Thompson, Matthew A - DNR

From: Iverson, Bruce <BIverson@trccompanies.com>
Sent: Friday, April 05, 2019 3:45 PM
To: DNR RR WCR; Thompson, Matthew A - DNR
Cc: Sheskey, Teresa
Subject: BRRTS # 0237000006_Wauleco_ Technical Memorandum - Work Plan Addendum No 1
Attachments: 2019-04-05_Wauleco_Addendum No. 1 - SI Work Plan Wood Waste Burning.pdf

Matt, on behalf of Wauleco, Inc. (Wauleco), attached for WDNR's review is Technical Memorandum – Work Plan Addendum No. 1 (Tech Memo 1). As discussed in Section 3.2 of the Site Investigation Work Plan, Wauleco Wood Waste Burning dated March 15, 2019 (SI Work Plan), this Tech Memo 1 proposes model input parameters to be used in the preparation of an air dispersion model, as discussed in Section 5.2 of the SI Work Plan.

A hard copy will also submitted to you. If you have any questions, please contact me. Thanks, Bruce

Bruce Iverson, P.E. (WI)
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Technical Memorandum – Work Plan Addendum No. 1

To:	Matt Thompson Wisconsin Department of Natural Resources
From:	Dave Fox, Ken Quinn, and Bruce Iverson TRC
Subject:	Technical Memorandum – Work Plan Addendum No. 1 to Site Investigation Work Plan, Wauleco Wood Waste Burning, BRRTS #02-37-000006
Date:	April 5, 2019
CC:	Evan Schreiner – Wauleco Dave Crass – Michael Best
Project No.:	189597.0008

On behalf of Wauleco, Inc. (Wauleco), TRC presents this Technical Memorandum – Work Plan Addendum No. 1 (Tech Memo 1). As discussed in Section 3.2 of the Site Investigation Work Plan, Wauleco Wood Waste Burning dated March 15, 2019 (SI Work Plan), this Tech Memo 1 proposes model input parameters to be used in the preparation of an air dispersion model (i.e., AERMOD, version 18081), as discussed in Section 5.2 of the SI Work Plan.

The sole purpose of this air dispersion modeling effort is to predict expected patterns of potential aerial distribution which, when combined with all other information to be developed as a part of the SI Work Plan implementation, will inform proposed sample locations for a data gap sampling plan, if needed. As such and as is typical in such projects that are hindcasting for several decades, the model input parameters suggested herein include in some cases reasonable assumptions in the absence of precise information. Since the sole purpose of the model is to predict dominant aerial distribution patterns, we have not made an effort to precisely define certain input parameters where the lack of precision or modest deviation is unlikely to have a material effect on the model results. The model input parameters and results cannot and should not be used for any other purpose.

Review of Historical Documents

TRC reviewed the historical documents produced in connection with Wauleco's March 15, 2019 submittal to develop an understanding of historical wood burning activities and the operation of two boilers at the site. The documents reviewed indicate that the boilers consisted of:

- Boiler 21, a 4.8 mmbtu/hr wood fired boiler
- Boiler 22, a 15.3 mmbtu/hr natural gas fired boiler

Both boilers discharged to the same stack (Stack 10).

Air Dispersion Model Input Parameters

Based on this review, TRC assessed appropriate input parameters to use in the air dispersion model. Where variations in the data were observed during the historical document review, TRC relied on information based on the following hierarchy: 1) Stack test and air permit application data; 2) More recent information vs older information; and 3) Engineering judgment based on TRC's collective experience in site investigations, air permitting and air dispersion modeling.

Proposed air model input parameters are summarized in Table 1 (Boiler 21 - wood fired boiler only), and Table 2 (Boiler 21 – wood fired boiler, and Boiler 22 –natural gas fired boiler assumed to operate concurrently).

Air Dispersion Modeling Approach

After a careful review of the historical documents referenced above, input parameters for the quantity of wood burned and the operating schedule of the boilers (i.e., Items 2 and 9, respectively, in Tables 1 and 2) are uncertain.

