CHATTANOOGA-HAMILTON COUNTY AIR POLLUTION CONTROL BUREAU

Statement of Basis
Part 70 Permit No. 47-065-6132

Kordsa, Inc.
4501 North Access Road
Chattanooga, Tennessee 37415-3899
Designated Representative: Collus Williams
Telephone: (423) 643-2731

J. Alan Frazier
Engineer
February 18, 2010

Emission Unit No.	Description
001	Continuous Polymerization Line IV
002	Continuous Polymerization Line V
003	Type 33 Spinning Machine 301
004	Type 33 Spinning Machines 321 and 331

Purpose

Kordsa, Inc. 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 Kordsa on August 11, 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 Kordsa dated January 21, 2009.

Process Description

Kordsa manufactures nylon 66 (polyhexamethyleneadipamide, $[HN(CH_2)_6NH(C=O)(CH_2)_4C=O]_n$) yarn for use in tires, conveyor belts, and other industrial applications. The nylon 66 polymer is made by a continuous process in Continuous Polymerization (CP) Lines IV and V **(Emission Units 001 and 002)**. Each of the two CP lines consists of an evaporator, a reactor, a pair of separators, and a pair of finishers. Except for periods of start-up and shutdown, only one of each pair of separators and only one of each pair of finishers are used at any time.

Hexamethylenediamine [1,6-hexanediamine, $H_2N(CH_2)_6NH_2$] and adipic acid [hexanedioic acid, $HOOC(CH_2)_4COOH$] raw materials are introduced into either of two reactors where they form an aqueous solution of nylon 66 salt [hexamethylene diammonium adipate, $H_3N(CH_2)_6NH_3OOC(CH_2)_4COO$]. These two atmospheric continuous reactors supply all of the nylon 66 salt that is used by both Kordsa and INVISTA. No emissions in the form of working

losses are considered to result from either of these reactors because the nylon salt in each of 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.

In each of the two CP lines, 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 separators followed by one of the finishers. Particulate emissions that result from each CP line are in the form of hexamethylenediamine carbonate, nylon salt, and short-chain nylon 66 polymer. Hexamethylenediamine carbonate is readily formed in the ambient air by a reaction between hexamethylenediamine and atmospheric carbon dioxide (CO_2). No appreciable amount of adipic acid is normally emitted because it is used as the limiting reactant.

For each of the two CP lines, particulate emissions from the evaporator and from the reactor are initially controlled by separate scrubbers. The exhaust from the scrubber for the evaporator is used to heat the raw materials feed in a preheater, and the exhaust from the scrubber for the reactor is usually used to heat the evaporator. The preheater and evaporator both function as shell-and-tube condensers with the exhaust streams flowing through the shell side, and additional particulate emission control occurs in them because of condensation. The exhaust streams from the reactors of both CP lines, when they are being used to heat their respective evaporators, are ultimately vented to a single flash tank. Particulate emissions from each separator are controlled by a primary scrubber (contact condenser). In addition, a single auxiliary scrubber (contact condenser) is used to control the particulate emissions from any of the separators of either CP line for short periods of time while the primary scrubber for that separator is off-line for cleaning. Water is used as the scrubbing medium in all nine of the scrubbers that are associated with CP Lines IV and V. Trace particulate emissions from the finishers are uncontrolled. Each of the four finishers is equipped with two exhaust stacks, only one of which is used a time.

Molten nylon 66 polymer is fed directly from the finishers of the two CP lines into spinning machines in which the liquid nylon is extruded through small holes in spinnerettes. 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.

Molten nylon for Type 33 Spinning Machine 301 **(Emission Unit 003)** is supplied by CP Line IV. This spinning machine is equipped with both a monomer exhaust and a hot chest exhaust. Particulate emissions of hexamethylenediamine carbonate from the monomer exhaust and particulate emissions of lubricating oil from the hot chest exhaust are uncontrolled. This spinning machine is actually partitioned into Spinning Machines 301 and 302, but these two modules cannot be operated independently and they are collectively referred to as Spinning Machine 301.

Molten nylon for Type 33 Spinning Machines 321 and 331 **(Emission Unit 004)** is supplied by CP Line V. These two spinning machines are each equipped with both a monomer

exhaust and a hot chest exhaust. Particulate emissions of hexamethylenediamine carbonate from each of the monomer exhausts are uncontrolled. The two monomer exhausts are vented together and share two stacks. Particulate emissions of lubricating oil from each of the two hot chest exhausts are controlled by a scrubber followed by a demister. Both of the scrubbers use water as the scrubbing medium. Spinning Machine 321 is actually partitioned into Spinning Machines 321 and 322, but these two modules cannot be operated independently and they are collectively referred to as Spinning Machine 321. In addition, Spinning Machine 331 is actually partitioned into Spinning Machines 331, 332, and 333. These three modules cannot be operated independently and they are collectively referred to as Spinning Machine 331.

