CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: April 5, 2016

TO: Rick Wulk

FROM: Jonathan Wright /s/ JJW

SUBJECT: Verso Corporation – Wisconsin Rapids Mill Research and Testing Exemption 16-JJW-053-EXM

Verso Corporation – Wisconsin Rapids Mill submitted a research and testing exemption request under the authority of s. NR 406.04(1)(i), Wis. Adm. Code to temporarily apply a calcium bromide solution to the solid fuel used in Power Boilers No. 1 and No. 2 to enhance mercury removal by their individual existing electrostatic precipitator (ESP) control devices used for particulate matter control. Due to the absence of halogenated compounds in their current solid fuels of low sulfur coal and wood, mercury vapors released during the combustion of coal are not oxidized. The use of a halogenated additive, such as calcium bromide, is expected to enhance mercury vapor oxidation and the removal of mercury by the ESP. During the proposed research and testing exemption period, the facility is proposing to apply the additive to the solid fuel at a maximum rate of 31.4 pounds of additive per 40,000 pounds of coal. Verso Corporation – Wisconsin Rapids Mill is a major source as defined under chs. NR 405 and NR 407, Wis. Adm. Code.

To qualify for a research & testing exemption, s. NR 406.04(2)(i)2., Wis. Adm. Code specifies that the anticipated emissions from the research & testing may not "present a significant hazard to public health, safety, or welfare or to the environment".

Power Boiler No. 1 (Boiler B21, Stack S11)
This spreader stoker boiler was installed in March 1966. It has a heat input rating of 412.3 MMBtu per hour. It combusts coal and wood waste. For particulate matter emissions control, the boiler is equipped with a multiclone and an ESP. This boiler exhausts through a stack that is 213 feet above ground level. The average stack results for particulate matter (PM) provided below are based on stack tests performed on October 3, 2007, September 28, 2011, and September 30, 2015.

Power Boiler No. 1 Specifications
Capacity: 412.3 MMBtu per hour
Estimated maximum coal usage: 24.08 tons per hour
PM emission limit (772010140-P01): 0.30 lbs/MMBtu
40 CFR 63 subpart DDDDD filterable emission limit: 0.0370 lbs/MMBtu
Assumed PM control efficiency: 99.5%
Average PM stack results: 0.0223 lbs/MMBtu filterable, 0.0288 lbs/MMBtu condensable = 0.0511 lbs/MMBtu total

Power Boiler No. 2 (Boiler B20, Stack S10)
This spreader stoker boiler was installed in March 1966. It has a heat input rating of 412.3 MMBtu per hour. It combusts coal and wood waste. For particulate matter emissions control, the boiler is equipped with a multiclone and an ESP. This boiler exhausts through a stack that is 213 feet above ground level. The average stack results for PM provided below are based on stack tests performed on October 10, 2007, September 28, 2011, and September 29, 2015.

Power Boiler No. Specifications
Capacity: 412.3 MMBtu per hour
Estimated maximum coal usage: 24.08 tons per hour
PM emission limit (772010140-P01): 0.30 lbs/MMBtu
40 CFR 63 subpart DDDDD filterable emission limit: 0.0370 lbs/MMBtu
Assumed PM control efficiency: 99.5%
Average PM stack results: 0.0258 lbs/MMBtu filterable, 0.0369 lbs/MMBtu condensable = 0.0627 lbs/MMBtu total

Additive Usage and Emissions
Maximum additive usage as proposed: 31.4 pounds per 40,000 pounds of coal
Maximum additional PM assuming additive is 100% solids: 24.08 tons/hr x (31.4 lbs/40,000 lbs) = 0.0189 tons/hr

Particulate Matter Emissions
PM Emissions increase per boiler
0.0189 tons/hr x 2,000 lbs/ton x (1-0.995) = 0.189 lbs/hr
0.189 lbs/hr x 1 ton/2,000 lbs x 8,760 hrs/yr = 0.83 tons/yr
Maximum additional PM emissions per heat input: 0.189 lbs/hr x hr/412.3 MMBtu = 0.000458 lbs/MMBtu

Power Boiler No. 1
PM / PM_{10} potential emissions = 0.0511 lbs/MMBtu + 0.000458 lbs/MMBtu = 0.0516 lbs/MMBtu < 0.30 lbs/MMBtu
Filterable PM potential emissions = 0.0223 lbs/MMBtu + 0.000458 lbs/MMBtu = 0.0228 lbs/MMBtu < 0.0370 lbs/MMBtu

Power Boiler No. 2
PM / PM_{10} potential emissions = 0.0627 lbs/MMBtu + 0.000458 lbs/MMBtu = 0.0632 lbs/MMBtu < 0.30 lbs/MMBtu
Filterable PM potential emissions = 0.0258 lbs/MMBtu + 0.000458 lbs/MMBtu = 0.0263 lbs/MMBtu < 0.0370 lbs/MMBtu

Based upon the calculations above, the boilers are expected to continue meeting their existing permit PM emission limitations and the filter PM emission limitations under 40 CFR 63 subpart DDDDD during the research and testing exemption period.