Patterns of aerial distribution will not be influenced by the quantity of wood burned but will be influenced by prevailing wind flows and stack parameters for the boiler stack. A 47-year wind rose record for the Wausau Airport is very similar to the wind rose record for meteorological data proposed for use in this analysis (43,824 hourly wind observations for the years 2011-2015). The Wausau airport is located in similar proximity to Rib Mountain as does the Wauleco site, so the prevailing wind flows (likely influenced by Rib Mountain) will be representative of historical site conditions. Because of the uncertainty regarding the amount of wood historically burned, and because the only purpose of the AERMOD analysis is to identify potential deposition patterns, rather than quantities, it is proposed that the AERMOD model be executed with a generic assumed 1 gram/sec unit emission rate, with the model directed to predict long term averages of air concentrations. These air concentrations will be contoured over the site and surrounding areas. It is reasonable to assume that air concentrations based on an assumed unit emission rate will be representative of distribution patterns from the former stack. The data gap soil sampling program, if necessary, will be based upon the patterns identified from the AERMOD analysis.

Regarding the wind rose data (Item 10 in Tables 1 and 2), meteorological data taken at the Wausau airport (for years 2011 to 2015) will be used to run the AERMOD model. The Wauleco

site is located approximately 1.3 miles from the airport. Both the site and the airport are northeast of Rib Mountain, a geographic feature that is likely influencing wind patterns in the area. The use of this data is appropriate, based on the following:

1. The WDNR has processed this data set for use in the AERMOD model using the latest version of the USEPA's AERMET data processor.
2. Potential impact patterns over time will follow prevailing wind direction. The wind rose pattern for the years 2011 to 2015 (the data used to run the model) are very similar to a much longer-term wind rose pattern for the years 1972 to 2019, see Appendix A. As such model ready meteorological data for the five-year period 2011 to 2015 should be representative of any long-term meteorological period at the same location.

Based on the approach discussed above and the input parameters summarized in Tables 1 and 2, four versions of the air dispersion model will be run consisting of the following scenarios:

1. **Boiler 21** - wood boiler only for 12 months/year, 16 hours/day (two shifts)
2. **Boiler 21** - wood boiler only for 7 cold months/year, 16 hours/day (two shifts)
3. **Boilers 21 and 22** - wood and gas boilers for 12 months/year, 16 hours/day (two shifts)
4. **Boilers 21 and 22** - wood and gas boilers for 7 cold months/year, 16 hours/day (two shifts)

This approach will identify areas where the highest expected occurrence of potential distribution of particulates would be. As such, soil sampling to close gaps, if needed, can be targeted in those areas of highest expected distribution.

Technical Review and Requested WDNR Responses

As discussed in Section 8 of the SI Work Plan, Wauleco submitted a technical review fee for review of the SI Work Plan, which also covers this Tech Memo 1. As part of the WDNR's technical review, Wauleco requests the WDNR's concurrence/responses on the following information:

- The proposed input parameters to use in the model, as summarized in Tables 1 and 2.
- The four versions of the air dispersion model that are proposed to be run.

After there is concurrence between the WDNR and Wauleco, the air dispersion modeling will be performed. As described in Section 7 of the SI Work Plan, the air dispersion model results will be provided to the WDNR within 30 days after concurrence.

If you have any questions, please contact Bruce Iverson (608) 826-3644.

Enclosures: Table 1 – Input Parameters For Wood Fired Boiler (Boiler 21)
Table 2 – Input Parameters For Wood Fired Boiler (Boiler 21,) and Natural Gas Fired Boiler (Boiler 22)
Appendix A: Wind Rose Data

Tables

Table 1
Wood Fired Boiler (Boiler 21)

ITEM NO.	MODEL INPUT PARAMETER	PROPOSED INPUT PARAMETER TO USE IN MODEL	BASIS/REFERENCE FOR INPUT PARAMETER	COMMENT
1	Size of Boiler	4.8 mmbtu/hr	1985 Permit Application WCO-WW000116[1]	
2	Typical Quantity of Wood Burned	Uncertain		Refer to Tech Memo 1, Section titled "Air Dispersion Modeling Approach" for discussion of approach
3	Particulate Matter (PM) Control Devices	None	None referenced in reports.	Cyclones referenced were for sawdust management, not stack emissions
4	Emission Factors	See Tech Memo 1. Unit emission rate will be used.		See Tech Memo 1.
5	Fuel Type	Kiln dried wood	December 17, 1991 letter page, WCO-WW000216	Kiln dried waste wood including non-spec pieces, trimmings.
6	Stack Parameters			
a	Height	86 feet	1985 Permit Application, page WCO-WW000118	
b	Diameter	4 feet	1985 Permit Application, page WCO-WW000118	
c	Exhaust Temperature	115º F	DNR 1976 Stack Test page WCO-WW00082 to 84	Average from stack test: (131+114+100)/3=115
d	Exhaust Airflow Volume	5,719 acfm (avg)	DNR 1976 Stack Test, page WCO-WW00077, 79, 81 to 84	Average from stack test: (6,037+5,871+5,250)/ 3 = 5,719 acfm

