west virginia department of environmental protection

Division of Air Quality
601 57th Street SE
Charleston, WV 25304
Phone 304/926-0475 • FAX: 304/926-0479

Earl Ray Tomblin, Governor
Randy Huffman, Cabinet Secretary
www.dep.wv.gov

ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-2157D
Plant ID No.:	055-00089
Applicant:	Minova USA Inc.
Facility Name:	Bluefield
Location:	Bluefield
SIC Code:	3087
Application Type:	Modification
Received Date:	April 12, 2010
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	$1000.00
Date Received:	April 12, 2010
Completeness Date:	September 13, 2011
Due Date:	December 12, 2011
Newspaper:	*Bluefield Daily Telegraph*
Applicant Ad Date:	April 6, 2010
UTMs:	Easting: 491.2 km Northing: 4,127.2 km Zone: 17
Description:	Modification application to incorporate the compliance plan from CO-R13-E-2009-16 and any other requirements to ensure the facility's status as a synthetic minor source of hazardous air pollutants (HAPs).

DESCRIPTION OF PROCESS

Minova USA's Bluefield, WV facility produces a two part mastic/paste used in the underground mining and tunneling industries for roof support and anchoring. This anchoring composite is packed in a single use cartridge with a film separating the two components, paste, and mastic, until the cartridge is used. When consumed, a roof bolt or anchor is drilled through the cartridge and breaks the film, which mixes the two components to form the plastic composite.

The Bluefield facility consists of three main areas, which are raw material storage, mastic/paste processing, and packing. The raw material storage area consists of five storage tanks, and two silos. Two of these tanks can each hold up to 6,500 gallons of polyester resin (7S & 8S). The other three tanks can hold up to 2,000 gallons of diethylene glycol.

SITE INSPECTION

On July 28, 2010, Mr. Dan Bauerle and the writer conducted a follow-up inspection of the facility. Mr. Leo Hickman, Safety, Health & Environmental Manager, and Mr. Paul Dials, Plant Manager was on hand to represent Minova USA during this inspection. The main purpose of this visit is to determine a course of action to develop styrene emission limits for the facility to be incorporated into their permit.

The facility is located within an industrial park in Mercer County, WV. The facility was operating during this inspection. No compliance issues were discovered during this visit. As a result of this visit, Minova agreed to conduct indoor styrene monitoring using personal monitoring systems to determine an indoor background concentration level.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

The pollutant of concern for this permitting action is styrene, which is classified as a volatile organic compound (VOC) and hazardous air pollutant (HAP). Styrene is a key ingredient in the mastic and is needed to create the adhesion when used in the desired application. Thus, styrene emissions from the mixing cannot be estimated by assuming all of the styrene is evaporated. Second, Minova believes a mass balance approach may not yield accurate results due to packing of the final product. The ends of the packed cartridge is not completely uniform for every cartridge. Therefore, typical mass balance calculation methods used to estimate VOC – HAP emissions is not feasible.

When Minova submitted this application, the styrene emissions were estimated based on the following:

- Air Emission Monitoring in 1998 of the Facility
- Emission Testing of emission point EP-1E in May 1999
- Emission Testing of emission point EP-1E in September 1999

Using this Minova created an emission factor of 0.765 lbs of Styrene per ton of mastic produced. The data used to create this emission factor was based on 12 cubic feet mixers. Minova had installed one 120 cubic feet mixer and proposed to install and operate a second one.

These mixers have a volume capacity 10 larger times than the ones the emission factor was based on. Additionally, Minova proposes to install knife gate valves to reduce potential styrene emissions during the mixing process. It is understood that this proposed control measure has not been proven and available data to determine reduction efficiency for a process similar to Minova's is not available.

Because these knife gate valves are considered as a control device, Minova has already installed these knife gate valves on the existing mixers, which were allowed to be installed without a permit under Rule 13. These knife gate valves are used to regulate the amount of exhaust air pulled across the top of the mastic in the mixer. These valves define the vapor space above the mixing mastic that would limit styrene losses.