Refined air quality modeling of PM_{10} from the full facility was last performed in 2007 in support of construction permit 07-POY-286. The results of that modeling indicated that the facility was in compliance with increment and the applicable National Ambient Air Quality Standards as shown in the following table. Conservatively assuming that all PM = PM_{10}, the total particulate matter emissions increase from the research and testing exemption is 0.378 pounds per hour and 1.65 tons per year. The refined air quality modeling of PM_{10} for construction permit 07-POY-286 assumed a facility-wide PM_{10} emission rate of approximately 427 pounds per hour, of which approximately 247 pounds per hour was emitted by Boilers B20 and B21. The use of the calcium bromide additive would potentially increase the PM_{10} emissions from Boilers B20 and B21 by approximately 0.15%. This increase is unlikely to cause or exacerbate a violation of increment or an air quality standard as the applicable PM_{10} modeling demonstrates the facility impact is still significantly below the applicable standards to accommodate a small increase in PM_{10} emissions.

TABLE M3
Increment Analysis Results
(All Concentrations in $\mu g/m^3$)

	PM_{10} – 24 hr	PM_{10} – Annual
Modified Source Impact	26.2	6.62
Level of Sig. Impact	5.0	1.0
PSD Class II Increment	30.0	17.0
% Increment Consumed	87.3	38.9

TABLE M5
Modeling Analysis Results
(All Concentrations in $\mu g/m^3$)

	TSP – 24 hr*	PM_{10} – 24 hr	PM_{10} – Annual
All Source Impact	99.2	99.2	23.8
Background	41.8	27.4	9.2
Total Concentration	141.0	126.6	33.0
NAAQS	150.0	150.0	50.0

% NAAQS	94.0	84.4	66.0

NOTE: TSP is no longer a pollutant subject to increment or air quality standards.

Dispersion modeling of direct $PM_{2.5}$ emissions is ineffective as a means for showing whether a source will cause or exacerbate violation of the $PM_{2.5}$ air quality standard or increment. Direct, industrial stationary source emissions of $PM_{2.5}$ do not correlate with ambient concentrations of $PM_{2.5}$ in the atmosphere. The details of this evaluation are available in the attached Technical Support Document (TSD) titled "Air Quality Review of $PM_{2.5}$ Emissions from Stationary Sources in Wisconsin", dated February 2016. Based upon this document, the Department has determined that this research and testing exemption will not present a significant hazard to public health, safety, or welfare or to the environment due to any increase in $PM_{2.5}$ emissions that are related to this research and testing exemption.

In addition, the increase in emissions does not appear to exceed the significance thresholds under ch. NR 405, Wis. Adm. Code, for particulate matter, PM_{10} and $PM_{2.5}$ emissions if the facility were to perform an actual to projected actual analysis of this project. Conservatively assuming that all PM = PM_{10} = $PM_{2.5}$, the total particulate matter emissions increase from the research and testing exemption is 1.65 tons per year. This annual emission rate is significantly less than the significant emissions increase thresholds of 25 TPY of PM, 15 TPY of PM_{10} and 10 TPY of $PM_{2.5}$ listed under s. NR 405.02, Wis. Adm. Code, Table A.

Particulate Matter Fugitive Emissions

This project is expected to not generate fugitive emissions. The additive will be brought in totes or in tank trucks, and will be applied into the existing solid fuel handling and distribution system either directly onto the fuels or at the fire box of each individual boiler.

Other Pollutants

This project is not expected to increase the emissions of any other criteria pollutant, such as carbon monoxide, nitrogen oxides, and sulfur dioxide.

Ch. NR 445, Wis. Adm. Code, Hazardous Air Pollutants

The use of this additive is expected to generate the following compounds regulated under ch. NR 445, Wis. Adm. Code. This analysis conservatively assumes that none of these substances are regulated under 40 CFR 63 subpart DDDDD by the name of the contaminant, by virtue of regulation of another substance as a surrogate for the contaminant or by virtue of regulation of a species or category of hazardous air contaminants that includes the contaminant such that ch. NR 445, Wis. Adm. Code, would not apply per s. NR 445.01(1)(b), Wis. Adm. Code.

