf (13.12 lbs/hr) for the monomer exhaust, 0.25 gr/scf (7.12 lbs/hr) for the hot chest exhaust, and 0.25 gr/scf (6.31 lbs/hr) for the bulking exhaust.

Emission Unit 012 Texturing Machines 104 and 105

Annual production from Texturing Machines 104 and 105 during calendar year 2005 was 28.084% of what would result from continuous operation at the maximum production rate. Each of the filters has an estimated particulate control efficiency of 99.5%. The estimated particulate emissions from the two bulking exhausts combined of each of the two texturing machines are given in Table IX, which follows. The potential emissions are based on continuous operation at the maximum production rate. All of the particulate emissions from these two texturing machines are considered to be both PM<sub>2.5</sub> and PM<sub>10</sub>.

Table IX. Particulate Matter (PM<sub>2.5</sub> & PM<sub>10</sub>) Emissions from Texturing Machines 104 and 105

Emission Source	Actual Emissions <i>tons/yr</i>	Potential Emissions		Allowable Emissions <i>lbs/hr</i>
		<i>lbs/hr</i>	<i>tons/yr</i>	
Texturing Machine 104	0.020	0.0082	0.036	0.15
Texturing Machine 105		0.0082	0.036	0.15
<b>Total Particulate</b>	<b>0.020</b>	<b>0.016</b>	<b>0.072</b>	<b>0.30</b>

Texturing Machines 104 and 105 were installed as Bulklers #4 and #5, respectively, in 1988. Modifications to both of them in 1989 resulted in emission increases, and subsequent modifications in 1995 resulted in emission decreases. Control of the particulate emissions from each of the bulking exhausts of these machines by a filter has been determined to be BACT [§4-8(e)(2)].

An appropriate BACT limitation for the particulate emissions from each of Texturing Machines 104 and 105 has been previously determined to be 0.15 lb/hr. Each of these limitations is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (3.37 lbs/hr) for each texturing machine. The sum of these two BACT limitations is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 2.21 lbs/hr, based on a process weight of 914 lbs/hr for both texturing machines combined.

### Conclusions

Combustion Engineering Boilers #1 and #2 (Emission Unit 001) and Riley Dowtherm<sup>®</sup> Vaporizer #6 (Emission Unit 003) are subject to and in compliance with §4-41, Rule 3 (visible emissions), Rule 12 (odor), Rule 13 (SO<sub>2</sub> emissions), and Rule 26.6 (RACT particulate emissions from fuel-burning equipment) of the Chattanooga Air Pollution Control Ordinance (the Ordinance).

Combustion Engineering Boiler #3, Riley Boiler #4, and Babcock & Wilcox Boiler #5 (Emission Unit 002) are subject to and in compliance with §4-41, Rule 3 (visible emissions), Rule 12 (odor), Rule 13 (SO<sub>2</sub> emissions), and Rule 26.6 (RACT particulate emissions from fuel-burning equipment) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

Riley Dowtherm<sup>®</sup> Vaporizers #1-5 (Emission Unit 003) are subject to and in compliance with §4-8(e)(2) (BACT particulate and visible emissions) and §4-41, Rule 12 (odor), Rule 13 (SO<sub>2</sub> emissions), Rule 15 (“Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units”), and Rule 25.3 (BACT VOC emissions) of the Ordinance.

The coal/coal ash storage and handling system (Emission Unit 004) is subject to and in compliance with §4-41, Rule 10 (particulate emissions), Rule 11 (visible emissions from material handling in open air), and Rule 26.11 (RACT visible emissions from material handling sources) of the Ordinance.

The Dowtherm<sup>®</sup> transport system (Emission Unit 005) is subject to and in compliance with §4-41, Rule 3 (visible emissions), Rule 12 (odor), and Rule 25.3 (BACT VOC emissions) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

The two hexamethylenediamine receiving tanks (Emission Unit 006) are subject to and in compliance with §4-41, Rule 3 (visible emissions), Rule 10 (particulate emissions), and Rule 12 (odor) of the Ordinance.

Continuous Polymerization Line II (Emission Unit 007) is subject to and in compliance with §4-8(e)(2) (BACT particulate and visible emissions) and §4-41, Rule 10 (particulate emissions), Rule 12 (odor), Rule 23 (reasonable and proper gaseous emissions), and Rule 25.3 (BACT VOC emissions) of the Ordinance.

The pelletizer classifier of Continuous Polymerization Line II (Emission Unit 007) is subject to and in compliance with §4-41, Rule 27.3 (reasonable and proper particulate and visible emissions) of the Ordinance.

Batch Polymer Evaporators #1-5 and Batch Polymer Autoclaves #5-16 (Emission Unit 008) are subject to and in compliance with §4-41, Rule 10 (particulate emissions), Rule 12 (odor), and Rule 26.17 (RACT particulate and visible emissions from synthetic yarn plants) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

Batch Polymer Autoclaves #1-4, #17, and #18 (Emission Unit 008) are subject to and in compliance with §4-41, Rule 10 (particulate emissions), Rule 12 (odor), Rule 23 (reasonable and proper gaseous emissions), Rule 25.3 (BACT VOC emissions), and Rule 27.1 (BACT particulate and visible emissions) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

The five casting machines of Batch Polymer Autoclaves #1-18 (Emission Unit 008) are subject to and in compliance with §4-41, Rule 12 (odor) and Rule 25.3 (BACT VOC emissions) of the Ordinance.

The batch polymer flake handling system (Emission Unit 009) is subject to and in compliance with §4-41, Rule 27.1 (BACT particulate and visible emissions) of the Ordinance.

Type 32 Spinning Machines 201, 203, 231, 241, and 251 (Emission Unit 010) are subject to and in compliance with §4-41, Rule 12 (odor) and Rule 26.17 (RACT particulate and visible emissions from synthetic yarn plants) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

Type 32 Spinning Machines 202, 211, and 221 (Emission Unit 010) are subject to and in compliance with §4-41, Rule 12 (odor), Rule 25.3 (BACT VOC emissions), and Rule 27.1 (BACT particulate and visible emissions) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

The polyester flake handling and conditioning system of Type 32 Spinning Machines 202, 211, and 221 (Emission Unit 010) is subject to and in compliance with §4-41, Rule 10 (particulate emissions), Rule 12 (odor), Rule 25.3 (BACT VOC emissions), and Rule 27.3 (reasonable and proper particulate and visible emissions) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

Type 71 Spinning Machine 110 (Emission Unit 011) is subject to and in compliance with §4-41, Rule 12 (odor) and Rule 27.3 (reasonable and proper particulate and visible emissions) of the Ordinance.

Texturing Machines 104 and 105 (Emission Unit 012) are subject to and in compliance with §4-8(e)(2) (BACT particulate and visible emissions) and §4-41, Rule 12 (odor) of the Ordinance.