From March 29-30, 2011, Minova had FBT Environmental Services, LLC perform sampling of Mixer #1 (12 ft^3) and Mixer #4 (120 ft^3) with the valves open (maximum venting) and cycling (control venting). The samples were collected in Summa canisters and analyzed for styrene in accordance with U.S. EPA Method TO-15. During the collection of the samples, exhaust flow data was collected, using Method 2, simultaneously for each run. Results of the tests are presented in the following table:

Table #1 – Results of The Method TO-15 Sampling				
Location	**Mixer #1 Vent**		**Mixer #4 Vent**	
Valve Operation	Cycling	Open	Cycling	Open
Styrene Con. ppm	899	914	386	1600
Duration of Sampling (min)	251	174	196	188
lb styrene/ton mastic	0.276	0.489	0.137	1.870

These results indicate that regulating the venting of the mixer has a significant effect on the amount of styrene generated. However, this data suggests that the past assumption was wrong, which was that the larger mixer had the same styrene-generating rate as the small mixer.

The previous permit (R13-2157C) allowed for 8 tons of styrene per year from the main process vent with a corresponding mastic production rate of 20,963 TPY. Minova agreed in the consent order to limit the amount of styrene from the main process vent to 7.54 TPY that should correspond to a mastic production rate of 19,734 TPY. This sampling data suggests that the main process vent has a maximum potential of 5.8 TPY of styrene with the knife gate valves installed on all five mixers.

There are numerous sources of fugitive styrene emissions within the main building that could be emitted to the atmosphere from three of the building exhaust fans (two on the roof, one wall fan). The total hydrocarbons (assuming all of the THC is styrene) passing across these were measured in March 1999. Acting on a suggestion to rule out or to quantify the amount of styrene emitted from the holding hopper during the off shift, Minova conducted static air sampling in the cartridge area and pump room over a 24-hour period in August 2010 using 3M Diffusional Monitors. Using the flow data from the March 1999 report, the writer estimated the fugitive styrene emissions as shown in the following table:

Table #2 – Fugitive Styrene Emission (Hourly Basis)				
Shift	**Location**	**Measured Conc. Per Shift (8 hours) ppm**	**Styrene Rate lb/hr**	**Corrected for Fifth Mixer lb/hr**
1st	Cartridge Area	3.67	0.26	0.31
2nd	Cartridge Area	2.62	0.19	0.23
Off Shift	Cartridge Area	0.487	0.04	0.04
1st	Pump Room	17.5	0.26	0.31
2nd	Pump Room	11.1	0.17	0.2
Off Shift	Pump Room	2.36	0.04	0.04

Taking the hourly data and adjusting it for an 80-hour a week production schedule, the annual emissions from the facility would be 1.1 TPY of styrene. Permit R13-2157C had estimated fugitives to be 1.82 TPY. Assuming the first shift was at full production and the fifth mixer would increase hourly production by 20%, fugitive styrene would be 1.4 TPY on an 80 hour a week production schedule. At a maximum production schedule, the maximum potential styrene emissions from fugitive sources located in the process building would be 2.76 tons of styrene per year. Using this annual rate, the corresponding background concentration was calculated to be 4.4 ppm for the cartridge area and 21 ppm for the pump room.

One other source of fugitive styrene emissions is breathing and working losses from the two 6,500 gallon polyester resin storage tanks. Styrene emissions from these two tanks, under Permit R13-2157C, were estimated to be 0.068 TPY (136 pounds per year). The applicant has estimated the breathing losses to be 15 pounds per year and the working losses to be 132 pounds, which yielded total losses of 147 pounds per year from each tank with an annual styrene resin throughput of 497,135 gallons. The application used the equations listed in EPA's "Estimating Releases and Waste Treatment Efficiencies for the TRI Form" handbook to estimate these losses, which is the same equation published in AP-42 Chapter 7.1.

The main goal of this permitting action is to create an enforceable permit that limits the facility's potential to emit of styrene to less than 9.5 tons per year. Before continuing, presented in the following table is a comparison of the facility's maximum potential emissions to predicted actuals.

Table #3 - Comparison of Maximum and Actual Emissions				
Source	**Maximum PTE (TPY) w/o controls**	**Predicted Actuals w/o controls (TPY)**	**Predicted Actuals w/controls (TPY)**	**Limits by Consent Order (TPY)**
Main Process Vent	33.4	10.1	2.14	7.54
Building Fugitives	2.75	1.4	1.4	1.82
Tanks	0.07	0.07	0.07	0.7
Production Rate	167,140	19,734	19,734	19,734
Total	36.22	11.57	3.61	9.43

The predicted actual emissions were based on each mixer handling one fifth of the annual production rate. The new maximum and predicted actual emissions with and without controls were based on recent sampling analysis, which is limited (sampling only of two mixers). Given the significant reduction from the use of the knife gate valves, the fugitives from the mixers could possibly increase, which needs to be confirmed in the future.