Calcium Oxide

The calcium bromide additive will contain calcium bromide up to 53% by weight based upon information provided by the facility. Using the additive may generate calcium oxide emissions based on the following equation:

$2CaBr_2 + O_2 \rightarrow 2CaO + 2Br_2$

Since calcium oxide generation is proportional to calcium bromide usage, potential calcium oxide emissions are estimated based on potential calcium bromide emissions proportioned to the molecular weight. Molecular weight of calcium bromide and calcium oxide are 199.89 and 56.08 lbs/lb-mole, respectively.

Potential calcium oxide emissions from each boiler:
0.189 lbs additive/hr x 53 lbs $CaBr_2$/100 lbs additive x 56.08 lbs CaO/lb-mole / 199.89 lbs $CaBr_2$/lb-mole x 2 lb-mole CaO / 2 lb-mole $CaBr_2$ = 0.028 lbs CaO/hr

Calcium Hydroxide

The calcium bromide additive will contain calcium bromide up to 53% by weight based upon information provided by the facility. Using the additive may generate calcium hydroxide emissions based on the following equation:

$CaBr_2 + 2H_2O \rightarrow 2HBr + Ca(OH)_2$

Since calcium hydroxide generation is proportional to calcium bromide usage, potential calcium hydroxide emissions are estimated based on potential calcium bromide emissions proportioned to the molecular weight. Molecular weight of calcium bromide and calcium hydroxide are 199.89 and 74.09 lbs/lb-mole, respectively.

Potential calcium hydroxide emissions from each boiler
0.189 lbs additive/hr x 53 lbs CaBr2/100 lbs additive x 74.09 lbs $Ca(OH)_2$/lb-mole / 199.89 lbs $CaBr_2$/lb-mole x 1 lb-mole $Ca(OH)_2$ / 1 lb-mole $CaBr_2$ = 0.037 lbs $Ca(OH)_2$/hr

Bromine
The calcium bromide additive will contain calcium bromide up to 53% by weight based upon information provided by the facility. Using the additive may generate bromine emissions based on the following equation:

$2CaBr_2 + O_2 \rightarrow 2CaO + 2Br_2$

Since bromine generation is proportional to calcium bromide usage, potential calcium hydroxide emissions are estimated based on potential calcium bromide emissions proportioned to the molecular weight. Molecular weight of calcium bromide and bromine are 199.89 and 159.81 lbs/lb-mole, respectively.

Potential bromine emissions from each boiler
0.189 lbs additive/hr x 53 lbs $CaBr_2$/100 lbs additive x 159.81 lbs Br_2/lb-mole / 199.89 lbs $CaBr_2$/lb-mole x 1 lb-mole Br_2 / 1 lb-mole $CaBr_2$ = 0.080 lbs Br_2/hr

Hydrogen Bromide
The calcium bromide additive will contain calcium bromide up to 53% by weight based upon information provided by the facility. Using the additive may generate bromine emissions based on the following equation:

$CaBr_2 + 2H_2O \rightarrow 2HBr + Ca(OH)_2$

Since hydrogen bromide generation is proportional to calcium bromide usage, potential calcium hydroxide emissions are estimated based on potential calcium bromide emissions proportioned to the molecular weight. Molecular weight of calcium bromide and hydrogen bromide are 199.89 and 80.91 lbs/lb-mole, respectively.

Potential hydrogen bromide emissions from each boiler
0.189 lbs additive/hr x 53 lbs $CaBr_2$/100 lbs additive x 80.91 lbs HBr/lb-mole / 199.89 lbs $CaBr_2$/lb-mole x 2 lb-mole HBr / 1 lb-mole $CaBr_2$ = 0.081 lbs Br_2/hr

Formic Acid
The calcium bromide additive will contain formic acid up to 0.10% by weight based upon information provided by the facility. The permittee assumes up to 95% of the formic acid will be combusted in the boiler according to the following equation:

$2HCOOH + O_2 \rightarrow 2H_2O + 2CO_2$

Potential formic acid emissions from each boiler
0.189 lbs additive/hr x 0.10 lbs HCOOH / 100 lbs additive (1-0.95) = 0.00000945 lbs HCOOH/hr

To determine compliance with ch. NR 445, Wis. Adm. Code, the emission increases for state hazardous air pollutants were added to the potential emissions for the same pollutant as listed in the preliminary determination for operation permit 772010140-P01 for this facility. According to the preliminary determination for operation permit 772010140-P01, calcium oxide and calcium hydroxide are also emitted by Process P30 – Rotary Drum Lime Kiln at a stack height greater than 75 feet. This preliminary determination does not list any other emission unit as capable of emitting any of the other compounds discussed in this section.

The total non-exempt potential emissions of HAPs subject to this research and testing exemption are summarized in the table below for the most significant state HAPs emitted from the facility. This table also lists the thresholds (annual and/or 1-hour/24-hour average) for each HAP for each stack height category.

