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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-2890
Plant ID No.:	087-00001
Applicant:	Armacell, LLC
Facility Name:	Spencer
Location:	Spencer
NAISC Code:	326299
Application Type:	Modification
Received Date:	July 11, 2011
Engineer Assigned:	Edward Andrews
Fee Amount:	$1000.00
Date Received:	July 11, 2011
Completeness Date:	October 26, 2011
Due Date:	January 23, 2012
Newspaper:	*Roane County Reporter*
Applicant Ad Date:	July 21 and 28, 2011
UTMs:	Easting: 469.9 km Northing: 4,295.5 km Zone: 17
Description:	Armacell concluded that the Spencer Plant should have obtained a permit as some point as the result of either equipment or process changes at the facility.

ADDITIONAL INFORMATION

The purpose of this additional information is to explain the overall history of the Spencer Plant and the control measures used throughout the years to comply with the emission standards of 45CSR7 (Rule7).

The Monarch Rubber Company was founded in Baltimore in 1928. In 1948, Monarch Rubber Company established the Spencer Plant located at the intersection of Main Street and

Locust Ave. While operated by Monarch Rubber Company, the Spencer Plant manufactured a wide variety of rubber products such as hockey pucks, sheet rubber, shoe soles and gaskets.

In the early part of 1970 and before Rule 7 was promulgated, the agency was receiving and investigating dust complaints from the Monarch Rubber Plant. One of these complaints noted the rubber dust problem from the plant has plagued the City of Spencer for years.

On October 8, 1970, the Monarch Rubber Company filed a Rule 7 General Registration for the Spencer Facility. This registration noted that the facility had the following:

- 200 hp Continental Boiler
- 80 hp Sellers Boiler (stand-by only)
- Banbury Rubber Mixer (Farrell) #11
- Banbury Rubber Mixer (Farrell) #3A
- Three Buffer Machines

Other process equipment at the facility that was noted in the process description but was not considered as emission sources were the sizing mills, calenders, and platen presses. The two boilers were natural gas fired and relatively small for industrial boilers. The main concern of emissions from the Spencer Plant at this time was from the mixers/sizing mill and buffering machines. Monarch Rubber used a settling chamber fill with water to control particulate matter from these mixers/sizing mills and buffer machines.

In January of 1976, the agency requested that Monarch Rubber update its Rule 7 Registration for the Spencer Plant. In this registration, the company reported that the process had gas fired ovens to cure the rubber. To comply with Rule 7, a cyclone was added before the settling chamber used to control particulate matter generated by the buffing machine. In addition, the registration noted that Monarch Rubber had requested quotes from venders to control particulate emissions from the ovens.

It was noted in two separate "Memorandums for Record" dated May 27, 1976, and June 29, 1976, that Monarch Rubber was evaluating the effectiveness of an electrostatic precipitator to control particulate matter emissions from the curing ovens. United Air Specialists of Cincinnati, Ohio manufactured this particular electrostatic precipitator. Based on the "Memorandum For Records" and other correspondence, the particulate emissions from the ovens were in violation of the visible emission standard of Rule 7. In another memorandum from a compliance inspection, Mr. Ronald Bell, Engineer for the agency, was informed by the Plant Manager the visible emissions from the curing oven were dependent on the type of rubber being cured.

On January 3, 1977, Monarch Rubber informed the agency that the trial precipitator from United Air was not working effectively enough to control opacity (visible emissions) from the curing ovens. As noted during a February 10, 1977, meeting with Monarch Rubber, the Spencer Plant has two banks of natural gas fired curing ovens. One bank has two gas-fired ovens that vent the oven exhaust to a "smog hog". The "smog hog" cleans the exhaust before discharging it to the atmosphere. The second bank consists of six gas-fired ovens that vent directly to the

atmosphere. As a result, Monarch Rubber was working on trying another precipitator from another manufacturer. There was additional correspondence between Monarch Rubber and the agency concerning a fixed compliance schedule for the curing ovens.

The facility utilizes an electric curing furnace for light colored rubber, and vents directly to the atmosphere. The discharge stack of the electric furnace has not been noted as out of compliance. It was later noted in a memorandum and Notice of Violation that all the curing ovens including the electric oven, were exhibiting visible emissions greater than allowed under Rule 7.

On July 10, 1977, Monarch Rubber notified the agency that a precipitator manufactured by Elton Mfg. of New Jersey was being installed. This precipitator was put on line on February 21, 1978. The precipitator had four ionizing and collection cells in which one of these cells was nonoperational. The three remaining cells were operating at 60% efficiency.