Minova has inquired about additional manufacturing flexibility based on the results of sampling with the knife valves. Because of the difference in control efficiencies between the mixers, Minova and the writer agreed to consider setting a facility wide limit of styrene to 8 tons per year and establishing batch limits. As noted earlier in this section, fugitive discharges of styrene could be at least 2.76 tons per year. Resin throughput to support an annual mastic production rate of 75,341 TPY would need to be about 1.9 million gallons per year. This throughput rate would generate 0.49 TPY of styrene from the two resin storage tanks. This would leave 4.74 tons of styrene to be discharged from the process (mixing). The following table illustrates how the batch limit was created and the ratio between the two different size mixers.

Table #4 – Batch Limits						
Mixer Size	**Max Batch Size ton/batch**	**Mixing Time Batches/Hour**	**Styrene Emission Factor**		**No. of batches that would generator 4.74 TPY of Styrene**	**Mastic Productio n TPY**
			lb/ton	**lb/batch**		
Large	4.76	0.25	0.137	0.652	14,540	69,210
Small	0.77	2.5	0.276	0.213	44,507	34,270
Ratio of the small mixer to larger mixer			2.01	0.33	3–12 ft^3 Batches = 1-120 ft^3 Batch	

One batch from the lager mixer is equal to three batches from the small mixer in terms of styrene emission. From a production point of view, the large mixer could double the production rate of the small mixer. Clearly, limiting total mastic does not benefit the environment and restricts manufacturing rates unnecessarily. Thus, an annual batch limit of 44,520 equivalent batches and a ratio of 3:1 to account for the large batches would limit Minova’ s styrene potential at or below 8 tons of styrene per year. This approach incorporates a 2 ton per year cushion to account for the uncertainty in the methods used to estimate emissions to ensure the minor source of HAPs status of this facility.

Using this batch tracking approach, the maximum number of batches produced in an hour would be nine equivalent batches (7.5 smaller batches and 0.5 larger batches), which would generate a maximum hourly styrene emission rate of 1.92 pounds per hour.

REGULATORY APPLICABILITY

The manufacturing operation at this facility only has specific emission standards from 45CSR7 (State Rule 7). Because Minova has elected to install the knife valves and take operational limits that restricts Minova’ s potential to emit of styrene (HAP) below 10 tons per year, the facility is not subject to 40 CFR 63, Subpart HHHHH – Miscellaneous Coating Manufacturing MACT. Therefore, the facility is only subject to the permitting requirement of 45CSR13, operating fees of 45CSR22 and particulate matter limitations of 45CSR7.

The emission points subject to applicable emission limitations of Rule 7 are the main process vent (1E) and the bin vent of the limestone storage silo (4E). The mixers are considered a process source operation and therefore subject to the process weight limitations of 45CSR§7-4.1. This provision of the rule restricts particulate matter being discharged in excess of 1.23 pounds per hour from the fifth mixer. This fifth mixer will be vented to the same dust collector as the other mixers. With this type of collection device, the potential to emit from 1E is 0.03 pounds per hour. This potential is significantly less that the allowable for the fifth mixer.

Both of these emission points are subject to visible emission limitations of Rule 7. The main process vent (1E) is limited to 20% opacity as stated in §7-3.1. Because the silo (storage structure) that is fully enclosed with a control device, the bin vent from the silo is not allow to exhibit any visible emission. Under normal operating conditions, the emission sources with the proposed controls should be capable of meeting these visible emission standards.

The draft permit will limit the facility’s styrene emissions below 8 TPY. Minova has installed the knife valves on the mastic mixers which are required with the batch limits to achieve this styrene limit. The Bluefield facility is classified as a synthetic minor source for HAPs. The Rule 13 requires Minova to perform Notice Level C as outlined in 45CSR§13-8.5. §13-8.5 requires Minova to post a sign near the entrance to the facility and publish a commercial ad in conjunction with the agency’s legal ad.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

Styrene

Effects of styrene on human health and the environment depend on how much styrene is present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

Styrene vapor irritates the eyes, the nose, and the throat. Styrene vapor can also adversely affect the human nervous system, causing adverse eye effects. These effects are not likely to occur at levels of styrene that are normally found in the environment.