Pollutant	Stack Height Class	$E_{Unobstructed}$		$4\times(E_{obstructed} + E_{Fugitive})$		E_{Total}		Ch. NR 445 Thresholds (lb/hr or lb/yr)	
		lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	1-hr/24-hr avg.	Annual
Bromine (7726-95-6) s	>75	0.080	--	--	--	0.080	--	1.06	--
Calcium Hydroxide (1305-62-0) s	>75	0.037+0.108	--	--	--	0.145	--	8.11	--
Calcium Oxide (1305-78-8) s	>75	0.028+0.055	--	--	--	0.083	--	3.24	--
Formic Acid (64-18-6) s	>75	9.45E-6	--	--	--	9.45E-6	--	15.3	--
Hydrogen Bromide (10035-10-6) s	>75	0.081	--	--	--	0.081	--	12.2	--

s = state HAP; f = federal HAP

The stacks that emit these state hazardous air pollutants are unobstructed and vertical. To demonstrate the source is in compliance for a HAP regulated by ch. NR 445, Wis. Adm. Code, the total non-exempt potential emissions of the HAP (or air toxic) for the entire facility must either be less than stack thresholds listed in Tables A, B or C in the chapter or meet applicable emissions limitations. To check to see if emissions are less than stack thresholds, first emissions for each stack height category is calculated. The calculated values are then compared to the corresponding values listed in Tables A, B or C of ch. NR 445, Wis. Adm. Code, for the pollutant and the particular stack height category. If the total for each stack height category is less than the amount listed in the table for each stack height category, then the source is in compliance with the ch. NR 445, Wis. Adm. Code, requirements. If the calculated emissions exceed the threshold for one or more of the stack categories then **all emissions** must be included in a determination to see if applicable emission limitations are being met. There are 4 stack height categories in the rule — stacks < 25 ft, 25 ft < stack < 40 ft, 40 ft < stack < 75 ft, and stacks > 75 ft.

Comparing the total non-exempt potential emission rates for each HAP to its corresponding ch. NR 445, Wis. Adm. Code, Table A, threshold values, it appears the facility will be in compliance with ch. NR 445, Wis. Adm. Code, for the pollutants listed above.

Federal Hazardous Air Pollutants

Methanol

The calcium bromide additive will contain methanol up to 0.09% by weight based upon information provided by the facility. The permittee assumes up to 95% of the methanol will be combusted in the boiler according to the following equation:

$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$

Potential methanol emissions from each boiler

0.189 lbs additive/hr x 0.09 lbs CH_3OH / 100 lbs additive (1-0.95) = 0.00000851 lbs CH_3OH/hr

Methanol emissions from the boilers are subject to emission limits of the National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heater. Under this NESHAP, this boiler is subject to a carbon monoxide emission limit. Carbon monoxide emissions are used as a surrogate for good combustion for organic pollutants. Thus, the methanol emissions from the facility are determined to be in compliance as long as the facility meets the requirements of this NESHAP.

Research and Testing Requirements

1. The facility is authorized to use and evaluate the calcium bromide additive system as defined in the submittal dated April 1, 2016, for a maximum of 12 consecutive months. The facility shall keep the following documentation during the research and testing period:

- The date that the calcium bromide additive system initially became operational. For the purposes of this R&TE, operational is defined as the first time the calcium bromide additive system is used to apply the calcium bromide additive to the solid fuel.
- The total amount of solid fuel combusted by each Boiler B20 and Boiler B21, in pounds per month.
- The total amount of calcium bromide additive applied to the solid fuel combusted by Boilers B20 and B21, in pounds per month.

- The ratio of calcium bromide additive applied to the solid fuel versus the total amount of solid fuel combusted by both Boilers B20 and Boiler B21, in pounds of bromide additive per pound of solid fuel combusted.

2. During the research and testing period, the facility shall perform stack tests for the following pollutants:
- Method 30B for mercury

3. Within 5 working days, the facility shall notify Ms. Michelle Farley of the Department by phone at (920) 662-5495 or via e-mail at michelle.farley@wisconsin.gov of the date that the calcium bromide additive system initially became operational.

The following tentative trial plan has been established to describe progress after a research and testing exemption final approval has been granted. The proposed research and testing period may not exceed 12 calendar months. The tentative proposed schedule is:

April 18, 2016:	Commence operation under the research and testing exemption.
April 18, 2017:	Complete operational testing under the research and testing exemption. Cease use of the calcium bromide additive pending regulatory approval, as applicable.

Conclusion

Based upon the available data, this project is not expected to constitute a significant hazard to public health, safety or welfare or to the environment. Verso Corporation – Wisconsin Rapids Mill may be required to submit a construction permit and an operation permit revision application if they wish to permanently use a calcium bromide additive system when the R&TE period expires.