An inspection of the facility was conducted on March 15, 1978. During this inspection, visible emission observations were taken of the curing oven stack. The average of these observations was noted to be approximately 55% opacity. The plant foreman turned the precipitator off and the inspector note no difference in the visible emissions from the curing oven stack. As result of the finding from this inspection, a Notice of Violation was issued to the company.

In a response to the Notice of Violation on March 15, 1978, Monarch Rubber noted that the visible emissions before the precipitator were about 50% opacity and the installed precipitator reduced the visible emissions down to about 25 – 30 % opacity, which is still above the allowable under Rule 7.

At the Spencer Plant on March 23, 1978, the agency met with the company and a representative from Electron Mfg. to discuss the violation observed on March 15, 1978. The manufacturer representative was only able to adjust the precipitator to achieve 35% opacity from the curing ovens, which is still not in compliance with the Rule 7 allowable. It was mentioned that a tandem unit (precipitator) could be installed which might bring the curing oven into compliance with Rule7.

Sometime after this March 23, 1978 meeting, Monarch Rubber installed a second ionizing and collection section to the precipitator. This was noted in an inspection memorandum that was for an inspection conducted on September 6, 1978. In addition, the inspector noted that the visible emissions from the curing oven were less than 10 percent opacity, which complies with the 20 percent opacity limitation under Rule 7.

After the second ionizing and collection section was added, visible emission observations noted in the file ranged from less than 20% to zero. One inspection memo noted that visible emissions from the curing ovens were zero with the precipitator on and 5 percent opacity when the precipitator was off , which is still within compliance of Rule 7.

From 1984 to 1985, several of the inspection memos noted the ductwork to the precipitator was clogged and being serviced which required the precipitator to not beoperating and the curing ovens were exhausted to the by-pass vent. Even though the curing ovens were bypassing the precipitator, the observations that were taken ranged from zero to 20 percent opacity. In addition, a memo noted that Monarch Rubber was planning to overhaul the precipitator in July of 1984.

An inspection memo for a January 21, 1987 compliance inspection of the Spencer Plant noted that the ductwork for the curing ovens was replaced with a new stainless steel duct and precipitator. No visible emissions were observed from the curing ovens stack.

In 1988, Monarch Rubber contacted the agency in regards to replacing the existing dry – wet particulate matter collection system for the grinding and buffing operation with a dry system. The current system used to control particulate matter emissions from the grinding and buffing operations used a cyclone that vents to a settling chamber filled with water. Monarch Rubber's Baltimore Plant recently employed two – single cyclones in series to control rubber dust from four buffing machines. Monarch Rubber provided test data from the Baltimore Plant that the highest measured rate of particulate matter emissions from single buffer with two cyclones in series was 0.41 pounds per hour. Therefore, on August 15, 1988 the agency issued a no permit-required decision for the replacement of the dry/wet collection system with the two cyclones in series. Not mentioned in this section but noted in the agency's files, the Spencer Plant had issues maintaining compliance with the visible emission standard of Rule 7 from the buffing and grinding of the rubber sheets.

In a memorandum as a result of inspection conducted on August 16, 1989, the inspector noted that the Spencer Plant was manufacturing rubber to be used for gasket material opposed to manufacturing rubber for shoe sole material. In addition, the inspector noted that it appears that the facility is utilizing the same process equipment. Further, it was noted for the record that the precipitator was not operational because of mechanical failure of the induce draft fan which occurred approximately a month earlier. No citation was issued because no visible emissions were observed from the ovens by-pass stack.

In a memo of an inspection conducted on March 20, 1992, Monarch Rubber was in the process of replacing a multi-bay, gas-fired oven with single a bay steam heated oven. During this inspection, one of two banks of the ovens had been replace with two new single bay ovens. In 1993, another inspection memo noted that Monarch Rubber had installed four steam heated curing ovens on line and a fifth one was being installed. The other bank of gas-fired ovens was out of service and scheduled to be removed. In addition, the existing electric oven was converted to be heated by steam now. A second 200 hp (8.37 MMBtu/hr) gas-fired boiler was installed to accommodate the additional steam demand for the ovens. Thus, the Spencer Plant had five steam heated curing ovens and a sixth one was being installed. Ductwork issues as the result of corrosion was noted. However, no visible emissions were observed to warrant a citation.

During an April 28, 1995 inspection of the Spencer Plant, visible emission observations were taken of the precipitator stack. The actual readings of these observations ranged from 20 to

40 percent opacity. A Notice of Violation was issued on May 31, 1995. Monarch Rubber responded to this notice that the precipitator was located in a different location due the changes being performed at the facility.