Human health effects associated with breathing small amounts of styrene over long periods in the workplace include alterations in vision, hearing loss and increased reaction times. Other human health effects associated with exposure to small amounts of styrene over long periods of time are not known. EPA is currently reviewing the potential for styrene to cause cancer in humans. Laboratory studies show that repeated oral exposure to large amounts of styrene cause cancer and adversely affects the blood and the liver of animals. Laboratory studies also show that repeated exposure to large amounts of styrene in air can damage the respiratory system of animals.

Styrene has moderate toxicity to aquatic life. Styrene by itself is not likely to cause environmental harm at levels normally found in the environment. Styrene can contribute to smog formation when it reacts with other volatile substances in air.

AIR QUALITY IMPACTS ANALYSIS

The writer deemed air dispersion modeling analysis was not necessary, because the proposed modification does not change the status of the Bluefield facility as a minor source as defined in 45CSR14. Minova will remain a minor source for all criteria pollutants.

MONITORING OF OPERATIONS

As discussed in the Estimate of Emissions Section of this evaluation, monitoring the number of batches by mixer size is key in ensuring compliance with the proposed limits. Other steps needed to ensure compliance are conducting visible emission checks for emission points 1E and 4E.

The styrene emission estimates are based on results of the sampling conducted using EPA Method TO-15 (mixing emissions) and the static indoor sampling (fugitive emissions from the building) using 3M Diffusional Monitors. The results of these analytic measurements must be verified on a routine basis to ensure compliance with the styrene limit in the permit. A reasonable frequency would be once every five years after the initial testing, which will be within 12 months after issuance of this permit.

In addition, the source will be required to conduct visible emission checks to prove that emission points 1E (main process vent) and 4E (silo) comply with the visible emission limitations of Rule 7. These observations (checks) should be conducted in accordance with EPA's methods. The appropriate standard language is incorporated into the draft permit.

CHANGES TO PREMIT R13-2157C

Permit R13-2157C was developed using an out dated permit format. The proposed version, Permit R13-2157D, was updated to reflect the current format. Since R13-2157C was issued, the Director has determined that natural gas fired furnaces used to condition indoor air are not necessary to be incorporated into the Rule 13 permit. Thus, the emission limit table for the heater listed in Condition A.4. will be omitted (See Policy on Rule 13 Guidance for Natural Gas Combustion Sources). In addition, annual batch limits will replace the existing mastic production limits.

Because this permit allows Minova to increase mastic production, the annual paste total needs to be increased. Based on the ingredients used to make the paste, pollutants of concerns should be PM and VOCs. The paste mixer is vented to the same dust collector as the mastic mixers and there is no proposed change. Thus, the hourly PM and VOC emission rate should not be effected. Other than styrene, the rest of the volatile organic compounds make up an insignificant portion of the VOC emission rate from the main process vent. The existing annual paste production limit and annual PM rate for 1E should be omitted from the permit. However, the hourly VOC limit is left in the permit because there are potential VOCs from the paste mixer, which is vented through the same process vent as the mastic mixers.

In accordance with the Director's policy on low emitting sources, diethylene glycol (DEG) storage vessels 11S, 12S, and 13S should not have specific emission limits listed in a permit. These vessels are 2,000 gallon tanks located indoors. Permit R13-2157C listed a permit VOC emission rate of 0.0009 TPY for each vessel. Clearly, these vessels fall within the low emitting sources policy and the respective VOC limits and the requirement to maintain records of throughput of diethylene glycol (Condition B.4) will be omitted from the draft permit.

The two styrene resin storage tanks (7S & 8S) have styrene and VOC limits in the existing permit. The main source of emissions from these two vessels are working loses, which were estimated to be nearly 0.5 TPY of styrene with a combined throughput of nearly 1.9 million gallons. The applicant will still be required to track and record the annual amount of resin received at the facility.

Permit R13-2157C has several insertions of Rule 7 without any direct reference to specific emission source or point. These actual rule citations will be omitted and replaced with specific conditions aimed at a specific source or emission point. The exception to this is §7-5.2., which requires Minova to maintain the grounds of the facility to include company owned/leased access roads and the parking lot in such a way to minimizes dust from the facility. Thus, §7-5.2. will be incorporated as Condition 3.1.7. of the draft permit.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application file indicates that Minova USA, Inc. proposed modification of a polyester resin cartridge manufacturing facility meets all the requirements of the applicable rules when operated according to the permit application. Therefore, this writer recommends granting Minova USA, Inc. a Rule 13 modification permit for their Bluefield facility

Edward S. Andrews, P.E.
Engineer

Date: October 18, 2011