Evaluation

It has been previously determined that particulate emissions from the INVISTA plant site, which includes Kordsa, 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)]. In addition, applicable sources of particulate emissions at this plant that were in existence on January 1, 1978, are subject to Rule 26 (RACT).

Emission Unit 001 Continuous Polymerization Line IV

Continuous Polymerization (CP) Line IV is normally operated continuously (8,760 hrs/yr). Annual production from this CP line during calendar year 2005 was 75.060% of what would result from continuous operation at the maximum production rate at that time of 6,600 lbs/hr. The scrubber for the evaporator has an estimated particulate control efficiency of 88%, and the particulate control efficiency of the scrubber for the reactor is estimated to be 90%. It is estimated that the preheater and evaporator each contribute an additional particulate control efficiency, due to condensation, of about 50%. The primary scrubbers are not vented to the atmosphere and are assumed to condense all of the particulate emissions from the separators. The auxiliary scrubber is estimated to be 86% efficient in controlling particulate emissions.

The estimated particulate emissions from the various emission sources of CP Line IV are given in the table at the end of this section. The actual emissions are based on continuous operation at 75.060% of the current maximum production rate of 3,600 lbs/hr, and the potential emissions are based on continuous operation at the current maximum production rate. The actual emissions are based on additional control by condensation only in the preheater, and the potential emissions are based on no additional control from either the preheater or evaporator. The actual emissions from the separators are based on particulate emission control being provided by the auxiliary scrubber for 5 min/day, and the potential emissions from the separators are based on using the auxiliary scrubber for 42 min/hr, 120 min/day, and 365 days/yr. All of the particulate emissions from this CP line are considered to be both $PM_{2.5}$ and PM_{10}.

The particulate emissions from CP Line IV are limited by Rule 26.17(1)d to 1.5 lbs/hr. This limitation is more stringent than the Rule 10.2 (Schedule 1) particulate emission limit of

10.4 lbs/hr, based on the current process weight of 8,024 lbs/hr for CP Line IV. The Rule 26 limitation is also more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf, which is equivalent to 1.83 lbs/hr for the evaporator as vented from the preheater, 2.87 lbs/hr for the reactor as vented from the flash tank, 1.62 lbs/hr for either of the two separators as vented from the auxiliary scrubber, and 1.43 lbs/hr for either of the two finishers.

In order to demonstrate compliance with the Rule 26 limitation for CP Line IV, appropriate limitations, as requested by Kordsa, has been previously determined to be that the auxiliary scrubber may be used instead of the primary scrubbers to control the particulate emissions from the two separators of CP Line IV for no more than 9.5 min/hr if neither the preheater nor the evaporator is being used for further particulate emission control, 16 min/hr if only the preheater is being used for further control, 25 min/hr if only the evaporator is being used for further control, and 32 min/hr if both the preheater and evaporator are being used for further control. These limitations are based upon potential emissions at the former maximum production rate of 6,600 lbs/hr. An additional appropriate limitation, as requested by Kordsa, has been previously determined to be that the auxiliary scrubber may be used instead of the primary scrubbers to control the particulate emissions from the two separators for no more than 120 min/day.

Because of the decrease in potential emissions corresponding to the decrease in the maximum production rate to 3,600 lbs/hr, the hourly limitations on the use of the auxiliary scrubber should be increased accordingly when the Part 70 permit is renewed. Such appropriate new limitations are proposed to be that the auxiliary scrubber may be used instead of the primary scrubbers to control the particulate emissions from the two separators of CP Line IV for no more than 42 min/hr if neither the preheater nor the evaporator is being used for further particulate emission control, 55 min/hr if only the preheater is being used for further control, and 58 min/hr if only the evaporator is being used for further control. (No hourly limitation on the use of the auxiliary scrubber will be necessary for the situation in which both the preheater and evaporator are used for further control.) The potential emissions that are given in the emissions table are based upon both the proposed limitation of 42 min/hr for no additional control and the 120 min/day limitation.