[1] Documents cited in this Table are from Wauleco's March 15, 2019 document production and are referenced by bates stamp numbers.

Table 1
Wood Fired Boiler (Boiler 21)

ITEM NO.	MODEL INPUT PARAMETER	PROPOSED INPUT PARAMETER TO USE IN MODEL	BASIS/REFERENCE FOR INPUT PARAMETER	COMMENT
7	Approximate Dimensions of Buildings Present During Period of Operations	Approximations: ▪ Height= 40' ▪ L x W= 500' x 650'	Figure, page WCO-WW000112	Figure shows heights of different edges of buildings. Heights range from 30-45 feet. Assume an average height of 40'. Horizontal dimensions approximated by size of existing site from historical aerial photos.
8	Approximate Location of Stack in UTM83 Coordinates	UTM83: ▪ 292016E ▪ 4980741N	Historical aerial photos.	
9	Operating Schedule	Two cases: ▪ 7 months/year at 16 hours/day ▪ 12 months/year at 16 hours/day	Actual schedule uncertain from information available; engineering judgment as to reasonable schedule.	Refer to Tech Memo 1, re four versions of model; scenarios 1, 2, 3, and 4
10	Wind Rose Data	Meteorological data taken at the Wausau Airport (for years 2011-2015) will be used to run the AERMOD model.	WDNR would require this data set for air quality analyses in Wausau. The site is located near the airport. The WDNR has also processed this data set for use in the AERMOD model.	Potential distribution patterns will follow prevailing wind direction. The wind rose pattern for the years 2011-2015 (the data used to run the model) are very similar to a much longer term wind rose pattern for the years 1972-2019.

Table 2
Wood Fired Boiler (Boiler 21), and Natural Gas Fired Boiler (Boiler 22)

Note: Parameters for the Wood Fired Boiler (Boiler 21) are the same as shown in Table 1.

ITEM NO.	MODEL INPUT PARAMETER	PROPOSED INPUT PARAMETER TO USE IN MODEL	BASIS/REFERENCE FOR INPUT PARAMETER	COMMENT
1	Size of Boiler	Boiler 22: 15.3 mmbtu/hr	1985 Permit Application, page WCO-WW000117	
2	Typical Quantity of Fuel Burned	Same as Table 1		
3	Particulate Matter (PM) Control Devices	None	None referenced in reports.	Cyclones referenced were for sawdust management, not stack emissions
4	Emission Factors	See Tech Memo 1, a unit emission rate will be used.		See Tech Memo 1.
5	Fuel Type	Natural Gas		
6	Stack Parameters			
a	Height	86 feet	Same as Table 1.	
b	Diameter	4 feet	Same as Table 1.	
c	Exhaust Temperature	Boiler 21 burning wood and Boiler 22 burning gas. Boiler B22 Gas Burning: 400º F. From Table 1 Boiler B21 exhaust temp is 115º F Weighted average for both boilers operating is 248º F	Typical gas boiler exhaust temperature.	Convert temps to absolute temp (degrees R) and do weighted average: ▪ 400º F = 860º R ▪ 115º F = 575º R ▪ ((860x5,000)+(575x5,719))/ (5,000+5,719) = 708º R = 248º F
d	Exhaust Airflow Volume	B21 burning wood, and B22 burning gas, use 10,719 acfm.	Engineering judgment for Boiler 22 burning gas, Total flow for Boiler B21 plus B22 burning gas	

Table 2
Wood Fired Boiler (Boiler 21), and Natural Gas Fired Boiler (Boiler 22)

Note: Parameters for the Wood Fired Boiler (Boiler 21) are the same as shown in Table 1.