In January of 1995, Monarch Rubber replaced the existing Banbury mixer with a Shaw K6A Intermix mixer. The Shaw K6A mixes more intensively than the Banbury that allowed the facility to increase its mixing rate by 33%. Certain design features of the Shaw K6A minimized fugitive dust emissions due to the mixing operations (i.e. hydraulically controlled dust seals, closable chute door, and drop door with self –adjusting springs).

From December 1996 to February 2005, the facility has been inspected on seven different occasions and found to be operating within compliance. In 2011, Mr. James Robertson, P.E., an engineer for the Compliance and Enforcement Section, inquired about the recent changes and asked if such changes required a permit. As result of this inquiry, Armacell provided the following list of installation dates for the curing ovens.

Table #1 – Oven Installation Dates

Oven	1	2	3	4	5	6	7	8	9	10
Year	1994	2010	1990	1990	1991	1999	2001	1991	1994	2003

Instead of evaluating the potential change in emissions (increase in emissions) due to the changes, Armacell concluded that the whole facility should have been permitted and therefore submitted this application.

DESCRIPTION OF PROCESS

Armacell, LLC's Spencer facility produces blocks or sheets of closed cell foam rubber.

Purchased raw materials are weighed into batches and then introduced into a rubber mixer to be mixed. Raw materials loaded into the rubber mixer are captured by the Dust Collector DC-1S and emitted through emission point EP-1E. The mixed rubber then unloads onto the first of two rubber mills. It is then transferred to the second rubber mill via a conveyor. The rubber is then fed into an extruder and roller dies to make it into a continuous sheet. This continuous sheet travels over a series of cooling drums to the cutting table where it is cut into specified lengths and stacked on pallets. The emissions from the rubber mills and extrusion process are emitted through Emission Point BHE-1S (building vent).

The sheets of rubber are placed in molds in steam presses and cured at specified temperatures and pressures for a specific length of time. Emissions from the presses are emitted through BHE-1S. The cured sheets are then expanded in expansion ovens at specified temperatures and pressures for a certain period. Emissions from the curing and expansion process in the ovens are emitted though BOE-1S. Emissions from outside the ovens are emitted through BHE-1S and BHE-2SE.

Expanded buns are prepared for shipment or sent to secondary operations. In the secondary operations, several different operations can take place. The most common is splitting the buns into different thicknesses and preparing them for shipment. Other operations include processing the buns through a rubber sander to provide a consistent thickness or sanded to provide a specified surface texture. Once the buns are at a proper consistent thickness, they can then be split, again into various thicknesses for shipment. Particulate matter emissions are controlled from the sander by one of two cyclones and emitted through emission points C-1SE or C-2SE.

SITE INSPECTION

Members of the Compliance and Enforcement Section have routinely inspected this facility. Mr. Richard Fenton of the Compliance and Enforcement Section last inspected the facility under review on February 22, 2005. As a result of this inspection, Mr. Fenton determined that the facility was being operated in compliance with all applicable rules and regulations.

The writer visited the facility on October 25, 2011. Mr. Mark Lamarre, Senior Staff Engineer for Armacell' s Mebane Plant, accompanied the writer during this visit. Mr. Lamarre pointed out several areas of the facility that were poorly designed and/or installed which included process equipment and associated support systems. One of these was the steam condensate system. The facility routes the exhausted steam to a large flash tank, which allows the rapid expansion of the steam that condenses back into a liquid phase. To prevent the vessel from being over pressurized, the vessel vent to the atmosphere and a portion of steam is continuously released in the form of a steam plume.

Another notable area focuses on the expansion ovens (curing ovens). Each oven has an induced draft fan to circulate the air inside the oven to maintain a negative pressure within the oven. The main collection duct is over sized which creates backpressure on the oven and overworks the individual induced draft fans. The writer observed an oven being pressurized to the point that vapors were escaping from seams and joins of the oven. One of the main problems with the exhaust system is the main trunk is oversized and is the same size at all connection points.

In addition, Mr. Lamarre pointed out issues with the installed control devices for the curing oven. The exhausts from the ovens were routed to a precipitator. The fields had been removed from this precipitator. Mr. Lamarre believes that the fields were either never installed or removed long before Armacell acquired the Spencer Plant. In addition, the hood system for the oven doors is routed to a cartridge style dust collector. Like the precipitator, the cartridges were missing from the collector. The cartridge style dust collector is the wrong type of control device for this application. The writer believes the precipitator was a condensing precipitator and was subjected to continuous fouling of the fields. Even without these internal components for the control devices, the writer did not detect a notable visible emission problem with the facility in operation. Nevertheless, the writer reported these findings to the Assistant Directors

of Compliance and Enforcement and Permitting Sections and other key managers shortly after this visit.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

The applicant used pollutant emissions factors from Chapters 1.3 and 1.4 of AP-42 to estimate emissions from their two natural gas fired boilers.