Emission Unit 002 Continuous Polymerization Line V

Continuous Polymerization (CP) Line V is normally operated continuously (8,760 hrs/yr). Annual production from this CP line during calendar year 2005 was 63.399% of what would result from continuous operation at the maximum production rate of 9,600 lbs/hr. The scrubber for the evaporator and the scrubber for the reactor each have an estimated particulate control efficiency of 98%, and it is estimated that the preheater and evaporator each contribute an additional particulate control efficiency, due to condensation, of about 50%. The primary scrubbers are not vented to the atmosphere and are assumed to condense all of the particulate emissions from the separators. The auxiliary scrubber is estimated to be 86% efficient in controlling particulate emissions.

The estimated particulate emissions from the various emission sources of CP Line V are given in the table at the end of this section. The potential emissions are based on continuous operation at the maximum production rate. The actual emissions are based on additional control by condensation in both the preheater and evaporator, and the potential emissions are based on no additional control from either the preheater or evaporator. The actual emissions from the separators are based on particulate emission control being provided by the auxiliary scrubber for 5 min/day, and the potential emissions from the separators are based on using the auxiliary scrubber for 38 min/hr, 76 min/day, and 365 days/yr. All of the particulate emissions from this CP line are considered to be both $PM_{2.5}$ and PM_{10}.

CP Line V was modified in 1995 by an increase in throughput, and the two scrubbers for the evaporator and reactor were modified at that time in order to increase their particulate control efficiencies. These modifications resulted in a net emissions decrease. Control of the particulate emissions from the evaporator by a scrubber followed by condensation in the preheater has been determined to be BACT [§4-8(e)(2)]. Control of the particulate emissions from the reactor and from each of the separators by a scrubber has also 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 finishers.

An appropriate BACT limitation for the particulate emissions from the evaporator, reactor, and two finishers combined has been previously determined to be 0.40 lb/hr. Appropriate BACT limitations for the particulate emissions from the two separators combined have been previously determined to be 1.10 lbs/hr and 2.20 lbs/day. The sum of the two hourly BACT limitations is equivalent to the Rule 26.17(1)d particulate emission limit of 1.5 lbs/hr for CP Line V, and it is more stringent than the Rule 10.3 (Schedule 2) particulate emission limit of 15.6 lbs/hr, based on a process weight of 21,400 lbs/hr for CP Line V. The BACT limitation for the evaporator, reactor, and two finishers combined is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf, which is equivalent to 2.64 lbs/hr for the evaporator as vented from the preheater, 2.42 lbs/hr for the reactor as vented from the flash tank, and 2.07 lbs/hr for either of the two finishers. The BACT hourly limitation for the two separators combined is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (2.35 lbs/hr) for either of the two separators as vented from the auxiliary scrubber.

In order to demonstrate compliance with the BACT particulate emission limitations for the two separators combined, appropriate BACT limitations have been previously determined to be that the auxiliary scrubber may be used instead of the primary scrubbers to control the particulate emissions from the two separators of CP Line V for no more than 38 min/hr and for no more than 76 min/day. The potential emissions that are given in the emissions table are based upon these limitations.

Emission Unit 003 Type 33 Spinning Machine 301

Type 33 Spinning Machine 301 is normally operated continuously (8,760 hrs/yr). Annual production during calendar year 2005 from CP Line IV, which supplies molten nylon to this

spinning machine, was 75.060% of what would result from continuous operation at the maximum production rate at that time of 6,600 lbs/hr. The potential particulate emissions are estimated to be 0.43 lb/hr from the monomer exhaust and 0.53 lb/hr from the hot chest exhaust.

The estimated total particulate emissions from the spinning machine are given in the table at the end of this section. The actual emissions are based on continuous operation at 75.060% of the maximum production rate of 3,600 lbs/hr for the spinning machine, and the potential emissions are based on continuous operation at the maximum production rate. All of the particulate emissions from this spinning machine are considered to be both $PM_{2.5}$ and PM_{10}.

The particulate emissions from Type 33 Spinning Machine 301 are limited by Rule 26.17(1)a to 1.0 lb/hr. This limitation is more stringent than the Rule 10.2 (Schedule 1) particulate emission limit of 6.08 lbs/hr, based on a process weight of 3,600 lbs/hr; the Rule 10.7 particulate emission limit of 0.25 gr/scf (34.29 lbs/hr) for the monomer exhaust; and the Rule 10.7 particulate emission limit of 0.25 gr/scf (18.21 lbs/hr) for the hot chest exhaust.