ITEM NO.	MODEL INPUT PARAMETER	PROPOSED INPUT PARAMETER TO USE IN MODEL	BASIS/REFERENCE FOR INPUT PARAMETER	COMMENT
7	Approximate Dimensions of Buildings Present During Period of Operations	Same as in Table 1		
8	Approximate Location of Stack in UTM83 Coordinates	Same as in Table 1		
9	Operating Schedule	Same as in Table 1		
10	Wind Rose Data	See Table 1 discussion		

Appendix A

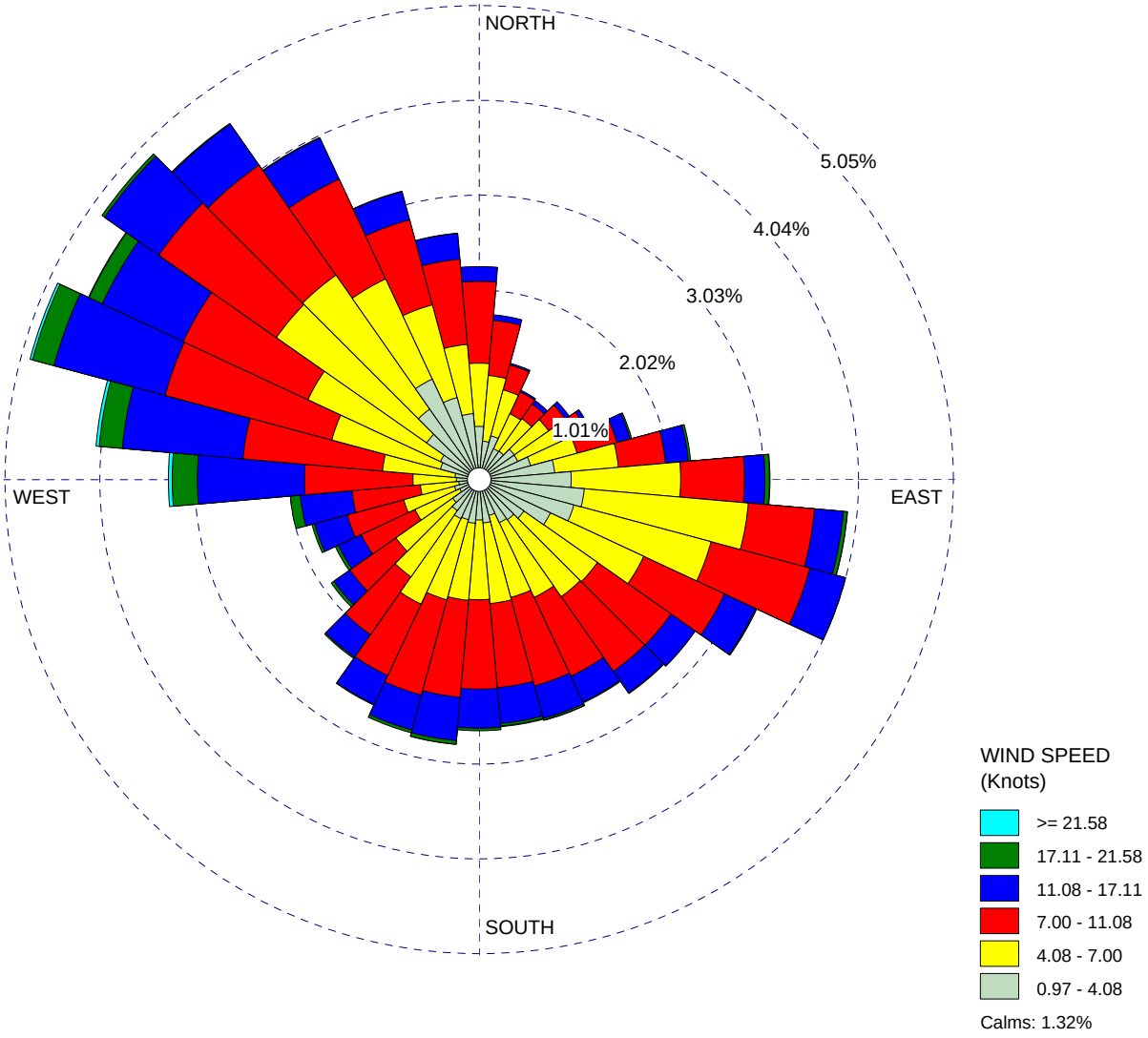
Wind Rose Data

WIND ROSE PLOT:

Wausau Airport 2011-2015

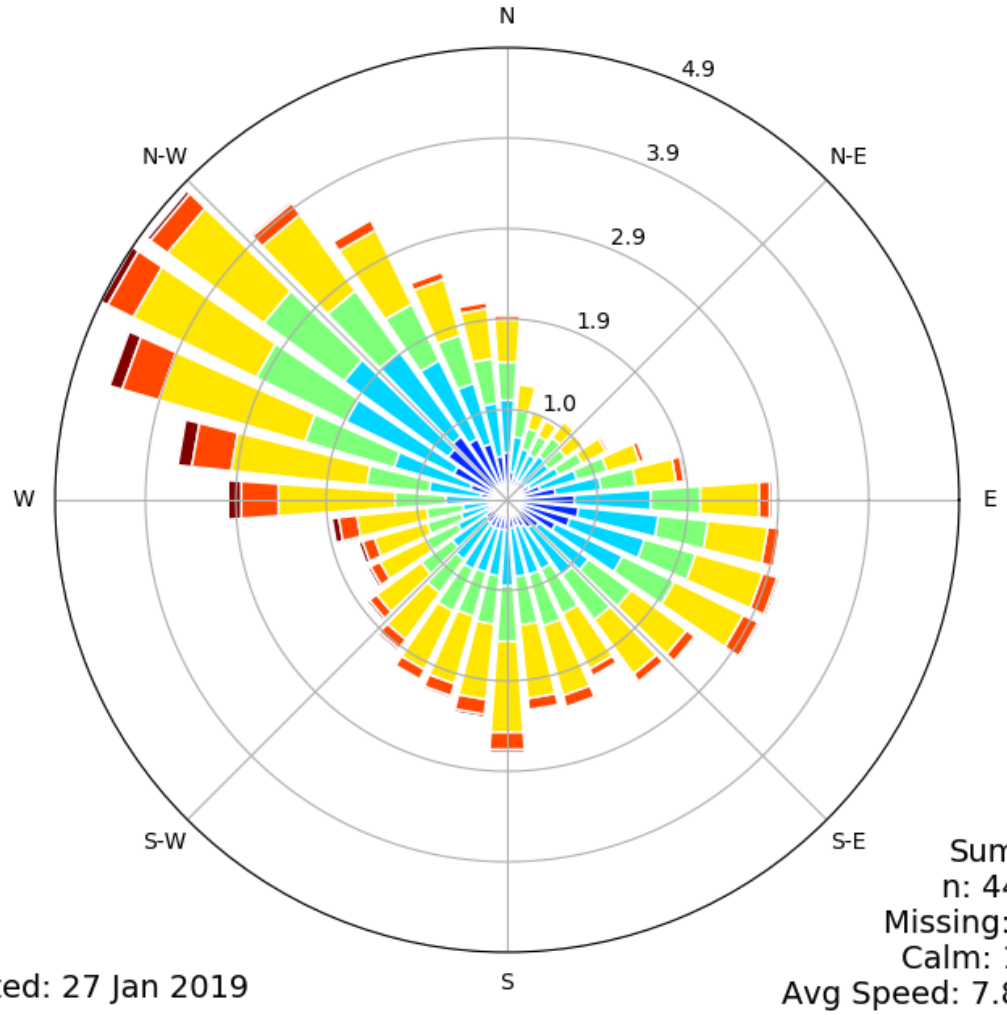
DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2011 - 00:00** **End Date: 12/31/2015 - 23:59**	COMPANY NAME:	
		MODELER:	Figure 1 Wind Rose Data 2011-2015
	CALM WINDS: **1.32%**	TOTAL COUNT: **43752 hrs.**	
	AVG. WIND SPEED: **7.22 Knots**	DATE: **3/8/2019**	PROJECT NO.:

[AUW] WAUSAU
Windrose Plot [All Year]
Period of Record: 31 Dec 1972 - 27 Jan 2019



Summary
n: 443504
Missing: 7699
Calm: 13.3%
Avg Speed: 7.8 mph

Generated: 27 Jan 2019

Wind Speed [mph]
2-5 5-7 7-10 10-15 15-20 20+