Table #2 – Emissions from Boilers

Pollutant	Both Boilers firing with Natural Gas		
	Emission Factor	Hourly Rate (lb/hr)	Annual Rate (TPY)
$PM/PM_{10}/PM_{2.5}$ Filterable	1.9 lb/MMcf	0.03	0.13
PM Condensable Fraction	5.7 lb/MMcf	0.09	0.39
SO_2	0.6 lb/MMcf	0.01	0.04
NO_x	100 lb/MMcf	1.64	7.18
CO	84 lb/MMcf	1.38	6.04
VOCs	5.5 lb/MMcf	0.09	0.39

The manufacturing of rubber products at the Spencer Facility involves five principal processing steps (mixing, milling, extrusion, curing, grinding). Armacell calculated the proposed emission estimates using emission factors from the proposed (draft version) Chapter 4.12 of AP-42. Armacell characterized the recipes used at the Spencer Facility as either ethylene-propylene-dienemethylene (EPDM) or emulsion styrene-butadiene rubber (SBR), which are referred to as Compound # 9 and #22 respectively in Chapter 4.12.

The mechanically created or externally added heat present during the principal process causes volatile organic compounds (VOC) and hazardous air pollutants to be generated. In addition, particulate matter is primarily emitted from the dry chemical (dry ingredients) utilized in mixing and mechanical sizing activities (grinding/buffering of rubber buns or sheets).

Armacell estimated emissions by individual operation to a common stack or emission point. Annual emissions were based on an maximum annual production rate of 25,200,000 pounds of rubber produced per year. Hourly rate were based on dividing the maximum number of hours in a year into the annual emission rate respectively. The following table is a summary of the emission estimates presented in the application.

Table #3 Summary of Emissions from Rubber Manufacturing						
Pollutant	**PM**		**VOC**		**HAP**	
Source	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Mixing	0.14	0.59	0.08	0.35	0.001	0.004
Milling	N/A		0.001	0.006	0	0
Extruding	N/A		0.03	0.15	0.01	0.03
Platen Presses[1]	N/A		5.04	22.09	0.06	0.27
Curing Ovens[2]	N/A		8.46	37.04	0.01	0.06
Rubber Buffer	0.014	0.06	N/A		N/A	
Total	0.154	0.65	14.12	59.37	0.43	0.36

1 – All Platen Presses are fugitive sources.
2 – Includes the exhaust and fugitive door emissions from all of the curing ovens.

REGULATORY APPLICABILITY

WV STATE RULES

45CSR2 To Prevent and Control Particulate Air Pollution From Combustion of Fuel In Indirect Heat Exchangers

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45CSR10 To Prevent and Control Air Pollution From Emissions of Sulfur Oxides

These two rules establish emission limitations for smoke and particulate matter (Rule 2), and sulfur dioxide (Rule 10), which are discharged from fuel burning units. The existing units at the facility are two 8.37 MMBtu/hr (200 Bhp) Johnston Boiler Co. boilers fired only with natural gas. The agency recognizes that natural gas is a clean burning fuel and assumes "Type b" fuel burning units to be capable of complying with PM and visible emission limitations of Rule 2 and the sulfur dioxide limit of Rule 10. In addition, 45CSR§2-11.1 and 45CSR§10-10.1 exempts the two boilers from most of the applicable requirements of these two rules except for the visible emission standard of 45CSR§2-3.1. The agency recognizes burning of natural gas in boilers should not generate visible emissions and deemed it unnecessary to develop a monitoring plan to verify compliance with the visible emission standard.

45CSR7 To Prevent And Control Particulate Matter Air Pollution From Manufacturing Process And Associated Operations.

The Spencer facility has been classified as a manufacturing process since the conception of Rule 7. Each source operation is subject to the process weight standard of 45CSR§7-4. and

visible emission limitation of 45CSR§7-3. The following table was developed to better illustrate the limitations associated with each process operation.