Emission Unit 004 Type 33 Spinning Machines 321 and 331

Type 33 Spinning Machines 321 and 331 are normally operated continuously (8,760 hrs/yr). Annual production during calendar year 2005 from CP Line V, which supplies molten nylon to these spinning machines, was 63.399% of what would result from continuous operation at the maximum production rate of 9,600 lbs/hr. Each of the scrubbers has an estimated particulate control efficiency of at least 80%. No additional particulate control efficiency has been estimated for either of the demisters. The potential particulate emissions are estimated to be 0.57 lb/hr from each monomer exhaust and 0.18 lb/hr from each of the hot chest exhausts.

The estimated total particulate emissions from each of the two spinning machines are given in the table at the end of this section. The actual emissions are based on continuous operation at 63.399% of the maximum production rate of 4,800 lbs/hr (½ × 9,600 lbs/hr) for each spinning machine, and the potential emissions are based on continuous operation at the maximum production rate. All of the particulate emissions from these two spinning machines are considered to be both $PM_{2.5}$ and PM_{10}.

Type 33 Spinning Machines 321 and 331 were modified by an increase in throughput in 1995. Control of the particulate emissions from the hot chest exhaust of each of these two spinning machines by a scrubber has been determined to be BACT [§4-8(e)(2)]. It has been determined that no controls are necessary in order to satisfy BACT for the particulate emissions from the monomer exhausts of these two spinning machines.

An appropriate BACT limitation for the particulate emissions from each of Spinning Machines 321 and 331 has been previously determined to be 1.0 lb/hr, which is identical to the Rule 26.17(1)a particulate emission limit for each spinning machine. Each of these BACT limitations is more stringent than the Rule 10.7 particulate emission limit of 0.25 gr/scf (17.04 lbs/hr) for each of the two hot chest exhausts. The sum of these two BACT limitations is more

stringent than both the Rule 10.3 (Schedule 2) particulate emission limit of 9.49 lbs/hr, based on a process weight of 9,600 lbs/hr for both spinning machines combined, and the Rule 10.7 particulate emission limit of 0.25 gr/scf (64.90 lbs/hr) for the two monomer exhausts combined.

Facility-Wide Particulate Matter ($PM_{2.5}$ & PM_{10}) Emissions

Emission Source	Actual Emissions *tons/yr*	Potential Emissions *lbs/hr*	Potential Emissions *tons/yr*	Allowable Emissions *lbs/hr*
CP Line IV Evaporator (015)	*0.675*	*0.410*	*1.798*	*1.5*
CP Line IV Reactor (015)	*1.548*	*0.471*	*2.063*	
Two CP Line IV Separators (015)	*0.010*	*0.617**	*0.322*	
Two CP Line IV Finishers (015)	*0.0033*	*0.0010*	*0.0044*	
CP Line IV Subtotal Particulate (015)	2.236	1.500	4.187	1.5
CP Line V Evaporator (016)	*0.267*	*0.192*	*0.841*	*0.40*
CP Line V Reactor (016)	*0.444*	*0.160*	*0.701*	
Four CP Line V Finishers (016)	*0.0028*	*0.0010*	*0.0044*	
Two CP Line V Separators (016)	*0.016*	*1.078*	*0.394*	*1.10*
CP Line V Subtotal Particulate (016)	0.730	1.431	1.940	1.50
Spinning Machine 301 (017)	3.156	0.960	4.205	1.0
Spinning Machine 321 (018)	2.083	0.750	3.285	1.0
Spinning Machine 331 (018)	2.083	0.750	3.285	1.0
Total Particulate	**10.288**	**5.391**	**16.901**	**6.0**

*Potential emissions from either of these separators are 0.882 lb/hr if based on operation for 60 min/hr while emissions from both the evaporator and reactor of CP Line IV are being further controlled by condensation. This scenario results in total potential emissions from CP Line IV of 1.324 lbs/hr.

Conclusions

Continuous Polymerization Line IV (Emission Unit 001) and Type 33 Spinning Machine 301 (Emission Unit 003) 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) of the Chattanooga Air Pollution Control Ordinance (the Ordinance).

Continuous Polymerization Line V (Emission Unit 002) is subject to and in compliance with §4-8(e)(2) (BACT particulate and visible emissions) and §4-41, Rule 12 (odor), Rule 23

(reasonable and proper gaseous emissions), and Rule 25.3 (BACT VOC emissions) of the Ordinance.

Type 33 Spinning Machines 321 and 331 (Emission Unit 004) 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.

§4-68(d) (Compliance Assurance monitoring [40 CFR Part 64 (§64.1-10)]) of the Ordinance is not applicable to any of the emission sources at this plant.