Table #4 - Rule 7 Process Weight Sources					
Source Operation	**Emission Point**	**Process Weight (lb/hr)**	**Rule 7 Allowable PM (lb/hr)**	**Proposed PM Rate (lb/hr)**	**Visible Emission Standard (opacity)**
Mixing	EP-1EP	2876	3.3	0.135	20%
Curing Oven	BOE-1S & BHE-2SE	2876	3.3	0	20%
Rubber Buffer	C-1SE & C-2SE	2876	3.3	0.014	20%

The hourly process weight rate for each operation was based on the facility's maximum annual rubber production rate of 25 million pounds per year and dividing by 8,760 hours per year. The mixing and rubber buffering (grinding) operation are equipped with particulate matter control devices. From this table, the facility should not have an issue achieving compliance with the process weight limitation of §7-4. In the past, the curing ovens have exhibited visible emissions and were required to be control under this rule.

However, the type of control technology applied was to control emissions (mainly visible emissions) from the curing oven, which targeted the wrong pollutant. The applied control technology was aimed at controlling particulate matter. The real pollutant of concern from the curing ovens is VOCs. Which explain whys the employed precipitator always had performance issues concerning the 20% opacity standard of this rule. The preferred control technology for controlling the VOC emissions from the oven would be oxidation (i.e. oxidizer).

The writer suspects the facility has achieved compliance with the visible emission standard over time through oil selection (raw materials) and switching from gas fired to steam heated curing ovens. Thus, the agency's current suggested visual observation checks will be incorporated into the draft as a means to continuously verify compliance.

45CSR13 - Permits for Construction, Modification, Relocation and Operation of Stationary sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The potential to emit from the rubber manufacturing process exceeds the 6 pounds per hour and 10 tons per year for particulate matter and VOCs, which is the trigger level of a source as defined in 45CSR§13-2.24. Thus, the facility is required to obtain a permit as required in 45CSR-13.5.1.

The facility has met the applicable requirements of this rule by publishing a Class I Legal Advertisement in *The Roane County Reporter* on July 28, 2011, paid the $1000.00 application fee, and submitted a complete permit application.

The facility is classified as a minor source (i.e. has PTE of < 100 TPY of PM and VOCs; <25 TPY of HAPs) concerning applicability under Title V (45CSR30) and is not subject to a federal regulation. Thus, Armacell is not required to obtain a Title V Operating Permit and is required to pay annual "Certificate to Operate" (CTO) fees as stated in 45CSR22 as a "9M" source, which it has been doing in the past.

40 CFR 63 National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers

This regulation establishes emission limitations for area sources (minor sources of HAPs) that operate boilers. Natural gas fired boilers are not an affected source under this regulation. Thus, the two natural gas boilers at the facility are not subject to this regulation.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

Armacell claimed that the Spencer Plant potential to emit of hazardous air pollutants (HAPs) is less than half a ton per year. In determine the facility's HAP potential, Armacell based the HAPs listed the facility's chemical inventory (chemical compounds in the raw materials). This low HAP potential is due to the types of rubber manufactured at the Spencer Facility.

During the application review process, the writer reviewed the list of Maximum Achievable Control Technology (MACT) regulation to ensure that there was no applicable regulation concerning this facility. As result, there was one possible regulation, Subpart OOOOOO for flexible polyurethane foam manufacturing. The regulation applies to foam manufacturing processes that use methylene chloride (i.e. blowing agent, etc.). The Spencer Plant does not manufacture polyurethane foam. The facility uses azodicarbonamide (CAS # 123-77-3) as a blowing agent, which is not a HAP. The facility is not subject to this MACT.

Due to the low HAP potential and that the facility is using a non-HAP based blowing agent, no further information is warranted for this permitting action.

AIR QUALITY IMPACTS ANALYSIS

The writer deemed that an air dispersion modeling study or analysis was not necessary, because the proposed facility does not meet the definition of a major source as defined in 45CSR14.

MONITORING OF OPERATIONS

Monitoring of the facility is going to rely on visible emission checks (monthly/quarterly) and tracking daily rubber production rates.

Based on the estimated emissions in the application, the pollutant with any significant discharge rate would be VOCs. The main sources of VOCs emissions would be from the platen presses and curing ovens. A special enclosure would have to be constructed to be able to measure the VOCs from the platen presses.

The exhaust side of the curing ovens accounts for over 56% of the total VOC emissions from the facility. Because the emission factors used to determine this potential has not been published and there is no other data available, the writer recommends that Armacell conduct a performance test to demonstrate compliance with the VOC limit.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that compliance with all applicable regulations should be achieved. At this time, the writer did not find any evidence that the exhaust from the curing ovens needs to be controlled to an applicable requirement. Therefore, the writer recommends that the Director grant a modification permit to Armacell, LLC for their rubber manufacturing process at the Spencer Plant.

Edward S. Andrews, P.E.
Engineer

Date: March 19, 2012